

Prepared for the International Science Initiative in the Russian Arctic (ISIRA) Advisory Group Meeting, International Arctic Science Committee, Potsdam, January 2011 by Lee W. Cooper, University of Maryland Center for Environmental Science (cooper@umces.edu)

I. Bilateral Activities and Projects in the Russian Arctic Involving U.S. and Russian Scientists

General Basis for U.S. funded research in the Arctic. The Arctic Research and Policy Act (ARPA) of 1984, U.S. Public Law 98-373, 31 July 1984; amended as Public Law 101-609, 16 November 1990 provides for a comprehensive U.S. national policy dealing with research needs and objectives in the Arctic. The ARPA established an Arctic Research Commission and an Interagency Arctic Research Policy Committee (IARPC) to help implement the Act. IARPC includes representatives of all U.S. federal agencies supporting research in the Arctic: the National Science Foundation, Department of Commerce [e.g. National Oceanic and Atmospheric Administration (NOAA)], Department of Defense [e.g. Office of Naval Research (ONR)], Department of State, Department of Health and Human Services, Office of Science and Technology Policy, Department of Agriculture, Department of Energy, Department of the Interior (e.g. National Park Service, Fish and Wildlife Service, Bureau of Land Management), Department of Homeland Security (e.g. U.S. Coast Guard), National Aeronautics and Space Administration, Environmental Protection Agency, and the Smithsonian Institution.

<http://www.nsf.gov/od/opp/arctic/iarpc/start.jsp> (IARPC)

<http://www.arctic.gov/> (Arctic Research Commission)

II. Active Individual National Science Foundation Projects with U.S. – Russian Scientific Cooperative Elements:

1. “Millennial Scale Arctic Climate Change for the last 3.6 My: Scientific Drilling at Lake El'gygytyn, NE Russia” The sedimentary record of Lake El'gygytyn, an impact crater in northeastern Siberia, has become a focus for paleoclimatic research, and it is an endorsed project under the International Continental Drilling Program (ICDP). Sediment cores retrieved from the deepest part of the lake (170 m) in 1998 and 2003 revealed a basal age of ~ 250 ka to nearly 300 ka, and reproducibly demonstrated the sensitivity of the lake to climatic change across NE Asia at millennial timescales. The current phase of the project has supported acquiring deeper cores in spring 2008 through to bedrock, and these samples are currently being analyzed as part of the U.S. contribution to the multi-national ICDP effort that joins contributions from the Canadian, German and Russian governments. This project is also sanctioned under the Russian Academy of Sciences-U.S. National Oceanic and Atmospheric Administration Memorandum of Agreement on World Oceans and Polar Regions, which helped facilitate international permitting for logistics, sample recovery and transfer.

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http://www.geo.umass.edu/lake_e/index.html

<http://www.geo.umass.edu/projects/chukotka/elg.html>

<http://www.icdp-online.de/sites/elgygytgyn/news/news.html>

<http://www.awi-potsdam.de/www-pot/geo/elgygytgyn.html>

2. “IPY: Collaborative Research on Carbon, Water, and Energy Balance of the Arctic Landscape at Flagship Observatories and in a Pan-Arctic Network” This project is establishing two terrestrial environmental observatories, in the U.S. and Russia, that form a part of a pan-Arctic network of observatories where coordinated measures of landscape-level carbon, water, and energy balance are carried out and results made available in a unified database. The observatories are located at two existing sites of research on landscape-level carbon, water, and energy balance - Toolik Lake (Alaska) and Cherskii (Siberia). The network of observatories across the Arctic where similar long-term observations of carbon, water and energy variables are made will include Toolik, Cherskii, Abisko (Sweden, the main site of the ABACUS project), Zackenberg (Greenland), and several sites in Arctic Canada. This project specifically provides for instrumentation improvements and personnel at Toolik and Cherskii, as well as international workshops and visits among the sites to ensure that data and instrumentation are easily comparable. Rather than studying one process at a time, this effort focuses on simultaneous measurements of carbon, water, and energy fluxes of the Arctic terrestrial landscape at hourly, daily, seasonal, and multiyear time scales.
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Gus Shaver, gshaver@mbl.edu (Marine Biological Laboratory)
<http://ecosystems.mbl.edu/arc/AON/index.html>
http://aon.iab.uaf.edu/AON_Study_Sites.html

3. “Black carbon in Arctic snow and ice and its effect on surface albedo” Two decades ago, measurements of the black carbon (BC) content of snow on land and sea in the western Arctic suggested that BC was responsible for possible reductions of albedo of 0-4%. However, more recent measurements suggest that the BC content of snow in the Arctic Ocean may have changed. This project is surveying the BC content of snow, with sampling near the time of maximum snow depth on the Arctic Ocean, in tundra areas of Russia, Alaska, and Canada, in both wet-snow and dry-snow zones of the Greenland Ice Sheet, and on ice caps in Iceland. As the snow melts, BC tends to concentrate at the surface, where it has a greater effect on albedo than if uniformly distributed. The effect of BC on the surface albedo will be estimated both regionally and seasonally. Air sampling concurrent with snowfall events is also being carried out at select locations, to determine the scavenging ratio, which is needed in atmospheric transport models that link emissions of aerosols to deposition in precipitation. The distribution of BC throughout the arctic snowmass and its seasonal variability may have important effects on climate variability due to their influence on albedo. The information provided by this project will be useful both for the further development and for the skill assessment of climate models.

