

Alaska EPSCoR 2008-09 Annual Report

A. Executive Summary

This report will show how Alaska EPSCoR is building Alaska's future by increasing the state's research capacity.

- **Vision**

The vision of Alaska EPSCoR is to enhance research capacity throughout the state of Alaska in order to make sustainable contributions to the state's knowledge and economy. Alaska EPSCoR seeks to foster the development of Alaska's science and engineering based on the state's unique opportunities, and to make its results relevant and accessible to Alaska's diverse residents.

- **Research**

Alaska EPSCoR sponsors research in three broad areas: physical science, biology, and social science. Integration across scientific disciplines, however, is one of our hallmarks, and EPSCoR researchers are encouraged to tackle projects which stretch across traditional boundaries.

Physical scientists at EPSCoR focus on the field of permafrost research, closely examining the permanently frozen ground that covers a significant amount of Alaska's land mass. Rising temperatures are having significant effects on the extent of permafrost in the North and, as a result, vegetation and wildlife zones are changing and man-made structures are at increased risk.

Alaska EPSCoR biologists are studying the patterns and processes that cause shifts in the home territories of Alaska flora and fauna, with a focus on subsistence species. The component is broadly split into two groups. The Landscape Genetics group examines the influence of geography, geology, and climate on species population structure and migration patterns with the intent of predicting future changes in species distributions. The Plant-Microbe Interactions group studies the relationships between these titular interactions and environmental change.

EPSCoR social science research centers on rural communities and how they respond to climatic and social change, with a focus on institutions, food systems and social networks. Rural communities are a focus of EPSCoR, but in year two our focus has expanded to include an examination of urban social-ecological systems in northern climates.

One key activity of Alaska EPSCoR Phase III is its interdisciplinary integration core, which is charged with drawing together information and research from the different disciplines involved in EPSCoR. The core is headed by an Integration Team, the major accomplishment of which thus far has been the development of three major conceptual and applied frameworks for integration:

- Social-Ecological Hotspots Mapping, through which qualitative data such as social values can be mapped alongside biophysical variables to represent a social-ecological landscape;

- An analysis of the vulnerability of freshwater sources in Alaska and the links between water resources and community values, using a technique known as FERAL (Forecasting Environmental Resilience for Arctic Landscapes); and
- The challenges of social-ecological stewardship.

The Integration Core has made substantial progress in developing this conceptual framework and in developing agent-based modeling and cybertools which allow the application of the concepts to integrate research from different EPSCoR theme areas. The core is now beginning to apply these tools to regional case studies which link these concepts and tools with field observations from different parts of the state.

EPSCoR researchers have secured considerable additional funding which will allow them to pursue their research goals over the three-year course of the grant. Since the previous annual report was submitted in May 2008, EPSCoR-supported faculty members have garnered around \$46 million in assorted grant support.

- **Diversity**

We at Alaska EPSCoR pride ourselves on diversity, both among our leaders and the people we serve.

All our award programs are merit-based; we collect demographic information only after an award is given. We gain diversity in our programs chiefly by extensively marketing ourselves to rural Alaska and to underrepresented populations at the University of Alaska.

Our 11-member leadership team consists of a part-Native American woman, a Native Alaskan woman from a rural campus, an Asian-American woman and Asian-American man, and a part-Hispanic woman. Also, one of our four external advisory committee members and one of our two independent evaluators are women.

Among the undergraduates, graduate students, and faculty members awarded funding by Alaska EPSCoR during the 2008-09 fiscal year, 54% are women, 16% are Alaska Native or Asian, 14% are first-generation college students and 18% are non-traditional students.

- **Workforce development**

Our workforce development programs stretch from K-12 outreach through to early-career and small business programs. We seek to slow the “brain drain” out of Alaska by encouraging interest in science at a young age, then fostering it through programs that stretch through into adulthood. Our K-12 programs also contribute to the development of human resources by providing professional development workshops and continuing education credits to K-12 teachers.

Our activities include six different K-12 outreach programs, focusing on rural Alaska and underserved urban populations; undergraduate, graduate, and early-career research fellowships; faculty buyouts; funding postdoc and faculty positions; travel awards; seed grants to explore new ideas; mini-grants

to faculty looking for new ways to engage Alaska Native people in research; and grants to assist small business proprietors with preparing grant proposals.

- **Cyberinfrastructure**

Through our Integration Core, led by co-PIs Lilian Alessa and Terry Chapin, we are developing Alaska's cyberinfrastructure to advance methods of studying social-ecological systems (SES). Our Social-Ecological Hotspots Mapping and FERAL programs use cutting-edge technology to further SES study and both have entailed software and hardware upgrades as well as faculty hires. Moreover, the Integration Core has reached out to serve the broad University of Alaska system with a video-conferenced discussion series and a hands-on workshop.

- **Outreach and communication**

We support extensive and varied K-12 programs, including an exciting new project teaching biological science to rural secondary school students. We issue two newsletters a year; run a redesigned website that is comprehensive and user-friendly; provide support to numerous workshops, conferences and discussion series; and organize a yearly all-hands meeting at rotating sites throughout the state. This year we also organized "Living on Earth," an NSF EPSCoR-sponsored workshop on social-ecological system research, and are producing short video documentaries on the workshop and on Alaska EPSCoR itself.

- **Evaluation and assessment**

The Alaska EPSCoR phase III team is committed to the continual improvement of the collaboration, education, and outreach processes of the Phase III effort. Our performance is tracked and evaluated both by our External Advisory Committee and our pair of independent evaluators, Drs. Julia Melkers and Eric Welch. In addition, Alaska EPSCoR leaders conducted a reverse site visit to the NSF in September 2009.

Our external advisory committee consists of Hugh French of the University of Ottawa, Nancy Grimm of Arizona State University, Igor Krupnik of the Smithsonian Institution, and Alan Covich of the University of Georgia. They held an initial site visit in 2008 and French also attended Alaska EPSCoR's All-Hands Meeting in 2009.

We have contracted with Drs. Julia Melkers and Eric Welch for an external evaluation that will address collaboration, integration, and outreach issues for the three years of funding. The evaluation uses multiple methods, including qualitative interviews, detailed internet-based surveys, reviews of documentation and program materials, and social network methodologies which allow the tracking of collaboration and knowledge exchange over time. These efforts will serve not only as an

accountability mechanism for NSF EPSCoR, but also as a formative feedback tool for our leadership and management processes.

- **Sustainability**

The primary goal of Alaska EPSCoR is to increase research competitiveness, enabling the continuation and increase of NSF and other funding to Alaska. We do this in part by concentrating on resilience science, a burgeoning field with great funding potential. By focusing our efforts in this promising direction we hope to leave a legacy of increased funding and study in this field.

Furthermore, Alaska EPSCoR fosters sustainability by supporting programs which encourage K-12 students to pursue STEM careers, as well as by running internal award programs for undergraduates, graduates and early-career faculty. We also encourage lasting relationships by supporting collaborative efforts in the university and in the larger community, and we improve the university infrastructure in the long term by creating tenure-track and permanent research positions.

In addition, we encourage sustainability by integrating Alaska's rural campuses into our activities, making them places to build research capacity; by increasing the participation of women and other underrepresented groups in the sciences; by sharing our results with Alaskans through outreach activities; and by spreading knowledge through activities like proposal-writing workshops and a rural grant proposal-writing program. Also, by integrating our research results into usable real-world models, EPSCoR research will prove useful to Alaskans far into the future.

- **Management structure**

Alaska EPSCoR has maintained the management structure outlined in our original proposal. Peter Schweitzer is Principal Investigator and Project Director, and Terry Chapin and Lilian Alessa are co-PIs. Anne Sudkamp is Project Administrator. Biology, Physical and Social Science components have leaders overseeing those research areas. The Integration Core of Terry Chapin and Lilian Alessa works to integrate findings from the three components. Our Education and Outreach efforts are led by Elena Sparrow.

Program-wide decisions are made by our management team comprising all of the above individuals, plus a rural campus representative and a University of Alaska Southeast representative. This structure has worked well to enable quick action and statewide input into decisions.

- **Key accomplishments**

Intellectual merit

Our numerous scientific accomplishments are described in the detailed report, below. However, one stands out: four EPSCoR physical science researchers made the ground-breaking discovery that Alaska's Arctic Coastal Plain was glaciated during the Late Pleistocene, thereby rewriting the natural history of the area. The find has led researchers to rethink many assumptions about human and animal populations of that region, and could have major implications for oil development.

Broader impacts

Our emphasis on rural campus involvement is producing a sea change at the University of Alaska, which is beginning to consider these campuses as places both for research and for building research capacity. Our rural campus support comes in many forms, from including a rural campus director on our management team, to continuing financial support of the annual Western Alaska Interdisciplinary Science Conference, to funding an early-career researcher in Nome and one affiliated with Bristol Bay. We also provide grant-writing assistance to rural campuses and travel support for collaboration among Alaskan researchers.

- **Actions taken in response to evaluations**

All levels of evaluation of Alaska EPSCoR have resulted in concrete responses by the program.

Based on recommendations by our independent evaluators, we have made changes to our travel grant program to increase emphasis on collaborations within Alaska. Also in response to our independent evaluation, we have worked to advertise our opportunities better by creating and widely disseminating a single flyer listing all of our internal award programs and deadlines. In the same vein, their recommendations have led us to increase outreach efforts such as workshops, meetings and discussion/seminar series.

Based on recommendations by our external advisory committee, we have increased our emphasis on outreach and communication and the important role of two-way knowledge exchange between researchers and communities.

Based on recommendations by NSF officials during our September 2008 Reverse Site Visit, we have stepped up our outreach to underrepresented groups at the university; clarified the substance of our Integration Core; arranged with our independent evaluators to develop project progress benchmarks further; and moved to integrate genome research into our program through several EPSCoR-funded projects, including a 454 genome sequencing project of an Alaska bird and a study of plant DNA useful for bioremediation.