Contact: Stephen Warren, sgw@atmos.washington.edu (University of Washington)
<http://www.atmos.washington.edu/sootinsnow/>

4. “IPY: The Polaris Project: Rising Stars in the Arctic” The Polaris Project is engaging students and early career scientists in a multifaceted effort that includes: a field course and research experience for undergraduate students in the Siberian Arctic; several new arctic-focused undergraduate courses taught colleges across the United States and in Russia; the opportunity for the participants to initiate research programs in the Siberian Arctic; and a wide range of outreach activities. The unifying scientific theme for the project is the transport and transformations of carbon and nutrients as they move with water from terrestrial uplands to

the Arctic Ocean. Education of both students and the general public about arctic environmental change is promoted through student and faculty visits to elementary and secondary classrooms; student generated and maintained blogs on research and experiences; and inclusion in the GoNorth curriculum (www.polarhusky.com) which is widely used in elementary and secondary schools worldwide.

Contact: R. Max Holmes, rmholmes@whrc.org (Woods Hole Research Institute)
<http://www.thepolarisproject.org/>

5. “Understanding the Impacts of Icy Permafrost Degradation and Thermokarst-Lake Dynamics in the Arctic on Carbon Cycling, CO₂ and CH₄ emissions, and Feedbacks to Climate Change” This project integrates field studies in a range of disciplines (geomorphology, geophysics, paleoecology, hydrology, limnology) with process modeling of permafrost thaw, lake formation, carbon cycling, and greenhouse gas (GHG) emissions. The goal is to understand how permafrost degradation in the Arctic, particularly thermokarst-lake (TKL) evolution, affects long-term atmospheric trace gas dynamics by releasing ancient carbon (C) stored in permafrost as carbon dioxide (CO₂) and methane (CH₄). Work is underway to (1) describe comprehensively the state of thermokarst (permafrost degradation) in Siberia and Alaska, (2) quantifying its impact on landscape configuration through the alteration of surface geomorphology and drainage patterns, (3) estimating its impacts on the C cycle via enhanced GHG (CO₂, CH₄) emissions, and (4) examining its potential to influence global climate potential C release from thawing permafrost in Siberia alone totals >50% of the current atmospheric C burden. The project is also integrated into an enhancement of collaborations within the Arctic Observing Network at observatories in Northeast Siberia (Cherskii) and Alaska (Toolik Lake), and work with international collaborators at Bristol University (UK), the Alfred Wegener Institute for Polar and Marine Research and the Max Planck Institute for Microbiology (both Germany) and the Permafrost Institute, Yakutsk (Russia).

Contact: Katey Walter, kmwalteranthony@alaska.edu (University of Alaska Fairbanks)
http://www2.gi.alaska.edu/snowice/Permafrost-lab/projects/projects_active/proj_thermokarst_NSF.html
<http://ine.uaf.edu/werc/people/katey-walter-anthony/thermokarst-lakes/>

6. “IPY: Municipal Water Systems and the Resilience of Arctic Communities” Over the past several decades, water infrastructure, in the form of municipal water systems (MWS) have been constructed in remote regions of the world in order to reduce morbidity and mortality associated with water-borne diseases and contaminants. However, scientists, policy makers, and communities have little understanding of the sociocultural effects of MWS. This research project asks "Does the presence or absence of MWS affect the social values of water?" Focusing the research on the role that MWS may play in affecting the values, perceptions and knowledge of water in the Russian Far East and Western Alaska communities, the investigators are studying aspects of community resilience and vulnerability with rapidly changing social and natural environments. The research team is gathering data in the Chukotka region of Eastern Russia and the Seward Peninsula, Western Alaska. Cross-cultural comparisons will aid the research team in understanding whether MWS reduce the adaptive capacity to manage water resources. The objective of the research project is to understand whether or not MWS affect longer term resilience of a community by decreasing the familiarity of the users in these communities with their hydrological landscapes. The interdisciplinary approach of the project uses information provided by residents about their values, perceptions, and knowledge of the

water they rely on. Ultimately, the research will help not only Arctic communities, but many developing communities worldwide to assess the trade-offs of MWS and whether or not the benefits that are provided by water treatment/supply technologies should be balanced against cultural changes in the short and long term.

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<http://ram.uaa.alaska.edu/AWRVI.htm>

7. “What's Climate Change to You?: Students Doing Science in a Global Network” Students Doing Science in a Global Network (WCCY) is involving elementary and secondary school students in exploring climate change. The project will form a network of 40 schools across the U.S. Canada, Russia, Sweden, Norway, Finland and Greenland where students and teachers will partner with scientists to explore climate change across tundra, taiga, prairies and maritime regions. The overarching objectives of WCCY are to 1) inspire students to examine how climate change affects their own lives and the lives of those around them; 2) to involve students in doing the science of snow and climate; and 3) to connect students with each other and the wider world through science and study of climate change. This project will investigate how computer-supported collaborative learning environments facilitate student inquiry and scientific learning, sharing, interaction, and collaboration. Participating schools will collaborate through an online forum. Local observations and strategies to adapt documented in online Community Climate Diaries will add to methodologies of engaging local communities in education and research about their knowledge, perceptions and concerns. A kit for each WCCY school, containing a computer base station, the WCCY Fieldwork & Science Guide and field tools, will enable inquiry-driven investigation. Students will 1) document local environmental observations within online Community Climate Diaries, and 2) collect snow depth and SWE measurements, snow crystal observations and temperature data sets. The students will be trained during the field expeditions and thereafter supported by regional science advisors. Two web casts each year will provide continuity and collaboration among the WCCY community. Indigenous students and teachers in the circumpolar Arctic will include Gwich'in, Yupik and Inupiat in Alaska; Chukchi and Yupik Inuit in Russia; Sami in Finland, Norway and Sweden; Inuit in Greenland; and Inuvialuit, Dene, and Oji-Cree in Canada.
Contact: Aaron Doering, adoering@umn.edu (University of Minnesota)
<http://www.polarhusky.com/>
Contact: Mille Porsild, Executive Director GoNorth! Adventure Learning + 1 .218. 370.9454, mporsild@polarhusky.com

8. “Collaborative Research: Moved by the State: Perspectives on Relocation and Resettlement in the Circumpolar North (MOVE)” This project is the US portion of a larger international collaboration that was conceived under BOREAS, a EUROCORES Programme of the European Science Foundation (ESF). The full ESF project is a collaboration of researchers from five countries, including the US, Canada, Russia, Greenland, and Finland. The U.S. part contains two components and five individual researchers from the University of Alaska Fairbanks and the University of Maryland. MOVE addresses a major shortcoming in conceptualizing northern histories, presents and futures. While the phenomenon of state-induced population movements in the recent history of the circumpolar North is well known, to date no comparative analysis of their local and regional contexts and impacts has been undertaken. “Moved by the state” refers to the commonality of having to cope with relocations and other population movements triggered by outside decisions. In analyzing a broad array of case studies

(small and large, indigenous and non-indigenous communities, in free market and central command systems, ranging from the mid-20th to the early 21st century), the collaborative research project tests the extent of commonality. Demographic, political, social and cultural variables are used to track the similarities and differences, both among communities facing being moved now and those that have been moved in the past. Extensive fieldwork, combining participant observation, various interview and survey strategies, and the recording of oral and life histories, as well as demographic and economic data collection and analysis, are the methodological backbone of the project. The practical relevance of the project is exemplified by imminent community relocations due to direct and indirect effects of climate change. Contact: Peter Schweitzer, ppschweitzer@alaska.edu (University of Alaska Fairbanks) <http://www.alaska.edu/move/>

9. “Stratigraphic, Geochemical, and Paleobiological Tests of the Co-Evolution of Multicellular Life and Environment in the Late Ediacaran Period” This project is undertaking a basin-wide stratigraphic, geochemical, and paleobiological study of the carbonate-dominated Khatyspyt Formation, along the Olenek, Khorbosuonka and Lena rivers. The 450-m thick Khatyspyt Formation contains a wide range of unique carbonate-hosted Ediacaran organisms, as well as carbonaceous macrofossils, small shelly fossils, trace fossils and planktonic microfossils all in Ediacaran fossils in this unit are remarkably preserved in fine-grained carbonates, promising a much enhanced anatomical and paleoecological view of Earth's earliest animals. It is hypothesized that Ediacaran biota distribution may track environmental conditions, and laboratory tests of this linkage are being undertaken through high resolution time-series analyses of carbon and sulfur isotopes in multiple equivalent sections across the Khatyspyt depositional basin as well as other biological, elemental and isotopic indicators of redox conditions. Results of the study should provide insights to the phenomenon of soft tissue preservation, increase the ecological resolution of the Ediacaran-Cambrian transition, and provide important constraints on the history of Earth's earliest metazoans and the oceans in which they originated, diversified, and ultimately perished. The primary aim of this field and laboratory based proposal is to test whether the geologically brief Ediacaran evolution of complex multicellular life was controlled by the oxidation state of shallow marine environments. The ongoing research is establishing a new international collaboration with colleagues in Russia, and Russian Arctic field work is an integral part of the project.

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10. “Arctic Perspectives (Workshop)” and “Arctic Perspectives Conference: International Travel & Student Support” This project supported a workshop in June 2010 on "Arctic Perspectives" in Arctic resources and climate in the 21st century that was held in Naryan Mar, Russia, to discuss the place of science and technology in Arctic regions. These issues included climate change; new claims on, and mounting competition for resources; the tension between national determinants of policy and the need for adequate international agreements for cooperation in resource management; increasing awareness of the rights of indigenous peoples to land and resources; and an examination of the preliminary results of the fourth International Polar Year. It was co-hosted by the Administration of the Nenets Autonomous Region of the Russian Federation, and included participation of scholars from the US, Russia, Finland, Norway, Denmark, Canada, and indigenous representatives to consider the issues from

historical and policy perspectives. The conference participants deliberated on issues that included: 1) the national determinants of resource management practices versus tensions for international cooperation, including evaluation of the adequacy of international agreements to regulate Arctic resources; 2) empire, science and economic development; 3) the infrastructure of arctic development; and 4) changing issues of urbanization, settlement and migration. Contact: Paul Josephson (Colby College) prjoseph@colby.edu

11. “Creative Arctic: Creative Capital for Regional Development in the Arctic (A Spatial Analysis)” This project is examining data from Alaska, Canada, Russia, the Faroe Islands, Norway, Sweden, and Finland to examine the role of creative capital, traditionally defined as a stock of creative abilities and knowledge(s) embodied in a group of individuals who either possess high levels of education and/or are engaged in creative (scientific, artistic, entrepreneurial or technological) types of activities, in economic development in these communities. This research is applying the concept to more rural, northern areas in hopes of developing new ways of understanding the successes and failures of northern economic development programs. Development of a web site, CreativeArctic, for researchers, classroom use, and informing local entrepreneurs, policy makers, and indigenous communities and interest groups interested in economic development in their regions. Contact: Anrey Petrov (University of Northern Iowa) andrey.petrov@uni.edu
<http://www.uni.edu/apetrov/creativearctic.html>