B. Detailed Report

1. RII participants and participating institutions

See FastLane

2. Program/Project Description

- **Research Accomplishments and Plans**

Accomplishments

Alaska EPSCoR enhances Alaska's research capacity through the strategic investment of National Science Foundation and state funds. EPSCoR supports undergraduates, graduate students, postdocs and faculty members throughout the University of Alaska system and also conducts an active public outreach program.

In 2008-09, Alaska EPSCoR funded five faculty course buyouts; nine early-career grants given to promising young researchers; 32 graduate fellowships; two post-doctoral hires; and eight undergraduate grants. EPSCoR also continues to fund salary for a number of University of Alaska faculty members and to provide substantial travel grants.

Entitled "Resilience and Vulnerability in a Rapidly Changing North: The Integration of Physical, Biological and Social Processes," EPSCoR's current research project (known as "Phase III") is focused on studying the rapid environmental and social changes taking place in Alaska and the world's northern latitudes.

EPSCoR sponsors research in three fields: physical science, biology, and social science. However, integration across scientific disciplines is one of our hallmarks. EPSCoR researchers are encouraged to tackle projects which stretch across traditional boundaries, while our multidisciplinary results are linked together in an Integration Core.

Physical Science. Physical scientists at EPSCoR focus on the field of permafrost research, closely examining the permanently frozen ground which covers a significant amount of Alaska's land mass. Rising temperatures are having significant effects on the extent of permafrost in the north country, and as a result vegetation and wildlife zones are changing and man-made structures are at increased risk.

A principal accomplishment of Alaska EPSCoR's physical science component was the ground-breaking discovery by four EPSCoR researchers that Alaska's Arctic Coastal Plain was glaciated during the Late Pleistocene, thereby rewriting the natural history of this area. The find has led researchers to rethink many assumptions about human and animal populations of that era, and it has major implications for oil development.

Physical science component members also made strides in permafrost monitoring. EPSCoR researcher Vladimir Romanovsky and his fellow researchers have created a statewide monitoring network mostly along a north-south transect. A global model of mean annual permafrost temperature from

1982-2005 has been generated, with temperatures projected through 2100. Their observations show a general but unsteady increase in Alaskan permafrost temperatures over the last three decades.

Physical science researchers also tackled a number of other areas, including measuring the particular sensitivity of permafrost to climate change in light of factors like topography, soil texture, organic-matter accumulation, vegetation, snow, surface water, groundwater movement, and disturbances. EPSCoR physical scientists also considered the effects of fire on the watershed exports of nutrients in stream flow and the impact of permafrost on dissolved organic matter composition in streams.

While permafrost and its effect on man-made structures is a focal point of EPSCoR study, EPSCoR physical science researchers cover a wide variety of other subjects as well. In 2008-09 they examined such diverse topics as the viability of electric cars in Alaska; slow-moving 'flow slides' in Alaska's Brooks Range; arctic solid waste management; and the effects of dam removal on downstream sedimentation.

Biology. Alaska EPSCoR's biology researchers are studying the patterns and processes that cause shifts in the home territories of Alaska flora and fauna, concentrating on subsistence species. The lack of scientific data regarding controls over biodiversity and species distributions at high latitudes limits our understanding of how Alaskan ecosystems are responding to current and future environmental changes. A better understanding of the mechanisms and patterns behind changes in biodiversity serves to link changes in Alaska's physical system to the services provided to society by ecosystems.

The component is broadly split into two groups. The Landscape Genetics group examines the influence of geography, geology, and climate on species population structure and migration patterns with the intent of predicting future changes in species distributions. The Plant-Microbe Interactions group studies the relationships between these interactions and both gradual and rapid environmental change.

EPSCoR biology graduate students in 2008-09 worked on topics ranging from documentation of mycorrhizal diversity in the Arctic to addressing invasive plant influences on the quality of moose forage and the genetics of adaptation in sculpin fish. A noteworthy individual accomplishment of the biology component came from entomologist Derek Sikes, who received \$272,000 in NSF funding to enlarge and upgrade the insect collection at the UAF Museum of the North. Sikes applied for the award thanks in part to a \$30,000 Alaska EPSCoR early-career grant.

Two biology postdocs were hired in 2008-09, one at UAF and one at UAS. Both have served to catalyze collaborative research efforts between biology faculty at their respective campuses.

Two biology research projects were funded which will increase research capacity within our existing programs, especially in the field of genetics. The planting of a large common garden of poplar genotypes was funded to study the genetics of adaptation to high latitude in trees and to identify high-yield tree genotypes for Interior Alaska. Also, a 454 genome sequencing study of the song sparrow was funded. (see Seed Funding, below.) Another EPSCoR grant is going to a DNA study of Alaskan plants to determine which are useful for bioremediation efforts.

The landscape genetics portion of EPSCoR's biology component has made significant progress. EPSCoR provided faculty salary, a graduate fellowship, and lab support for a study of landscape genetics of North Slope caribou herds, helping stimulate a collaborative proposal for submission to USGS entitled "Ecological niche modeling of montane herbivores: sufficiency of protected areas in climate-change 'hotspots.'" In addition, an EPSCoR postdoc fellow will examine the population structure of Sitka black-tailed deer, an important subsistence species in southeastern Alaska.

Additionally, a group of EPSCoR biology graduate students collaborated to run an EPSCoR seminar series in the spring 2009 semester to disseminate information better throughout the component and beyond. The series featured weekly presentations by EPSCoR-funded grad students and culminated with a pair of invited speakers in May 2009.

Social Science. EPSCoR social science research centers on rural communities and how they respond to climatic and social change, with a focus on food systems, cultural institutions and social networks. Rural communities are a focus of EPSCoR, but research in year two expanded to include urban social-ecological systems, particularly those in northern climates.

EPSCoR-supported social science faculty have generated many new research proposals across all three social science themes. Many of these proposals consider how people interact with the environment, and some are highly interdisciplinary in nature, including the involvement of behavioral scientists who are finding ways to go beyond clinical studies of human behavior to address issues in community vulnerability and resilience.

Specific EPSCoR social science projects include a survey of Alaskan human migration trends; an examination of the effects of alcohol policies in rural Alaskan villages; a study of the effects of Alaska's Distant Early Warning Line military radar stations on indigenous peoples; and a survey of concepts of aging among Alaska Natives.

The social science component sponsored a seminar series in fall 2008 to better disseminate information to other researchers and interested parties. Held in Anchorage, the seminars were videoconferenced to Anchorage and Fairbanks. The focus of the seminars was on social science issues and methods related to Alaska EPSCoR themes of vulnerability, adaptation, and resilience in arctic communities facing rapid change. Also, a social science research group at UAF, mostly EPSCoR members, met weekly in 2008-09 to discuss relevant topics, and EPSCoR faculty members Daniel Monteith and Erica Hill organized a three-day meeting of the Alaska Anthropological Association in Juneau in May 2009, which included an EPSCoR session. All of these activities received EPSCoR financial support

Integration Core. One key activity of Alaska EPSCoR Phase III is its interdisciplinary integration core, which is charged with drawing together information and research from the different disciplines involved in EPSCoR. The core is headed by an Integration Team, the major accomplishment of which thus far has been the development of three major conceptual and applied frameworks for integration:

- Social-Ecological Hotspots Mapping, through which qualitative data such as social values can be mapped alongside biophysical variables to represent a social-ecological landscape;
- An analysis of the vulnerability of freshwater sources in Alaska and the links between water resources and community values, using a technique known as FERAL (Forecasting Environmental Resilience for Arctic Landscapes); and
- The challenges of social-ecological stewardship.

This third area, in particular, represents a fresh focus for the integration core for 2008-09. The core's focus on resilience-based ecosystem stewardship integrates three broad sustainability strategies:

- *Vulnerability analysis* provides proven guidelines for reducing stresses that drive change, as well as reducing sensitivity and adapting to threats that cannot be mitigated.
- *Resilience strategies* shift resource-management philosophy from *reactions* to observed changes to *proactive* policies that shape change. This shift is achieved by fostering a diversity of options; by social learning through experimentation and innovation; by a mix of stabilizing feedbacks and creative renewal; and by using adaptive governance to implement solutions under changing conditions.
- *Transformations* involve forward-looking decisions to avoid or escape undesired or unsustainable social-ecological trajectories. Transformation strategies include preparing for transformation by identifying and vetting options and pathways; navigating transitions with transparency and stakeholder participation; and building resilience of the new system.

The Integration Core has made substantial progress in developing this conceptual framework and in developing agent-based modeling and cybertools which allow the application of the concepts to integrate research from different EPSCoR theme areas. The core is now beginning to apply these tools to regional case studies which link these concepts and tools with field observations from different parts of the state.

The Integration Core's work has yielded valuable information about the social science aspects of resilience theory. This includes data which suggest that human behaviors require significant forcing in order to change patterns of resource use, at thresholds which appear to be greater than the existing literature suggests. Core researchers have also found evidence suggesting that social-ecological systems can be classified based on "sociometabolic" transitions which are dictated by the rates and scales of matter and energy transformations.

Integrative science has been in evidence throughout Alaska EPSCoR's 2008-09 component activities. In the physical science component, for example, researchers such as Ph.D. students Matt Bray and Yu Zhang have integrated their studies of permafrost geology with frozen-ground structural engineering. Other members of the physical science component are incorporating biology into their work, examining wildlife habitat shifts due to permafrost changes.

Integrative science was at the center of "Living on Earth," an NSF EPSCoR-sponsored workshop on social-ecological systems put on by Alaska EPSCoR in May 2009. Researchers from 10 states attended the four-day conference, which focused on the emerging field of Social-Ecological System study and

revolved around an innovative “Immersion Activity” in which attendees visited SES hotspots and prepared presentations on their findings.