12. “International Collaborative Circumpolar Archaeological Project (ICCAP): Joint Russian-American research in Kamchatka International Collaborative Circumpolar Archaeological Project (ICCAP): Joint Russian-American research in Kamchatka” The ICCAP research project's main goals are to investigate: 1) the extent to which the circumpolar area has been subject to varying trends of environmental change in the past and 2) the similarities and differences in human adaptations to these changes in different areas of the Arctic. The research team is using direct and indirect proxies of climate and human adaptation based upon methods from dendro-climatology, palynology, geochemistry, climate modeling, ethnography, and archaeology. By using a long-term perspective on human responses to climate and environmental change in these three coastal circumpolar locations between 60 and 78 degrees N latitude and 7000 to 3000 years ago, the researchers proposed to answer some basic questions that are important for science and policy. For example: in the long run, e.g. over several thousand years, are yearly average temperatures more important than seasonal temperatures? Are absolute temperature and precipitation changes more important than the variability in temperature and precipitation? Does diversity of environmental change result in increasing stability or diversity of human adaptation? Are there thresholds that must be met in environmental change or in human adaptation before changes occur? Does human adaptation to environmental or climate change need to be reactive or may it successfully be pro-active? Ultimately, this project proposes to explain the past and the potential range of human resilience when faced with global and local environmental changes. In addition to these research activities, the project has a strong outreach program through PolarTREC (www.polartrec.com), which involves teachers in field research, in this case in Kamchatka. Teaching has been accomplished in Magadan in the Russian Far East and other outreach has been facilitated by bringing Russian scientists to the US and Canada, where they have provided secondary and university-level lectures in addition to collaborating with the project scientists. Contact: Ezra Zubrow (State University of New York, Buffalo) zubrow@acsu.buffalo.edu

http://www.polar.ch2m.com/arlss_reports/ARLSS_ProjectsDetail.aspx?cbPropNum=0915131
<http://www.polartrec.com/expeditions/prehistoric-human-response-to-climate-change-2010>

13. “Collaborative Research: Territorial Imaginaries and Arctic Sovereignty Claims” This research project revolves around the following questions: (1) What role do explicit and assumed imaginaries of a place's elemental nature, its geophysical properties, and its geographic location, play within the broader cultural imaginaries of the Arctic? (2) How do territorial imaginaries of the Arctic intersect with state and non-state actors' proposals for exercising (or not exercising) sovereignty in the region? (3) Do territorial imaginaries of the Arctic point to a transformation of sovereignty in the region, and what impact might this have on the potential for regional cooperation? These questions are being examined through a collaborative, multi-sited study in five Arctic nations -- Canada, Denmark, Norway, Russia, and the United States and includes analysis of data from a variety of sources including extant texts such as policy documents, reports, and news stories, as well as directed but open-ended interviews with individuals involved in Arctic policy debates.

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<http://mailer.fsu.edu/~psteinbe/garnet-psteinbe/research.html#arctic>

14. “Genetic Drift Versus Genetic Draft in Holarctic Ducks: Is the Assumption of Selective Neutrality Violated by Non-coding Nuclear DNA” This project is examining the influence of selection on non-coding DNA and will evaluate the sensitivity of various methods to this problem. Sequences from twenty independent regions of DNA sampled from six co-distributed species of Holarctic ducks will be compared to data simulated without selection. Results from this study will be broadly applicable, as non-coding DNA is often used for setting conservation and management priorities, studying species' responses to climate change, and understanding ecology and natural history. Also, the six species have a circumpolar distribution, and this project includes many birds from Arctic Alaska and Russia. Results will provide baseline data for examining responses to changing environments; for example, climate change may be contributing to the decline of one species and the expansion of two. Finally, this project is providing opportunities for postdoctoral training, undergraduate research, secondary education outreach, and expansion of a long-term collaboration between US and Russian scientists. Contact: Jeffrey Peters (Wright State University) jeffrey.peters@wright.edu
<http://www.wright.edu/biology/department/directory/faculty/peters/>

15. “Postdoctoral Research Fellowship” This project will support a Post Doctoral training and research grant. The research of Dr. Drew Gerkey will include field sites in Alaska and in Kamchatka, Russia where he will be working with salmon fishing communities to examine how the formation of networks of interdependence and support contribute to our understanding of how cooperative interactions between individuals have cumulative effects at the community level. As part of the Post Doctoral Fellowship, Dr. Gerkey will be developing and teaching undergraduate courses and training arctic community members in new media technology so that they can document their lives themselves.

Contact: Drew Gerkey, gerkey@u.washington.edu

16. “Collaborative Research: Mechanisms of transient deformation following great 2006-2007 Kuril earthquakes: Frictional afterslip or viscoelastic relaxation?” This project is extending GPS monitoring and theoretical analysis of postseismic deformation following the unusual great earthquake doublet in the Kuril Islands on 15 November 2006 (Mw=8.3) and 13 January 2007 (Mw=8.1). A GPS array of continuous stations was installed several months before the great earthquakes as a collaborative effort of Russian and US scientists, which has allowed for continuous monitoring before and after the tremors. The current funded work is meant to guarantee continuity of the postseismic time series, and to analyze and develop models of postseismic transient deformation. The work is comparing and assess geodetic and seismologic models for the two events, and mapping the space-time distribution of frictional afterslip, and in particular study how stress changes from the second event affected ongoing afterslip. Another goal is to model the deformation caused by the eruption of Sarychev volcano (Matua Island in the central Kurils).

Contacts: Jeffrey Freymueller, jeff@giseis.alaska.edu (University of Alaska Fairbanks)
Mikhail Kogan, kogan@ldeo.columbia.edu (Columbia University)

17. PIRE: United States - Russia - Japan Partnership in Research and Education in Volcanology This Partnership for International Research and Education brings together U.S., Russian and Japanese scientists and students to address an important problem in volcanology of immediate relevance: the devastating cone collapse/blast sequence and its aftermath that beset Mount St. Helens in 1980 and two analogous systems in Kamchatka, Russia - Shiveluch in 1964 and Bezymianny in 1956. Volcanoes are among the most exciting and inspiring, as well as dangerous phenomena on the planet Earth and this project uses one of the most volcanically active regions of the world as a natural laboratory. Understanding volcanoes has become increasingly important as growing population and technical complexity of society make us more vulnerable to natural catastrophe and as we realize the role of volcanism in global change. By conducting an integrated comparison of these three especially violent analogous systems at different times since their eruptions over the last 50 years, this project will advance our understanding of how magma is stored in the crust, how eruptions are triggered, and how sector collapse affects future eruptive behavior.

Contacts: Pavel Izbekov, pavel@gi.alaska.edu; Jeff Freymueller, jeff.freymueller@gi.alaska.edu; Mike West, west@gi.alaska.edu (all at University of Alaska, Fairbanks); <http://gps.alaska.edu/PIRE/index.html>

18. “Collaborative Research: Degrading Offshore Permafrost and Arctic Hydrates as a Current and Potential Source of Methane on the Siberian Arctic Shelf” This project involves an international, interdisciplinary research team that is determining the distribution and stability of permafrost on the East Siberian Arctic Shelf and evaluating its significance as a methane source to the arctic region. Rates of biological methane production and consumption (oxidation) are being quantified in permafrost and sediments at in situ and elevated temperatures. Natural abundance stable carbon and hydrogen isotope measurements are also being used to quantify the age and source of methane collected from different sites and depths. These data will be used as input to numerical models to determine the current and future potential release of methane from offshore permafrost, together with development of a methane budget for the East Siberian Arctic Shelf.

Contact: Igor Semiletov (International Arctic Research Center) igorsm@iarc.uaf.edu
http://www.iarc.uaf.edu/research/projects-detail?proj=siberian_shelf_study.php

19. “BE/CNH: The Kuril Biocomplexity Project: Human Vulnerability and Resilience to Subarctic Change” This research project is bringing together an interdisciplinary team of American, Japanese, and Russian scholars and students to examine the 5,000-year history of human-environmental interactions along the Kuril Island chain in the northwest Pacific. Evidence of human colonization, persistence and abandonment at various times in the past five millennia and under different social, economic, and technological regimes is being used to study human vulnerability and resilience to both catastrophic and gradual environmental changes, including human-induced changes. The project's primary objectives include (1) understanding feedbacks among climate, sea ice, marine and terrestrial ecology, and human activity; (2) estimating the degree of human vulnerability to catastrophic events and their ecological consequences at different spatial and temporal scales; and (3) assessing the role of cultural variables both in influencing community survival and affecting environmental changes. Contact: Ben Fitzhugh (University of Washington) fitzhugh@u.washington.edu

IV. Current U.S. Interagency or International Research Frameworks that support Russian-U.S. research in the Arctic

1. “Study of Environmental Arctic Change” (SEARCH) SEARCH is conceived as a broad, interdisciplinary, multi-scale program with support from a number of U.S. agencies. A core aim is understanding recent Arctic environmental change and its relationship to hemispheric phenomena. Science plans for SEARCH were developed and are available from the SEARCH website.

Contact: Hajo Eicken (University of Alaska Fairbanks, Chair, Science Steering Committee; Neil Swanberg, (National Science Foundation, Working Group chair)
<http://www.arcus.org/SEARCH/index.php>

The following research initiatives are contributions to the SEARCH program that involve U.S. – Russian research collaboration

A. “Climate-Ecosystem Interactions and Ocean Exploration” Several U.S. National Oceanic and Atmospheric Administration (NOAA) programs include support for work in the Arctic. In particular, the Arctic Research Office supported joint U.S. – Russian research (RUSALCA) cruises in the Bering and Chukchi Seas in 2004 and 2009 (interdisciplinary), and annually since 2005 for mooring deployment and recovery across the international boundary in Bering Strait between the U.S. and Russia. Planning is underway for a multidisciplinary cruise in 2012. The long-term project goal is to detect and evaluate physical climate change and biotic responses. Individual studies that are funded by NOAA directly or through a Cooperative Institute arrangement with universities include a broad spectrum of physical, biological and chemical studies on the Bering and Chukchi shelves in cooperation with Russian scientists from several institutes affiliated with the Russian Academy of Science and also with Roshydromet. In addition, this NOAA program leads U.S. participation in the Pacific Arctic Group (PAG), a multinational working group with Russian, U.S. Canadian, Korean, Chinese and Japanese participation, with facilitation provided by the International Arctic Science Committee. It has an interest in strengthening research collaborations in the Pacific-influenced sector of the Arctic Ocean that is guiding science planning efforts.

Contact: John Calder (NOAA, Arctic Research Office); john.calder@noaa.gov

<http://www.arctic.noaa.gov/>

<http://www.arctic.noaa.gov/aro/russian-american/>

<http://pag.arcticportal.org>

B. **“Tiksi International Hydrometeorological Observatory”** The Tiksi Observatory is located on the Arctic Ocean coast in the Lena River delta and consists of two buildings, including a weather station and clean air facility. The main goal of the Tiksi Observatory is to serve as an arctic observatory site that will contribute atmospheric measurements to the [Global Atmosphere Watch \(GAW\)](#), [Baseline Surface Radiation Network \(BSRN\)](#), and the [Atmospheric Radiation Measurement](#) programs. The cooperating Russian agency is the [Russian Federal Service for Hydrometeorology and Environmental Monitoring \(Roshydromet\)](#)

Contacts: Dr. Alexander Makshtas (maksh@aari.nw.ru) Taneil Uttal (Taneil.Uttal@noaa.gov)

http://iasoa.org/iasoa/index.php?option=com_content&task=view&id=81&Itemid=119

C. **“Arctic Observing Network”**

Individual Arctic Observing Network projects that involve U.S. – Russian scientific cooperation in the Arctic