Another integrative EPSCoR effort was an international workshop conducted by members of the physical science component in July 2008. Entitled “Permafrost and Sustainable Development of Northern Communities,” the workshop was part of the Ninth International Conference on Permafrost, which was itself supported by Alaska EPSCoR.

EPSCoR is encouraging researchers to develop integrative projects further by organizing five regional integration teams, one each for southeastern, southcentral, interior, North Slope, and Bering Strait regions. A sixth group covering the state’s western region was added in May 2009. The Bering Strait group has spearheaded the creation of a Bering Strait Research Consortium, which held a roundtable discussion at the Western Alaska Interdisciplinary Science Conference (WAISC) event in Nome in April 2009.

The Resilience and Adaptive Management Group, an EPSCoR-affiliated organization at UAA, is taking the lead in many of EPSCoR’s integrative science endeavors. Members of the group meet weekly to discuss issues of resilience and adaptation and have organized numerous events to increase knowledge of the themes among researchers. These events included a three-day Agent-Based modeling workshop held in September 2008 and featuring visiting lecturers Mark Altaweel and Michael North of the Argonne National Laboratory and Michael Barton of the Center for Social Dynamics and Complexity at the University of Arizona. The workshop was held at UAA but videoconferenced to both UAS and UAF. The RAM group also offers regular forums to advance understanding of integrative resilience science, including a health-climate change research retreat in November 2008 and a 2008 summer discussion series.

Along the same lines, EPSCoR co-PI and RAM group head Lil Alessa spearheads a regular discussion series among EPSCoR faculty to discuss integrative topics. Discussions series took place in fall 2008 and spring 2009 and another set of discussions took place leading up to the Living on Earth workshop in May 2009. The initial fall discussion featured guest speaker Robert O’Conner of the NSF.

Funding. External funding is an important measure of research progress, and many EPSCoR researchers have secured considerable additional funding that will allow them to pursue their research goals over the three-year course of the grant and beyond. Since May 1, 2008, when the reporting period for the previous annual report ended, EPSCoR-supported faculty members have been awarded more than \$46 million in grant support through 85 grants. The following is a list of some of the grants awarded to EPSCoR researchers since May 1, 2008:

- Lilian Alessa, \$888,000 from the National Science Foundation for ‘Municipal Water Systems and the Social Values of Water in the Arctic’
- Perry Barboza, \$50,000 for ‘Monitoring Body Condition of Caribou for the CARMA Network’
- Perry Barboza, \$111,000 from the U.S. Geological Survey for ‘Condition and movement of moose in relation to urban development’

- Perry Barboza, \$20,000 for 'Preparation for Caribou and Nutrition Research Initiative at LARS'
- Matt Berman, \$5,000 from the Regulatory Commission of Alaska for 'Comparison of Natural Gas Pricing Proposals'
- Matt Carlson, \$177,000 from the National Science Foundation for 'Ecological Genomics of Flower Color Evolution in the Arctic'
- Terry Chapin, \$78,000 from the National Science Foundation for 'LTER Supplement 2008: The Dynamics of Change in Alaska's Boreal Forests'
- Jessica Cherry, \$31,000 from the National Oceanic and Atmospheric Administration for 'Southeast Alaska Hydropower: Reconsidering climate variability and change in the development process'
- Jessica Cherry, \$12,000 from the National Weather Service for 'A Study of WRF Capabilities in Resolving Temperature Inversions in Alaska and Montana'
- Jessica Cherry, \$69,000 from the Bureau of Land Management for 'Application of SAR to Fish Habitat Management'
- Terrence Cole, \$23,000 from the Fairbanks North Star Borough for 'Teaching American History 2008'
- Stephen Colt, \$70,000 from the Alaska Energy Authority for 'Alaska Energy Statistics'
- Stephen Colt, \$50,000 from the Alaska Division of Corrections for 'Cost Containment for Crime'
- Billy Connor, \$10,000 from the Alaska Department of Transportation and Public Facilities for 'Screening Test of RAP Application'
- Billy Connor, \$3.2 million from the U.S. Department of Transportation for 'National University Transportation Centers: Alaska: Year 4 Funding'
- Billy Connor, \$230,000 from the University of Idaho for 'Development, Deployment, and Assessment of a New Paradigm (Based on Active, Problem-Based Learning) for Transportation Professionals and University Students'
- Peter Fix, \$48,000 from the National Park Service for 'Monitoring Indicators in Denali National Park'
- Mary Ellen Gordian, \$284,000 from the Municipality of Anchorage for 'Assessment of the Impact of New Regulations Limiting Benzene in Gasoline on Indoor Air Quality in Homes with Attached Garages'
- Gilberto Fochesatto, \$100,000 from the National Science Foundation for 'Studying the Influence of Continental Aerosols in the Stratocumulus Clouds of the South Pacific Marine Boundary Layer during VOCALS-REx'
- Birgit Hagedorn, \$12,000 from the Alaska Department of Fish and Game for 'Fatty Acids in Steller Sea Lions'
- Birgit Hagedorn, \$7,200 from the University of Washington for 'Dynamics of Ground Ice on Earth & Mars: An Investigation Using Terrestrial Measurements, Modeling and Remote Sensing'
- Birgit Hagedorn, \$24,000 from the Municipality of Anchorage for 'Municipality Gasoline Testing'
- Birgit Hagedorn, \$34,000 from the University of Washington for 'Ground Ice Dynamics in Hyperarid Soils of the McMurdo Dry Valleys Antarctica'

- Sharman Haley, \$42,000 from Tetra Tech, Inc. for 'Red Dog Mine Aqqaluk Extension EIS'
- Larry Hinzman, \$10,000 for 'The Arctic Community-Wide Hydrological Analysis and Monitoring Program (Arctic Champ) Science Management Office'
- Larry Hinzman, \$25 million from the National Science Foundation for 'International Collaboration to Achieve Circumpolar Synthesis and Integration'
- Scott Huang, \$25,000 from the Alaska Department of Transportation and Public Facilities for 'Unstable Slope Management Program Research Phase I (Part II)'
- Stefanie Ickert-Bond, \$25,000 from the National Science Foundation for 'Supplement to Capacity Expansion and Imaging/Data Capture at the Herbarium of the University of Alaska Museum (ALA)'
- Douglas Kane, \$228,000 from the Alaska Department of Transportation and Public Facilities for 'Updated Precipitation Frequency Analysis for the State of Alaska,'
- Douglas Kane, \$51,000 for 'UAF Icewater Node'
- Douglas Kane, \$7.8 million from the Alaska Department of Transportation and Public Facilities for 'Umiat Corridor Hydrology Project,'
- Douglas Kane, \$92,000 from the U.S. Geological Survey for 'Annual Application to NIWR'
- Douglas Kane, \$25,000 from the Inland Northwest Research Alliance for 'INRA Steering Committee Support'
- David Koester, \$10,000 from the National Science Foundation for 'DEW Line Passage Project'
- Andrew Kulmatiski, \$238,000 from the Andrew W. Mellon Foundation for 'A Definitive Water Budget for Savanna' Mark Lindberg, \$479,000 from the Alaska Department of Fish and Game for 'Habitat Modeling and Diet of Yellow-billed Loons in Northern Alaska'
- Mark Lindberg, \$75,000 from the National Park Service for 'Developing a Long-term Monitoring Protocol for Marine Predators'
- Mark Lindberg, \$15,000 from the U.S. Geological Survey for 'Prevalence and Effects of Avian Influenza in Waterfowl'
- Mark Lindberg, \$11,000 from the U.S. Geological Survey for 'Amendment to Relationship between Physiological Condition and Reproduction of Lesser Scaup'
- Mark Lindberg, \$13,000 from the Alaska Department of Fish and Game for 'Supplement to FY09 Wildlife Base Funding'
- Mark Lindberg, \$75,000 from the National Park Service for 'Developing a Long-Term Monitoring Protocol for Marine Mammals'
- Amy Lovecraft, \$6,000 from the Canadian Embassy for 'The International Polar Year in North America: Engaging the Human Dimension through Peace and Security Dialogue'
- Amy Lovecraft, \$10,000 from the Marine Mammal Commission for 'Human Dimensions of Marine Mammal Management in the Arctic'
- Marie Lowe, \$11,000 from the Alaska Department of Fish and Game for 'Cultural Models of Copper River Salmon Biology'
- Stephanie Martin, \$11,000 from the Alaska Division of Administrative Services for 'Alaska Native Language Assistance'

- Gerald Mohatt, \$19,000 from the National Science Foundation for ‘Successful Aging through the eyes of Alaska Natives’
- Link Olson, \$9,000 from the National Science Foundation for ‘Thrice through Beringia? Unraveling the evolution of North American pikas’
- Matt Olson, \$10,000 from the National Science Foundation for ‘Assessing the effects of pollinator behavior on the evolution of gynodioecy’
- Mary Pete, \$1.088 million for ‘Kuskokwim Campus CCRAA Renovation Grant’
- Abby Powell, \$52,000 from the U.S. Geological Survey for ‘Diet of Glaucous Gulls on Alaska's North Slope’
- Abby Powell, \$145,000 from the U.S. Geological Survey for ‘At-Sea locations of Juvenile and First-Year King Eiders’
- Abby Powell, \$24 million from the U.S. Geological Survey for ‘Amendment to Avian Ecology in Northern Alaska Within a Changing Environment’
- Sanjay Pyare, \$60,000 from the Alaska Department of Fish and Game for ‘Evaluation of survey methodology to assess Aleutian Tern population status’
- Sanjay Pyare, \$44,000 from the U.S. Fish and Wildlife Service for ‘Southeast Alaska GIS Library, User Training Module Development, and Pilot Demonstration Project’
- Sanjay Pyare, \$180,000 from the National Fish and Wildlife Foundation for ‘Using shipboard observers to test how ship speed and other factors influence the rate and severity of encounters between large ships and large whales’
- Thomas Ravens, \$47,000 from Texas A&M University Research Foundation for ‘Design of Erosion-Resistant Marshes’
- Thomas Ravens, \$78,000 from the Alaska Department of Fish and Game for ‘Sediment Transport in Lower Ship Creek’
- Thomas Ravens, \$22,000 from the Kenai Peninsula Borough for ‘Kenai Coastal Erosion Analysis’
- Thomas Ravens, \$38,000 from the U.S. Geological Survey for ‘Predictive Coastal Erosions Modeling in the Lake Teshekpuk Special Area’
- Vladimir Romanovsky, \$10,000 from the National Oceanic and Atmospheric Administration for ‘State of the Arctic Land Report’
- Vladimir Romanovsky, \$11,000 from the Federal Highway Administration for ‘Long-term Permafrost Dynamics of the Proposed Kiniktuuraq proposed relocation site for the village of Kivalina, Alaska’
- Vladimir Romanovsky, \$2 million from the National Science Foundation for ‘The Thermal State of Permafrost in North America and Northern Eurasia’
- Amanda Rosenberger, \$57,000 from the Alaska Department of Fish and Game for ‘Lake Correlates of Stocked Fish Productivity in Interior Alaska’
- Amanda Rosenberger, \$40,000 from the Pollock Conservation Cooperative Research Center for ‘Continuing to Increase Experiential Learning Opportunities for Undergraduate Students in Fisheries at the University of Alaska Fairbanks’

- Roger Ruess, \$174,000 from the U.S. Forest Service for 'Dynamics of Change in Alaska's Boreal Forests'
- William Schnabel, \$96,000 from the U.S. Department of Agriculture for 'Partitioning Behavior of Pathogen Indicator Microbes in Snowmelt'
- William Schnabel, \$1 million from the Alaska Department of Transportation and Public Facilities for 'Sagavanirktok River/Bullen Point Hydrology Project'
- Peter Schweitzer, \$120,000 from the National Science Foundation for 'Partial Support of the Sixth International Congress of Arctic Social Sciences'
- Yuri Shur, \$50,000 from the Alaska Department of Transportation and Public Facilities for 'Geotechnical Investigations for the Dalton Highway Innovation Project as a Case Study of the Ice-Rich Syngenetic Permafrost'
- Derek Sikes, \$6,000 from the U.S. Fish and Wildlife Service for 'Insect & Plant Study for USFWS Kanuti National Wildlife Refuge'
- Derek Sikes, \$273,000 from the National Science Foundation for 'Critical Upgrade to the University of Alaska Museum Insect Collection'
- Derek Sikes, \$9,000 from the U.S. Fish and Wildlife Service for 'Survey of Aleutian Islands Arthropods 2009'
- Elena Sparrow, \$50,000 from the National Science Foundation for 'Ice e-Mysteries Polar e-Book: An Innovative Approach to Science and Literacy Education'
- Alan Springer, \$196,000 from Seward Association for the Advancement of Marine Science for 'Support for Science Director Springer Stationed at the Alaska SeaLife Center, Seward, AK'
- David Tallmon, \$44,000 from the Alaska Department of Fish and Game for 'Population Structure and Conservation Status of Spruce Grouse in Southeast Alaska'
- David Tallmon, \$13,000 from the National Oceanic and Atmospheric Administration for 'King Crab Aquaculture and Enhancement in Alaska'
- Greg Walker, \$118,000 from the Federal Aviation Administration for 'Development of a Three-Dimensional RADAR-based Airspace Monitoring and Surveillance Instrument'
- Katey Walter, \$90,000 from the U.S. Department of Energy for 'Quantifying Climate Feedbacks from Abrupt Changes'
- Katey Walter, \$600,000 from the National Science Foundation for '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'
- Zhaohui Yang, \$13,000 from the Alaska Department of Transportation and Public Facilities for 'Effects of Permafrost and Seasonally Frozen Ground on the Seismic Response of Transportation Infrastructure Sites'
- Zhaohui Yang, \$20,000 from PND Inc. Consulting Engineers for 'Numerical Analyses of the Pull-Out Resistance of Open Cell Sheet Pile Walls'

Feedback. Feedback on the program thus far has been positive. From the NSF Reverse Site Visit report: "Research and education are both well-integrated and closely linked to innovation. The state is

making appropriate investments to increase research capacity more broadly in its higher education system institutions. In short, the state is making progress.”

From the first independent evaluators’ report: “The evaluation team is struck by the intense motivation and commitment of students to their research. There is evidence that students and faculty have begun to collaborate on papers, proposals and other research outcomes. The activities that foster these types of interactions and outputs should continue.”

Plans

Year three of Alaska EPSCoR Phase III will continue largely along the same tracks as years one and two.

While the three main components will be busy meeting their disciplinary benchmarks, there will also be more attention paid to integrating and synthesizing the results of individual research projects. Gathered information will continue to be incorporated into real-world models.

The year will see a redoubled emphasis on linking projects and researchers across disciplines and across jurisdictions. Grants and other support will be offered to multi-investigator, multi-disciplinary projects, especially ones which incorporate collaboration by researchers outside of Alaska. In addition, EPSCoR is working with the IGERT Resilience and Adaptation program at the University of Alaska Fairbanks to support graduate students building a community of interdisciplinary inquiry.

In addition, we plan to increase our outreach and education efforts in year three in order to continue to extend our reach beyond academia.

EPSCoR will continue with its successful internal award programs; for example, 22 graduate students have already been selected to receive funding for 2009-10. One noteworthy development will be the hire of two new social scientists, one at UAA and the other at UAF.

An EPSCoR office retreat is planned for the summer of 2009 so that core EPSCoR staff can consider necessary changes and course corrections as we commence year three of the grant.

- **Diversity and Broadening Participation, Including Institutional Collaborations**

- i. **Broadening Participation**

Alaska EPSCoR’s commitment to diversity is exhibited in the spread of its students, faculty, and leaders.

The strong participation by minorities and women in EPSCoR has increased or remained roughly steady in all areas since the conclusion of EPSCoR’s previous RII (“Phase II”) in 2007. EPSCoR’s record of supporting women is especially strong, with females outnumbering males in several significant categories.

41% of the faculty hired or supported in 2006-07 (final year of Phase II) were female and 28% were underrepresented minorities. In 2008-09, 60% were female and 25% were underrepresented minorities.

54% of the students who received major EPSCoR support in 2006-07 were female and 30% were underrepresented minorities. In 2008-09, 50% were female and 20% were underrepresented minorities.

Demographic numbers for staff and External Advisory Committee members have remained steady. In 2006-07 and in 2008-09, all three EPSCoR office staff were female, two of whom were underrepresented minorities. EAC members in 2006-07 included six Caucasian males and two Caucasian females; in 2008-09 the EAC is made up of three Caucasian males and one Caucasian female.

These consistently strong numbers represent a continued effort on EPSCoR's part to appeal to women and to members of underrepresented groups, especially Alaska Natives. Efforts to involve Alaska Natives in Alaska EPSCoR's programs serve to broaden participation on several fronts at once: geographic, racial, and ethnic. Many of these efforts directly involve outreach to Alaska's rural campuses, which are recognized as TCUP affiliates.

Efforts to reach out to Natives and other groups include:

- Funding four \$20,000 Alaska Native Engagement Mini-Grants in 2009. This internal funding program is aimed at increasing the interest of Alaska Natives in STEM careers (see outreach section, below);
- Sending EPSCoR Communication/Outreach Coordinator Pips Veazey to the "Building Diversity in Higher Education" conference in West Virginia in October 2008. The NSF-sponsored conference was "a workshop for policymakers, research administrators and faculty members committed to recruiting and retaining women, underrepresented racial/ethnic minorities and people with disabilities."
- Marketing all of EPSCoR's award programs to rural campuses of the University of Alaska and to an extant list of Alaska Native students;
- Continuing a proposal-writing assistance program for rural campuses; Supporting a variety of educational outreach programs specifically aimed at Alaska Natives, including the Alaska Rural Research Partnership, the Alaska Summer Research Academy, and the Rural Alaska Honors Institute (See outreach section, below.);
- Providing scholarships to students in the Alaska Native Science and Engineering Program, and partnering with the NSF IGERT program at UAF to include more students;
- Being represented (in the person of Anne Sudkamp) on the UAF Interim Chancellor's Transition Team in summer 2008. The team in particular stressed to the chancellor the importance of funding rural campuses and their Native students;
- Working through professional associations; for example, EPSCoR Education/Outreach Director Elena Sparrow is president of the Alaska chapter of the Association for Women in Science;

Also noteworthy is Alaska EPSCoR's continuing support of the Western Alaska Interdisciplinary Science Conference. The conference seeks to bring together researchers and rural Alaskan residents to share research and observations and to both coordinate and bolster research efforts in rural communities.

The high-profile events are aimed at increasing local awareness and interest in research efforts and attract significant numbers of Alaska Natives. EPSCoR provided travel funding for the conference, held in Nome in 2009, and many EPSCoR students and faculty were in attendance.

Alaska Native people also are valued by Alaska EPSCoR as important sources of cultural knowledge, and their participation in our research efforts often takes the form of imparting traditional wisdom. EPSCoR researchers in the field turn to local Native residents for expert advice on local conditions. EPSCoR personnel also seek Native knowledge in organized ways. The GLOBE Seasons and Biomes K-12 program (see outreach, below), for example, arranges for Native elders to participate in the program in rural schools. In October 2008, Alaska EPSCoR helped sponsor a visit of three Native elders to Fairbanks to lead a discussion entitled “How We Learned What We Know: Indigenous Experts Document Arctic Ice and Climate Change.” EPSCoR co-PI Terry Chapin also arranged for the elders to meet with IGERT Resilience and Adaptation Program students – many of them EPSCoR-funded – in an informal manner.

Native knowledge is also key to the “Urban Elders Project,” an initiative by the Resilience and Adaptive Management Group at UAA to interview elders in Southcentral Alaska from Native Alaskan and immigrant communities in order to gather traditional knowledge about water, health and the environment and how these contribute to communities’ ability to adapt to change.