1. “The Circumpolar Active Layer Monitoring Network--CALM III (2009-2014): Long-term Observations on the Climate-Active Layer-Permafrost System” This award will support the continuation of the Circumpolar Active Layer Monitoring (CALM) program as an integral part of the Arctic Observing Network (AON) and the Study of Environmental Arctic Change (SEARCH). The active-layer network of 168 sites represents the only coordinated and standardized program of observations using standard measurement protocols designed to observe and detect decadal changes in the dynamics of seasonal thawing and freezing in high-latitude soils. The 'Intellectual Merit' of this study lies in the need for long-term time series of active layer depth, ground temperature, and thaw settlement measurements at the same locations and across diverse terrain types and regions in order to identify scales of spatial variation, establish trends, and validate models. The data will also contribute to detailed process studies, and validating and developing climate change, ecology, hydrology and geocryology models. Education and outreach are essential components of the 'Broader Impacts' of CALM. The project will provide opportunities for field experience and educational participation at levels ranging from elementary school through postdoctoral. Local, predominantly indigenous people, will assist with the observations at remote sites. CALM will continue to incorporate data into its Web-based database, and transfer all existing and new data to the AON archive CADIS.

Contact: Nikolay Shiklomanov (University of Delaware) shiklom@udel.edu

2. “Collaborative Research: IPY: Arctic Great Rivers Observatory (Arctic-GRO)”

The Arctic Great Rivers Observatory (Arctic-GRO) project is assessing river constituent (chemistry, isotopes, nutrients) fluxes and discharge in the Ob', Yenisey, Lena, Kolyma, Yukon and Mackenzie Rivers. These observations are being used to test

hypotheses about the magnitude, controls and ecological significance of these fluxes, and will provide new information on inter-annual variability and trends in the major fluxes of constituents to the Arctic Ocean. By measuring the flux of water and constituents in these key rivers at the junction between the continents and the Arctic Ocean, it is possible to efficiently assess changes occurring across vast regions of the continents that may diagnose environmental change on land, and forecast imminent changes in circulation and biogeochemical processes in the Arctic and North Atlantic oceans. Contact: Bruce Peterson, peterson@mbl.edu (Marine Biological Laboratory, Woods Hole

<http://ecosystems.mbl.edu/partners/>

3. Bering Sea Sub Network: A Distributed Human Sensor Array to Detect Arctic Environmental Change” This project is implementing a Bering Sea Sub-Network (BSSN), which is a regional initiative of community-based organizations in Western Alaska and Northeast Russia. The distributed network employs people as individual, coordinated sensors for local environmental observations of socio-ecological change. BSSN is addressing the following questions: (1) how have economically significant species changed over the past century and what strategies have residents used to cope with these changes; (2) what key biophysical variables and indicators may be correlated to changes in distribution and properties of ecologically significant species; (3) how well do indigenous and traditional knowledge and Western science show spatial/temporal convergence and statistical correlation at local and regional scales; and (4) what are the major trends, patterns and constraints in individual and community adaptation to changes? A key product will be a widely disseminated and highly accessible publication entitled *The State of the Bering Sea Bioresources: Perspectives of Local Residents*, an assessment based on observations of local and indigenous observers. Other products will include a tool kit for communities to develop their own observing programs based on the framework of BSSN, and an annual illustrated magazine aimed at the village and regional levels.

Contact: Victoria Gofman (Aleut International Association) victoriag@alaska.net Lilian Alessa afla@uaa.alaska.edu
<http://bssn.net/>

4. “AON: Thermal State of Permafrost (TSP) in North America and Northern Eurasia: The US Contribution to the International network of Permafrost Observatories (INPO)” There exists no global database that defines the thermal state of permafrost within a specific time interval. Internationally, reported or unpublished temperature measurements have been obtained at various depths and periods over the past five or more decades, and it is known that these temperatures have changed at different rates in different regions. Analysis of temperature measurements obtained in these boreholes provides historical records of secular surface climate changes (deep holes) and interannual to decadal changes in surface boundary layer (intermediate depths). The Global Terrestrial Network for Permafrost (GTN-P) is a metadata based system established in the late 1990s under the World Meteorological Organization (WMO) which currently contains access to more than 425 documented borehole and 165 active layer sites across both polar regions. In Alaska, two major series of boreholes exist within the GTN-P with observations dating back to the 1970s; the US Geological Survey

deep boreholes (>125 m) and the University of Alaska's intermediate boreholes (<100m). This effort will link approximately 80 Alaskan boreholes with sites of observations in other countries in Northern Eurasia, and in so doing will initiate the International Network of Permafrost Observatories (INPO). This work will coordinate data collection using standard equipment and protocols at the Alaskan borehole sites and at a selected number of sites in Russia. The Alaskan and Eurasian borehole temperature data sets will provide the baseline to reconstruct past surface temperatures, to assess the future rates of change in near-surface permafrost temperatures and permafrost boundaries, and to provide spatial data for validation of climate scenario models and temperature reanalysis approaches.