Alaska EPSCoR sought to reach out to another underrepresented minority group through a United Negro College Fund SEEDS field course in August 2008. Alaska EPSCoR supported the course, which aims to inspire African-American students and faculty to choose careers in ecology. Sixteen students and 10 faculty visited the Bonanza Creek Experimental Forest, the Large Animal Research Station and the Museum of the North (all at UAF) as well as other sites in August 2008 as part of the course, which was coordinated in part by EPSCoR co-PI Terry Chapin. The course followed a similar event in May 2008.

EPSCoR also seeks to broaden participation in a geographic sense by making sure all three major UA campuses are hosts to EPSCoR events. Though EPSCoR is headquartered in Fairbanks, both our “Living on Earth” workshop and our 2009 All-Hands meeting were held in Anchorage. Next year’s All-Hands Meeting is tentatively set for Juneau.

EPSCoR’s efforts to overcome institutional and disciplinary barriers through integrative projects and activities are extensively documented elsewhere in this report.

ii. Institutional Collaborations

Alaska EPSCoR operates in the context of one diverse institution, the University of Alaska. Within that institution, however, EPSCoR’s reach is extremely broad. While the organization is headquartered in Fairbanks, members of the leadership team reside in Fairbanks, Anchorage, Juneau and Bethel.

EPSCoR-supported students and faculty hail from all three main campuses of the UA system, in Fairbanks, Anchorage and Juneau. EPSCoR markets its grant and award programs to all three campuses as well as to the UA's multiple rural campuses, which are recognized as TCUP affiliates.

The Resilience and Adaptive Management Group at UAA, an EPSCoR component, has retained Mark Altaweel of the Argonne National Laboratory as a visiting researcher since May 2008. The RAM group also invited fellow Argonne researcher Michael North to speak at an agent-based modeling workshop in Anchorage in September 2008. North has also been instrumental in the development of the FERAL software developed for use by the Integration Core.

Alaska EPSCoR's industry collaboration comes, to a significant extent, from our agreement with the Technology Research & Development (TREND) Center of Alaska, an affiliate of UAA's Alaska Small Business Development Center, to provide seed grants to fledgling tech businesses. EPSCoR and TREND collaborate to award "Phase 0" and "Bridge" Grants that help Alaskan small businesses organize and coordinate to apply for larger sums in federal funding.

From 2008-09 TREND awarded a total of \$103,000 in grants to nine different startup businesses. The grants went to companies working on extracting antimicrobial compounds from fish bycatch; smart lighting technology; management software; using geothermal energy to farm abalone; multi-media imaging for breast cancer patients; fish waste conversion; the use of gas lift bags for underwater salvage; a flight deck cleaner; and rural Alaskan blueberry farming.

Also, in fall 2008, Alaska EPSCoR executive officer and communications/outreach coordinator met with Paul McCarthy, principal of PMC Management Alaska, to discuss business development resulting from research at the University of Alaska. PMC Management of Alaska has received a contract from the University of Alaska to survey the possibilities.

In addition, many individual EPSCoR researchers partner with industry. This is especially true of our physical science component, where much of our research is of interest to Alaska's oil and gas producers. Oil giants like BP and ConocoPhillips and the Alyeska Pipeline Service Company, which runs the Alaska oil pipeline, have all partnered with EPSCoR researchers during Phase III. In summer 2008, Chena Hot Springs Resort, an Interior Alaska hot springs which has also become a pioneer of alternative energy, partnered with EPSCoR to support an undergraduate researcher doing biofuels research.

- **Workforce Development**

EPSCoR provides educational opportunities to everyone from K-12 students to seasoned faculty. On the university level, EPSCoR has awarded the following grants and fellowships since July 2008:

- 8 fellowships to undergraduates for spring and/or summer 2009, ranging in size from \$3,300 to \$8,000.
- 23 fellowships to graduate students for the 2008-09 academic year, most of them for \$21,200.

- 9 early-career awards to support researchers in calendar year 2009, ranging in size from \$20,000 to \$30,000.
- 5 faculty course buyouts awarded for spring and summer 2009. The course buyouts finance substitutes to take on teaching loads so scientists have more time to devote to research.
- 49 travel grants, totaling \$51,494, awarded to students and faculty for presentations and collaboration and exchange opportunities. Travel grants represent only a portion of Alaska EPSCoR's travel funding: in total, since May 2008 Alaska EPSCoR has funded \$132,738 in travel for 139 people.

EPSCoR Phase III has excelled at bringing new students into the fold. In the first two years of Phase III, we have funded a total of 59 grad student fellowships to 49 different people (10 people received fellowships both years.) Of these 49 people, 42 had never received funding from Alaska EPSCoR prior to Phase III. In addition, Alaska EPSCoR awarded 19 undergraduate fellowships in 2008 and 2009 to 17 different students (2 students received fellowships both years.) All 17 students had never received EPSCoR funding before.

Alaska EPSCoR also advances research careers through direct hires and funding to researchers. In addition to course buyouts, component leaders, and administrators, EPSCoR has hired six faculty members and four postdocs in Phase III, and funding has been allocated for several more positions over the three-year life of its grant.

Alaska EPSCoR presented an opportunity for training and development at its second All-Hands Meeting in May 2009. The meeting brought together Alaska EPSCoR participants for sessions on both disciplinary and interdisciplinary planning and presentations, panel discussions, a poster session, and one-on-one research discussions. Approximately 100 people attended.

Along similar lines, Alaska EPSCoR asked its graduate students to attend the Arctic Science Conference in Fairbanks in September 2008 and provided travel funding for them to do so. The conference provided an excellent opportunity for professional development and networking.

Grad students in the IGERT Resilience and Adaptation Program at UAF, many of them EPSCoR-funded, were invited to meet with UAF Chancellor Brian Rogers in a discussion of sustainability issues in October 2008. EPSCoR co-PI Terry Chapin, who arranged the event, called it a "mutual introduction" between the students and Rogers, who assumed his position July 1. Rogers' presentation was followed by a free-ranging and informative discussion among attendees, mostly focused on how research results and sustainability goals can be integrated successfully into policy decisions.

EPSCoR's pipeline to science continues down through K-12 education through a variety of school-level education and outreach programs. These programs are discussed at length in the "Outreach and Communication" section, below.

These K-12 programs also provide workforce development in a direct sense through ongoing teacher training. The EPSCoR-supported IPY GLOBE Seasons and Biomes program (see outreach section, below) participated in a professional development workshop for educators in Boulder, Colorado in August 2008 and conducted a workshop for teachers and teacher trainers from Alaska, California,

Florida and Idaho in Fairbanks in October 2008. Continued support is provided to GLOBE teachers beyond the workshops and includes equipment to conduct investigations with their students, email, phone and data entry support. Many teachers who participate in GLOBE programs are eligible for continuing education credits at the University of Alaska.

The new Culturally Infused Biological Science Education Project (see Outreach section, below) also provides an opportunity for teacher training in the form of a 4-credit UAF course which prepares teachers to initiate the project in their own classrooms.

Alaska EPSCoR Education/Outreach Director Elena Sparrow traveled to Thailand in November 2008 to lead a science inquiry workshop for undergraduate and graduate students at Wailalak University and to lead a workshop at the Botanic Resort in Chiang Mai for Thai teachers, Thailand University faculty, and others. In addition, Sparrow conducted a two-hour Seasons and Biomes workshop at the American Geophysical Union Conference in San Francisco in December 2008.

- **Cyberinfrastructure**

EPSCoR's integration core focuses on the use of cybertools to enable complex examination of the interactions between social and ecological systems. Both SES Hotspots Mapping and FERAL techniques make use of cutting-edge technology that has necessitated both software and hardware upgrades.

The use of FERAL necessitated the development of dedicated, open-source software. This software was developed through collaboration with Michael North of Argonne National Laboratories and modified by visiting EPSCoR researcher Mark Altaweel, also of Argonne.

The FERAL software remains open source and can be accessed and used by anyone without the need for proprietary software. The availability of the source code and the right to modify it is very important to making this technology useful. It enables the unlimited tuning and improvement of the software, and also makes it possible to port the code to new hardware, to adapt it to changing conditions, and to reach a detailed understanding of how the system works. Making it available to the public allows it be shared by large communities who can use the software in any way they see fit, thus resulting in broader impacts and benefits and allows for external improvements to the model, potentially increasing its quality and functionality.

Hardware improvements in the Integration Core consist of a high-powered desktop computer for use by the Integration Team. An unrelated hardware upgrade was made to the bioinformatics core operating system in March 2009.

Human capital has been invested in these cyberinfrastructure efforts as well. Altaweel continued to work on the developing FERAL, while other faculty who have worked on modeling in 2008-09 include Richard Lammers of the University of New Hampshire and UAF postdoc Jennifer Schmidt. In an unrelated effort, Alaska EPSCoR early-career grantee Jessica Cherry is engaged in a 'data rescue'

project, locating, digitizing and cataloging historic climate and water information related to the Seward Peninsula.

Cyberconnectivity is key in a state the size of Alaska, and a number of EPSCoR discussion and lecture series have used interactive videoconferencing techniques to enable participation by a statewide audience. The Integration Team and stakeholders have identified several key areas in which cyberconnectivity needs to be improved, and have proposed remedies for these areas:

- The installation in remote settings of small, remote digital video units capable of working off several conduits, including satellite, cable and phone.
- The standardization of software protocols and procedures among key partners and the University through a Cyberconnectivity Agreement.
- The training of faculty, students, staff and community partners in the use of the hardware and software mentioned above.

Alaska EPSCoR continues to focus on these challenges as it heads into its third year.

- **Outreach and Communication**

Education and outreach are key components of Alaska EPSCoR. By providing myriad science education activities to Alaskan youth, especially Alaska Natives, we help funnel promising students into science careers. And by keeping lines of communication open to Alaskan communities, organizations and individuals, we ensure that our research findings are disseminated to the people who can make the most use of them.

Education. Alaska EPSCoR's various K-12 programs contribute to research capacity-building by engaging K-12 students and their teachers in ongoing investigations as a way of learning and teaching science.

One exciting new program for 2008-09 is the Culturally Infused Biological Science Education Project. The project will create new professional development courses and curricula for rural Alaskan secondary school science teachers which will integrate Native ways of knowing with scientific information. Data collected by rural students in field projects will contribute to the central database described in the Integration Core section, providing rural students the opportunity to participate in a statewide research project while providing scientists with useful data.

The project's initial stages are underway, in the form of a 4-credit teacher education course to run at UAF during the summer of 2009. Two weeks of the course will be taught via distance learning, the other two during a two-week residency. Teachers enrolled in the course will have their tuition and expenses covered and will be expected to implement teaching from the course in their classrooms; follow-up support will include a visit to each participant to help set up the class. The class is open to up to 10 teachers.

The course content will focus on phenology, invasive plants, and nitrogen fixation using plant-symbiont relationships and mycorrhizae as a unifying theme, and includes the development of lesson plans

and experiments that educators implement in their own classrooms. Two modules will be taught, one on the biogeography and phenology of the bearberry, and the other on invasive legumes and their nitrogen fixers. The program is being developed in large part by Alina Cushing, who was hired in October 2008 as an Alaska EPSCoR- funded science outreach professional.

Also new for 2008-09 are the Alaska Native Engagement Mini-Grants. These four \$20,000 grants were given to researchers with projects designed to spur the interest of Alaska Natives in science and research. The grants were awarded to UAF's Kenji Yoshikawa for his program of installing frost tubes in schools (see below); Mary Beth Leigh of UAF for an innovative program teaching Native middle-schoolers about climate change through creative expression in writing and dance; Anita Hartmann of UAF for a project to distribute brief videos and brochures about Alaska Native research opportunities to high schools across the state; and Claudia Ihl of the UAF Northwest Campus in Nome to involve Native musk ox hunters in a study of musk ox hunting and usage practices.

Another new program is the "Ice e-Mystery project," currently under development, which will involve students from 12 pair elementary and middle school classes in Alaska and Tasmania working together to write and illustrate on-line books in a mystery genre focused on various themes of polar science.

EPSCoR has also continued to contribute to a host of K-12 education programs. EPSCoR provides both funding and expertise for "Monitoring Seasons through Global Learning Communities," also known as the IPY (International Polar Year) GLOBE (Global Learning and Observations to Benefit the Environment) Seasons and Biomes project. Seasons and Biomes is a worldwide educational project in which K-12 students discuss climate change and learn about scientific inquiry through their observations of the seasons. Activities have included an international videoconference and Web forum; professional teacher development workshops; and class and individual investigations into plant and ice phenology and other climatic topics by K-12 students across Alaska and the world.

GLOBE teachers and students have developed protocols for measuring climate change through phenomena such as times of river freeze-up and break-up, permafrost measurements taken through frost tubes, and mosquito observations and statistics. Learning activities to support the protocols are also being developed.

In Alaska 30 teachers and their students are actively involved in the program. One group of Alaska Native students, their teacher and the Native elder working with them were chosen to present their climate change-related project at the GLOBE Learning Expedition in South Africa alongside students from more than 24 countries.

Alaska EPSCoR also supports the Alaska Rural Research Partnership, which partners students from rural, mostly Alaska Native high schools with UA scientists for research projects which they then present at state or regional science fairs. Alaska EPSCoR provided equipment for students to conduct their investigations as well as travel support and \$1,500 scholarships to each student.

Six students participated in the 2008-09 program, all from Mt. Edgecumbe High School in Sitka, a primarily Native-serving institution. Their projects examined microorganisms in Southeast Alaska

muskeg. This year's students were remarkably successful, taking home top prizes at the Alaska Statewide High School Science Symposium, the Southeast Regional Science and Engineering Fair, and the I-SWEEEP (International Sustainable World Energy, Environment, Engineering Project Olympiad) resulting in subsequent trips to national competitions in Nevada and Texas. Another ARRP student received a prestigious Gates scholarship. (See honors and awards, below.)

EPSCoR also supports the Permafrost Monitoring Program, which through which temperature sensors are installed in permafrost soil at more than 100 school sites across Alaska and the Yukon. Program lead Kenji Yoshikawa has traveled to the schools and put in the devices personally, involving the schoolchildren in their installation and teaching them about permafrost science in the process. Yoshikawa has also increased permafrost knowledge by creating and exhibiting three educational "Tunnel Man" videos, in which Yoshikawa imaginatively explains permafrost principles for a young audience.

EPSCoR also has entered into several productive partnerships for K-12 outreach. Alaska Native Bioscience is a partnership with the NSF-funded Alaska Native Science Engineering Program which supports Alaska Native students interested in careers in bioscience. In 2008-09 Joel Hunt, a Yupik Eskimo, and James Mills, an Inupiaq, were each awarded \$2,500 scholarships by EPSCoR through the program.

Alaska EPSCoR provides funding for students in the Rural Alaska Honors Institute, a UAF program which brings rural, mostly Native high school students to campus for a summer term to help interest them in and prepare them for college. In summer 2008 EPSCoR supported four students, from the rural towns of Hooper Bay, Dillingham, Barrow and Point Lay.

EPSCoR provides funding for a high school summer research internship program in collaboration with the Bonanza Creek Long Term Ecological Research (LTER) Project. The program partners rural - mostly Alaska Native - and urban minority high school students with UA researchers for a summer program. Two Alaska Native female students were interns in summer 2008 and both have since completed their freshman years at UAF. EPSCoR also provided partial support for one rural student at the Alaska Summer Research Academy, a two-week long academic program at UAF for high schoolers.

Outreach. EPSCoR's outreach efforts reach beyond the classroom as well to encompass a variety of efforts to inform and educate the public on science topics.

Alaska EPSCoR organized and hosted the "Living on Earth" conference, an NSF-sponsored workshop on social-ecological system research. Held in Anchorage in May 2009, the workshop was attended by more than 50 people from 10 EPSCoR jurisdictions. Though the event featured speakers and discussion sessions, it centered around an "immersion activity" in which attendees visited and studied various Anchorage sites that constitute social-ecological systems and were asked to report as groups on their findings. The innovative format of the conference received high marks from attendees.

EPSCoR contracted with a UAF undergraduate videographer to film the conference and produce a short documentary about it. The 10-minute film will be posted on EPSCoR's website and made available on DVD to all interested parties. The same videographer is also producing a short documentary about Alaska EPSCoR in general. The documentary will be posted on EPSCoR's website and made available on CD as a video brochure.

EPSCoR continues to have a noteworthy presence online and in print. Our website is continuously updated with information and features, and we produce newsletters twice a year. The newsletter size shot up 50 percent in the last year, from 8 pages to 12. Newsletters are distributed to a 1,300-strong mailing list and made available at state fairs and other public events. EPSCoR has increased support for its print efforts, including sending graduate student Tom Moran to the Western Alaska Interdisciplinary Conference in Nome to report on it and to the Living on Earth and All-Hands meetings in Anchorage, where he took photos and notes for newsletter articles and helped produce the mini-documentaries discussed above.

Moran also contributed material to "Frontiers," a widely-distributed magazine of UAF research accomplishments. In addition, a piece he wrote on EPSCoR Early-Career grantee Katey Walter for the EPSCoR newsletter and website is being used by the UAF Geophysical Institute as part of a statewide K-12 educational curriculum. The article will be made available to teachers in Alaska and beyond.

The Resilience and Adaptive Management Group, an EPSCoR-affiliated organization at the University of Alaska Anchorage, also sends out a bi-monthly newsletter.

At the Annual Meeting of the Alaska Anthropological Association in Juneau in March 2009, four EPSCoR faculty members held an information session entitled "What is EPSCoR?" for a small crowd of anthropologists and agency representatives.

The EPSCoR-supported Alaska TREND program has an active outreach component, publicizing itself regularly at trade shows, business fairs, economic development meetings, conferences and other events. This included a dozen public appearances between August 2008 and March 2009.

Alaska EPSCoR supports Science Potpourri, a science open house held annually at UAF for the past 15 years. The event showcases science and engineering to the whole community, including hands-on activities for children and demonstrations which appeal to adults. The crowd numbers in the hundreds each year.

Alaska EPSCoR has also contributed funds and/or in-kind support to numerous public lectures and events over the past year, including showings in Anchorage, Fairbanks and Juneau of documentary films, as well as associated discussions, for World Water Day in March 2009; a pair of lectures on Viking archeology (and associated social events) by visiting scholar Tom McGovern in February 2009; a lecture in September 2009 by oncologist Devra Lee Davis on cancer and dangerous toxins; and a seminar by Duke University evolutionary biologist Anne Yoder in February 2008.

EPSCoR-funded undergrad Michael Golub has taken his expertise in retrofitting cars to run on electricity on the road. Golub has taught classes in electric car conversion in Barrow, Dillingham, and Palmer, Alaska, in addition to multiple classes in Fairbanks.

In January 2009 EPSCoR co-PI Lil Alessa presented at the Alaska World Affairs Council on “Water and the Arctic: The Endgame.” The presentation was recorded and aired twice on radio station KSKA 91.1 in Anchorage.

Students in the EPSCoR-affiliated IGERT Resilience and Adaptation program organized numerous public lectures in fall 2008, including a visit by Native elders entitled “How We Learned What We Know: Indigenous Experts Document Arctic Ice and Climate Change” (see ‘Broadening Participation,’ above). Other RAP seminars dealt with urban fisheries, the aging process in rural Alaska, consumption choices in Fairbanks, and sea-ice information products.