Contact: Vladimir Romanovsky, veromanovsky@alaska.edu (University of Alaska Fairbanks)

C. “Northern Eurasia Earth Science Partnership Initiative (NEESPI)” NEESPI is a research framework supporting earth system science research in northern Eurasia, including participation from Russia, Ukraine, Finland and many other countries. In the U.S., the National Aeronautics and Space Administration (NASA) has provided project funding through the NASA Land Cover Land Use and NASA Carbon Cycle Science programs, and other projects supporting the science plan have been funded through NSF and NOAA. Not all projects would be considered arctic, but for convenience, the currently funded projects that are supported in part by NASA in Russia are outlined below, with U.S. contacts provided; other U.S. and international projects are tabulated on the [NEESPI website](http://www.neespi.org/)
NEESPI lead contact: Pavel Ya. Groisman (Pasha.Groisman@noaa.gov)
<http://www.neespi.org/>

Land Abandonment in Russia: Understanding Recent Trends and Assessing Future Vulnerability and Adaptation to Changing Climate and Population Dynamics. [Abstract.](#)
Contact: Kirsten de Beurs (kdebeurs@vt.edu), Virginia Polytechnic Institute and State University

The Influence of Changing Forestry Practices on the Effects of Wildfire and on Interactions between Fire and Changing Climate in central Siberia. [Abstract.](#)
Contact: Susan Conard (SGConard@aol.com), US Forest Service, Washington, DC

Changes of Land Cover and Land Use and Greenhouse Gas Emissions in Northern Eurasia: Impacts on Human Adaptation and Quality of Life at Regional and Global Scales. [Abstract.](#)
Contact: Quinlai Zhuang (qzhuang@purdue.edu), Purdue University

Remote Sensing of Forest Structure across Multiple Scales from Leaves to Canopies and Stands. [Abstract.](#)
Contact: Yuri Knyazikhin (jknjazi@crsa.bu.edu), Boston University

Land use change, protected areas, and biodiversity in the Caucasus and Ural Mountains. [Abstract.](#)
Contact: Volker Radeloff (radeloff@wisc.edu), University of Wisconsin, Madison,

Integrating Field and Remotely Sensed Data for Improved Characterization of Permafrost Landscapes in the Russian Arctic. [Abstract.](#)

Contact: Michael O'Neal (michael@udel.edu), University of Delaware,

Assimilation of tower and satellite-based methane observations for improved estimation of methane fluxes over northern Eurasia. [Abstract.](#)

Contact: Dennis Lettenmaier (dennisl@u.washington.edu), University of Washington, Seattle, Washington, USA

Adaptation to Rapid Land-Use and Climate Changes on the Yamal Peninsula, Russia: Remote Sensing and Models for Analyzing Cumulative Effects. [Abstract.](#)

Contact: Donald Walker (ffdaw@uaf.edu), University of Alaska, Fairbanks, Alaska, USA

Contribution to studies of LCLUC in Northern Eurasia. [Abstract.](#)

Contact: Olga Krankina (krankinao@fsl.orst.edu), Oregon State University

Response of forest growth to climate variability and change: remotely-sensed and in situ data for European Russia. [Abstract.](#)

Contact: Malcolm Hughes (mhughes@lrr.arizona.edu), University of Arizona

D. “The Japan-Kamchatka-Alaska Subduction Processes (JKASP)” JKASP is a broad, multidisciplinary consortium led by the University of Alaska Fairbanks (USA), Institute of Volcanology and Seismology (Russia), and Hokkaido University (Japan). The Kurile-Kamchatka-Aleutian volcanic arcs are among the least understood in the world. Yet, their high level of activity and continuity across continental and oceanic lithosphere provide an exceptional opportunity to understand the linkages among tectonism, magma genesis, and eruption that characterize subduction zones. Through continuing series of meetings we seek to build a vital international geoscience community in the North Pacific, while at the same time drawing upon insights from workers in other areas. A special emphasis of our meetings is on the hazards posed by arc volcanism and great subduction zone earthquakes (including tsunamis). Our intent is to nurture productive collaborations in monitoring of and research into subduction zone processes, both between geoscientists in Alaska and in the remainder of the United States, and between those of the US and its North Pacific neighbors.

Contacts: John Eichelberger, jeichelberger@usgs.gov (USGS Volcano Hazards Program); Pavel Izbekov, pavel@gi.alaska.edu (University of Alaska, Fairbanks); Evgeny Gordeev, gordeev@kscnet.ru (Institute of Volcanology and Seismology); Victor Chebrov, chebr@emsd.ijs.ru (Kamchatkan Branch of Geophysical Survey); Hiroaki Takahashi, hiroaki@mail.sci.hokudai.ac.jp (Hokkaido University); Mitsuhiro Nakagawa, mnakagawa@mail.sci.hokudai.ac.jp (Hokkaido University)"

V. Other U.S. organizations and agencies with some Russian arctic research interactions (probably not a comprehensive list)

1. U.S. National Park Service: “Shared Beringian Heritage Program” The U.S. National Park Service funds projects of scientific and community importance in the Beringia Region of western Alaska and Chukotka. The projects are typically local community-based, and relatively small in scope. A complete list of current projects is available at the program web site.

Contact: Janis Kozlowski (National Park Service) janis_kozlowski@nps.gov
<http://www.nps.gov/akso/beringia/>

2. CRDF Global: CRDF Global is an independent nonprofit organization that promotes international scientific and technical collaboration through grants, technical resources, and training. CRDF Global is based in Arlington, Virginia with offices in Moscow, Russia; Kyiv, Ukraine; Almaty, Kazakhstan; and Amman, Jordan. Most Russian projects are not explicitly Arctic in orientation, but several funded programs have had at least some Arctic emphases. See Stanford University entry for one example.