EPSCoR did outreach work for Alaska’s fledgling NASA EPSCoR program, liaising with group leaders and mentioning them in our newsletter.

EPSCoR management team members Elena Sparrow and Terry Chapin both serve on the Climate Change Task Force of the Interior Issues Council, a program of the Fairbanks North Star Borough. The task force is a group of citizens and public employees collaborating to establish and build a sustainable climate-resilient community through education, public outreach, and borough-wide actions. Chapin is also a member of the Adaptation Advisory Group of Alaska governor Sarah Palin’s Sub-cabinet on Climate Change.

- **Evaluation and Assessment**

We evaluate and document our activities on two levels. Our performance is tracked and evaluated by our pair of independent evaluators, Drs. Julia Melkers and Eric Welch, and by our External Advisory Committee. We also keep internal records of our activities.

Drs. Melkers and Welch are working hand-in-hand with us to improve our program through a phased three-year evaluation plan. Their methodology includes collecting both qualitative and quantitative data through surveys, document review, interviews, and bibliometric analyses of curricula vitae, and they are seeking to examine both EPSCoR’s discrete research results and the success of our integrative efforts. The surveys have proven effective methods of data-gathering; the 2009 survey had a faculty response rate of 86% (59 total respondents) and student response rate of 85% (57 total respondents). In addition the evaluators have made multiple visits to Alaska to review the program.

Drs. Melkers and Welch are examining numerous aspects of Alaska EPSCoR, including productivity; integration; proposal creation and attraction of new talent; fostering of career paths and networking opportunities; benefits for Alaska Natives; and student involvement. Their evaluation criteria include studies of EPSCoR’s progress toward developing intra- and interjurisdictional collaborations to address key issues. They hope to answer two questions: First, whether EPSCoR’s research plans are coherent, and second, whether Alaska EPSCoR has the ability to carry them out.

In the first year of EPSCoR phase III, Drs. Melkers and Welch principally worked to gather baseline data to allow the tracking and analysis of collaborations and other interactions among EPSCoR

participants. Data collection in both the first and second year of EPSCoR phase III included semi-structured interviews with faculty and students as well as a detailed survey of all affiliated faculty and students. The final year 1 evaluation report was provided to us in the summer of 2008 and included several recommendations designed to strengthen the capacity of faculty and students in Phase III.

We made several changes based on these recommendations. First, we developed an internal database of EPSCoR students, faculty and stakeholders to track their involvement.

Second, we took several steps to increase our collaborative efforts. We added a new category to our travel grant award program to increase emphasis on collaborations within Alaska. We have worked to better advertise our opportunities by creating and widely disseminating a single flyer listing all of our internal award programs and deadlines. We also have increased communication by holding numerous workshops, meetings and discussion/seminar series, including two All-Hands meetings; discussion/seminar series in integration, in biology and in social science; an EPSCoR session at the Ninth International Conference on Permafrost in Fairbanks in July 2008; an Agent-Based modeling workshop in Anchorage in September 2008; an EPSCoR session at the Alaska Anthropological Association in Juneau in May 2009; and the Living on Earth NSF-EPSCoR workshop in Anchorage in May 2009.

Third, the evaluation pointed to the need to increase interaction both with and within the EPSCoR student body. The 2008 and 2009 All-Hands meetings both included significant student sessions and breakouts. Students were also substantially involved in the workshops, meetings and discussion/seminar series noted above. The biology discussion/seminar series, in particular, was developed and run entirely by EPSCoR graduate research fellows.

The primary focus of the ongoing year 2 evaluation effort is on integration within the context of EPSCoR Phase III. "Integration" is treated broadly within the evaluation to include both integration across groups and integration across areas of expertise. Under 'groups,' the evaluators are examining integration across and among campuses, faculty ranks, faculty-student groups, and user groups. Under 'expertise and specializations,' they are considering integration across and among disciplines/component groups, specialization within components, data, conceptual and theoretical bases, and methodological approaches.

The year 2 evaluation report will be released in summer 2009. Early results point to advances in identification of integrative research areas and interests that may build toward future research. For example, the majority of faculty report having "developed new ideas or plans for research as a result of interaction with EPSCoR Phase III." Reflected in this finding, the survey results show important grant proposal development that crosses disciplines as well as institutions. The results show especially promising integrative developments in the specific areas of species response to climate change, ecosystems services in rural Alaska, and institutional approaches to resilience.

Year 3 of the evaluation will have a special emphasis on integration with external stakeholder groups, including Native and community groups. The evaluators also will continue their tracking of

collaborative activities and outcomes, as well as address the institutional support mechanisms which facilitate integrative research, education and outreach within the Alaskan environment.

In addition to the independent evaluators, EPSCoR is evaluated by an external advisory committee consisting of Hugh French of the University of Ottawa, Nancy Grimm of Arizona State University, Igor Krupnik of the Smithsonian Institution, and Alan Covich of the University of Georgia. They held an initial site visit in 2008 and French also attended Alaska EPSCoR's All-Hands Meeting in 2009.

EPSCoR also keeps meticulous records, both for internal purposes and for the benefit of evaluators. These include the comprehensive database of all EPSCoR faculty, students and stakeholders (as recommended by our independent evaluators) which is updated regularly; a constantly updated mailing list of all people interested in EPSCoR; and an up-to-date demographic spreadsheet.

Many EPSCoR component parts have built-in assessment protocols. As an example, the GLOBE Seasons and Biomes program administers a variety of surveys and assessments both before and after teacher training workshops, and students are tested both before and during the program. Participants in the Living on Earth workshop were given surveys which will be used to help plan future workshops.

- **Sustainability and Project Outputs**

Sustainability is a key facet of Alaska EPSCoR, with results designed to last long after the program has completed its three-year lifespan. By meeting its principal goal of increasing research competitiveness among Alaskan researchers, Alaska EPSCoR seeks to increase the state's competitiveness for NSF and other grant money in the long term.

Alaska EPSCoR also seeks to sustain its research progress by concentrating on resilience science, a burgeoning field with great funding potential. By focusing our efforts in this promising direction we hope to leave a legacy of increased funding and study in this field.

We also build capacity through the Integration Core and its inclusive modeling process. The Core has been instrumental in the development of a national effort to bring computational social sciences to the forefront of resilience research. This involves the development of "Open ABM: A Community Framework for Complexity Modeling in the Social and Natural Sciences" (openabm.org).

The goal of Open ABM is to foster and improve the development, communication, and dissemination of agent-based models, such as those being developed by the Core, for research, practice, and education. The potential of ABM research to answer significant questions about human interaction with the landscape has led to significant interest in Alaskan research by state and federal agencies.

Interest in the FERAL technique has led a small but highly dedicated group of researchers to coalesce around the philosophy and methodology of integration and integrative science. This group consists of representatives from Native communities such as the Aleut International Association, agencies like the North Slope Science Initiative, and both major and minor UA campuses.

EPSCoR also builds capacity via its concentration on K-12 education helps create a pipeline to science. By funneling children into science through K-12 programs and keeping them there through university student and faculty grant programs, we seek to inspire young Alaskans' interest in STEM careers, leading to increased scientific capacity over a period of years and decades.

Our extensive travel grant program regularly sends EPSCoR students and faculty to national and international symposia, affording them opportunities to build collaborative efforts. For example, one travel grant helped pay for a faculty member to attend a conference in Yakutsk, Russia, at which that individual was invited to apply for a European Commission Marie Curie Fellowship to conduct collaborative research in population and landscape genetics with researchers at the Mammal Research Institute in Bialowieza, Poland. Moreover, the faculty member received an invitation to spend a sabbatical year at the Swedish Agricultural University in Umea, Sweden.

EPSCoR's legacy also lies in its focus on interdisciplinary research, which encourages the formation of new partnerships with the university and in the larger community, leading to lasting relationships. Events like the Living on Earth conference and our All-Hands meetings also encourage networking and the creation of long-term partnerships. As an example, EPSCoR undergraduate Michael Golub made a business contact at our 2008 All-Hands Meeting which led to him being invited to demonstrate his specialty – converting gasoline cars to electric ones - at a rural Alaska campus. That in turn led Golub to form a business specifically to run car-conversion workshops throughout Alaska, an enterprise which has the potential to outlast EPSCoR itself.

Golub's success illustrates another facet of EPSCoR's sustainability: its focus on rural campuses. By thoroughly integrating them into our activities, we are instituting potentially permanent changes in their ability to conduct research in the future.

Along the same lines, EPSCoR's improved outreach activities contribute to sustainability by sharing results with more Alaskans, allowing them to take long-term action based on EPSCoR's research results. And by integrating research results into usable real-world models, which is a central goal of our integration core, we create products which will prove useful to Alaskans in the long term.

i. Seed Funding and Emerging Areas

EPSCoR seed funding comes to an extent in the form of our early-career awards, which are given on an annual basis to promising young researchers in EPSCoR fields. The awards, which reach up to \$30,000 a year, are meant to give researchers the funding and time to put together proposals for much larger grants from national organizations.

The Early-Career grants, like all grants awarded by Alaska EPSCoR, are awarded based on thorough evaluations of applicants in a competitive and speedy process. Proposals which have the potential for transformative or high-impact results are encouraged and given priority. While grants are given out on a regular schedule, EPSCoR is always willing to be flexible in awarding grant funding for promising and timely proposals.

For example, based on discussions at the 2008 All-Hands Meeting, EPSCoR co-PI's Terry Chapin and Lil Alessa decided to invite Richard Lammers of the University of New Hampshire to work with the Integration Core as a hydrological modeler on a summer contract. Lammers' hire was a swift decision based on an opportunistic appraisal of the program's needs.

Another example of redirecting funding is \$20,000 provided by the EPSCoR biology component to Kevin Winker of the University of Alaska Museum of the North for a 454 whole genome sequencing study of the song sparrow, an avian species which exhibits considerable phenotypical variability across Alaska. This is among the first 454 studies to be conducted at the University of Alaska and will allow researchers to become proficient in these highly useful techniques for genetic research.