<http://www.crdf.org/>

3. Barrow Arctic Science Consortium (BASC) The Barrow Arctic Science Consortium, a non-profit entity in Barrow, provides logistical services for researchers working on the North Slope of Alaska and in Chukotka. One of their initiatives has been to improve capabilities for supporting scientific research in Chukotka through the improvement of infrastructure. The Chukotka Science Support Group (CSSG), an official Russian non-profit entity run by Yupik Eskimo and Chukchi Natives and supported by BASC, is developing science support facilities in the villages of Lavrentiya and Provideniya, which are available to visiting researchers. Limited facilities are also available in Anadyr

Contact: Dr. Glenn W. Sheehan (Barrow Arctic Science Consortium), basc@arcticscience.org
<http://www.arcticscience.org/>

4. The Alaska Volcano Observatory is operated by the U. S. Geological Survey, the Geophysical Institute of the University of Alaska Fairbanks, and the State of Alaska Division of Geological and Geophysical Surveys. In its international efforts, the Observatory interacts with the Kamchatka Volcanic Eruption Response Team, which is a unit of the Institute of Volcanology and Seismology and the Kamchatka Branch of Geophysical Survey, both based in Petropavlovsk-Kamchatsky. A coordinated research program monitors volcanic activity along the breadth of the Aleutian-Kamchatkan-Kurile Arcs. Goals include monitoring and other scientific investigations in order to assess the nature, timing, and likelihood of volcanic activity; assessing volcanic hazards associated with anticipated activity, including kinds of events, their effects, and areas at risk; and providing timely and accurate information on volcanic hazards, and warnings of impending dangerous activity, to local, state, and federal officials and the public.

Contacts: Steve McNutt, Coordinating Scientist (University of Alaska Fairbanks Geophysical Institute) steve@giseis.alaska.edu
<http://www.avo.alaska.edu/>

5. The U.S. Fish and Wildlife Service. The U.S. Fish and Wildlife Service. The U.S. Fish and Wildlife Service (USFWS) oversees transnational wildlife management and conservation issues, including migratory birds, marine mammals, salmon, wildlife refuges/nature reserves, and ecosystem studies of the Bering and Chukchi Seas. Bilateral activities are carried out under the U.S.-Russia Environmental Agreement (1972; 1994); U.S.-Russia Migratory Bird Convention (1976); and U.S.-Russia Agreement on Conservation and Management of the Alaska-Chukotka Polar Bear Population (2000). There are regular exchanges of information and scientists, as well as periodic joint research cruises for wildlife surveys and physical oceanography studies.

Contact: Steven Kohl, Steven_Kohl@fws.gov (Russia-East Asia Branch, Division of International Conservation, U.S. Fish and Wildlife Service)
<http://www.fws.gov/international>

6. Stanford University. Researchers based at Stanford University have carried out extensive field geologic research in the Russian Far East over many years, with funding from varied sources. Research has been in collaboration with Russian geologists, including those from the Geological Institute of the Russian Academy of Sciences (GINRAS) in Moscow as well as geologists from the Northeast Interdisciplinary Scientific Research Institute (NEISRI), Magadan and from the Diamond and Precious Metals Institute, Yakutsk. Two projects that are ongoing involve Arctic Ocean work (National Science Foundation EAR 098673, Origin and evolution of the Amerasian Basin of the Arctic and a US Geological Survey-Stanford Collaboration of Analysis of rock material dredged from the Chukchi Plateau-Alpha Ridge System, Arctic Ocean). A third project that is in the process of being awarded for work in the Russian Far East through CRDF. Principal investigators are P.I Akinin, V. V. and Miller, E.L. CRDF Collaboration Stanford University with NEISRI, Far-East Branch National Academy of Sciences, Magadan: Age and compositions of magmas across Arctic Chukotka: Constraints on the evolution of the Alaska-Chukotka plate and opening of Amerasia Basin.

Contact: Elizabeth Miller, elmiller@pangea.stanford.edu
<http://pangea.stanford.edu/research/groups/structure/index.php?page=3>

7. University of Alaska Fairbanks.

The International Arctic Research Center (IARC) located at the University of Alaska Fairbanks (UAF), is jointly supported by U.S. and Japanese government funds and conducts research throughout the Arctic. Several IARC-led projects include work in the Russia Arctic, including those described in the NSF (Section III) and NEESPI framework outlines (Section IV.C)

Contact: Larry Hinzman, lhinzman@iarc.uaf.edu (IARC)
<http://www.iarc.uaf.edu>

“International Volcanological School.” The Department of Geology and Geophysics of the University of Alaska Fairbanks offers two-week field class in volcanology in cooperation with the Kamchatka State University (KSU) and the Institute of Volcanology and Seismology (IVS) in Petropavlovsk-Kamchatsky, Russia. The course is offered every summer both in Katmai National Park, Alaska, site of the largest eruption on Earth of the 20th century and on Gorely and Mutnovsky Volcanoes, south of Petropavlovsk-Kamchatsky. Students explore and discuss the full range of phenomena that constitutes volcanoes, using some of the best examples in the world. The course is co-taught at both the undergraduate and graduate level by John Eichelberger of the Volcano Hazards Program, USGS, Pavel Izbekov of UAF, as well as by guest scientists from Russia, the US, and Japan. Students come from across the US, Russia, and Japan, and occasionally from other countries.

Contacts: Pavel Izbekov, pavel@gi.alaska.edu (University of Alaska Fairbanks) and John Eichelberger, jeichelberger@usgs.gov (US Geological Survey Volcano Hazards Program); <http://www.uaf.edu/geology/field-studies/international-volcanologi/>

8. *University of Northern Iowa (UNI)*. Researchers at UNI are involved in several major Arctic research initiatives with several Russian institutions. This includes the Taimyr Reindeer and Environmental Change (TREC) project that studies migration dynamics of wild reindeer in Taimyr region in conditions of changing climate and human activities. Main Russian collaborators are from the Russian Academy of Sciences and the Extreme North Agriculture Research Institute in Noril'sk. Through the Program in Research and Outreach in Geography between Russia and United States (PROGRUS) UNI also maintains collaboration with St. Petersburg State University, Herzen University and Russia's Polar Academy.
Contact: Andrey Petrov andrey.petrov@uni.edu