Interdisciplinary and integrative research is a hallmark of Alaska EPSCoR, as is evidenced throughout this report. All aspects of EPSCoR's organization and mission, from the activity of the integration core to the preference given to grant applicants with interdisciplinary proposals, are geared toward research that combines work from different disciplines into a coherent whole. Alaska EPSCoR makes new faculty hires via a competitive process, and considers applicants from Alaska as well as from elsewhere, creating an opportunity to attract new minds to the state.

Alaska EPSCoR's research is linked with industry and other sectors in an organic fashion thanks to the nature of science in Alaska. Because of the state's huge amount of public lands and resources, EPSCoR researchers invariably liaise and collaborate with government field workers. EPSCoR physical science researchers also regularly work with oil companies like BP and ConocoPhillips due to their interest in the Alaskan landscape and petroleum exploration and transport. Alaska EPSCoR thus does not have a centralized program to link research to the public and private sectors as such because such linkages happen here without need of prompting.

Due to Alaska's huge land mass, Alaska EPSCoR explores innovative ways of gathering remote data. In particular, EPSCoR takes advantage of "human relay stations" in rural villages throughout the state. Kenji Yoshikawa's frost tubes installed in schools across Alaska are instructive and informative for the students but are also part of a program to collect and log useful data from across a vast and diverse geographic area. Students in the Culturally Infused Biological Science Education Project will serve a similar function by collecting biological data in their home areas for use by scientists. Students in the Seasons and Biomes program collect useful data on seasonal changes and perturbations in their areas. By incorporating the help of students in these far-flung locales, EPSCoR is able to help educate them in the sciences and also maintain an elaborate statewide system of data collection points.

ii. Human Resources Development

EPSCoR's educational and workforce development programs have already been covered in full in the outreach and workforce development sections, above.

In specific terms, EPSCoR is adhering to its human resource implementation plan as set forth in its strategic plan, including the hire of faculty members, postdocs, research associates and technicians;

regular grant funding of young researchers, graduate students and undergrads, K-12 programs; and other activities.

This effort includes the hire of several people for tenure-track positions: two social scientists, a microbial ecologist and an economist/political scientist. Erica Hill has been hired as a social scientist and Andrew Kulmatiski as a microbial ecologist. EPSCoR graduate Chanda Meek has just accepted a position as a social scientist while recruitment is underway for the economist/political scientist position.

Elizabeth Bent began work in 2008 as a new postdoc studying plants and microbes. Jennifer Moore was hired as another biology postdoc in February 2009, and physical science has hired former EPSCoR graduate fellow Matthew Bray as a research associate.

Also noteworthy is Alaska EPSCoR's success at awarding grants. The implementation plan calls for the awarding of 66 graduate fellowships, 15 early-career awards and 39 undergraduate awards over the three years of the program. To date the program has awarded 82 graduate fellowships and 18 early-career awards. Only 19 undergrad awards have been given out, largely due to a change in award emphasis in favor of giving larger awards to fewer people.

EPSCoR's human resources goals integrate with the research and partnership opportunities of Alaska inasmuch as they closely mesh with the mission of Alaska EPSCoR itself, an interdisciplinary approach that confronts issues specific to Alaska. EPSCoR's principal focus is the dramatic environmental and social change taking place in Alaska, and efforts to study the physical, biological and social changes taking place here are bolstered by our focusing our resources on these areas of research as identified in our initial RII proposal.

According to internal and University of Alaska records, by early 2009 six previously EPSCoR-funded graduate students had completed their degrees, with an additional 11 grad students and 1 undergrad expected to finish their degrees in calendar year 2009. Among the highlights:

- Paula Williams, a 2007-09 EPSCoR graduate fellow, received her Ph.D. from UAA in May 2009. Even before graduation, Williams was hired as Sustainability Director at UAA, in charge of all of the campus' green efforts. Williams credits Alaska EPSCoR with making her competitive for the position: "The EPSCoR fellowship allowed me to complete an incredible amount of work in a relatively short period of time," she said. "I would never have been at this point without the funding that was provided by EPSCoR, and probably would not have been competitive for this job. "
- Jianfeng Xu, a 2007-08 EPSCoR graduate fellow, graduated from UAF in May 2008 with a PhD in Mechanical Engineering. He relocated to Houston, Tex. to take a job with the Advanced Engineering Group of J P Kenny Houston, a consulting company for builders of undersea oil and gas pipelines. His work concerns modeling and analysis of pipelines in Arctic environments.

- Colin Shanley, a 2007-08 and fall 2008 EPSCoR graduate fellow, received his M.S. in Wildlife Biology from UAS in December. He is working in Juneau as a Conservation Planner/GIS Analyst for the Nature Conservancy's Alaska Coastal Forests Program.
- UAA Biology grad student James Sowerwine, an EPSCoR fellow in 2007-08 and 2008-09, is on track to receive his Master's degree this summer. Sowerwine has signed up for a 5-10 month internship with the Chicago Botanic Garden. The garden is likely to send him to work in the BLM office in Arcata, Calif., where the bulk of his work will involve monitoring rare and invasive plants.
- Alison Meadow, a spring 2008 EPSCoR graduate fellow, defended her doctoral thesis in March and graduated in May. Meadow, an Environmental Anthropology student at UAF, is now located in Tucson, where she is beginning a Master's degree program in Urban Planning at the University of Arizona. She plans to pursue a career in urban planning in Tucson, with a focus on human health and the built environment and in planning for climate change.

Also worth noting is the success of former EPSCoR graduate fellow Ken Tape, who will finish his Ph.D. next year but already has obtained a NASA post-doctoral grant. Tape credits the grant funding to collaborations he developed through EPSCoR. In addition, Tape has raised \$15,000 in grant funds to support production of a book on the changing arctic landscape.

In conjunction with the book, Tape is assembling an exhibit for display in the University of Alaska Museum in the North in Fairbanks in summer and fall 2010. About 70,000 visitors are expected to see the exhibit during its Fairbanks run, after which time it will travel to other museums. The exhibit will also have a junior high and high school educational component. Alaska EPSCoR is likely to lend the exhibit direct financial support.

iii. Leveraging NSF Programs

Alaska EPSCoR partners with numerous other NSF-funded programs at the University of Alaska, most notably UAF's IGERT and LTER, as well as UAA's Resilience and Adaptive Management Group (RAM), to move forward on our goal of increasing research capacity in Alaska.

There is a considerable amount of interaction between EPSCoR and the IGERT Resilience and Adaptation Program at the University of Alaska Fairbanks. Our graduate students and RAP students join each other in seminars and work with each program's faculty on interdisciplinary research on resilience. In addition, we collaborate with IGERT as well as the UAF graduate school and the UAF Center for Global Change to fund as many students as possible without overlap. This effort has allowed us to fund a total of 82 graduate students rather than the 66 we noted in our proposal.

Most of our integrative core researchers are part of the UAA RAM group, thus extending their research capacity.

Alaska EPSCoR participated extensively in International Polar Year, an event significantly funded by the NSF. The GLOBE Seasons and Biomes program (see outreach, above) was designated an IPY

program. EPSCoR faculty member Nicole Molders received IPY-designated monies to investigate the impact of the eruption of Alaska's Augustine volcano on weather and climate.

Other IPY projects run by EPSCoR members include the "MOVE" project, a study of state-induced population movements in the circumpolar North; the Arctic Social Indicators project, which seeks to devise indicators to facilitate the tracking and monitoring of human development in the Arctic; and the "Municipal Water Systems and the Resilience of Arctic Communities" project, which focuses on the sociocultural effects of municipal water systems. IPY-designated funds also support Kenji Yoshikawa's project to place frost tubes in schools across Alaska and the North. (See education and outreach, above.)

The Resilience and Adaptive Management Group, an EPSCoR-affiliated organization at the University of Alaska Anchorage, is a member of the Bering Sea subnetwork, which is funded through the NSF Arctic Observing Network program. The BSSN is a cooperative effort among Bering Sea communities in Alaska and Russia to record and catalog social and environmental observations. Other participating organizations include the Aleut International Association, the Conservation of Alaska Flora and Fauna, and the Alaska Native Science Commission. The BSSN thus leverages NSF funds to enable the pooling of national and international resources.

EPSCoR also works with The Bonanza Creek Long Term Ecological Research (LTER) site in Fairbanks, which is administered by EPSCoR co-PI Terry Chapin. Numerous biology researchers work with the UAF LTER program, thus extending their research capacity. EPSCoR also works collaboratively on supporting and mentoring high school summer research interns at the facility as well as visits through the SEEDS program.

- **Management Structure**

The Alaska EPSCoR management team consists of Project Director Peter Schweitzer; co-Principal Investigators Terry Chapin and Lil Alessa; Executive Officer Anne Sudkamp; disciplinary component leaders Roger Ruess, Matt Olson, Matt Berman and Yuri Shur; Education/Outreach component head Elena Sparrow; UAS representative Sanjay Pyare and rural campus representative Mary Pete. Management team personnel have remained the same throughout Phase III.

Alessa hails from UAA, Pyare from UAS and Pete from the UAF Kuskokwim campus in Bethel; all others are UAF-affiliated. Schweitzer, Chapin, Ruess, Olson, Berman and Shur are Caucasian males. Alessa is a part Native American female, Sudkamp is a part Hispanic female, Pete is a Native Alaskan female, Sparrow is an Asian-American female and Pyare an Asian-American male.

Members of the leadership team are responsible for continually shaping the direction of Alaska EPSCoR and keep in contact through meetings almost every month in addition to strategic planning sessions, retreats, and EPSCoR's annual All-Hands Meeting. Schweitzer and Sudkamp are responsible for the day-to-day management of EPSCoR.

Members of the management team have met multiple times in 2008-09. Important issues discussed have included the awarding of grant proposals and details of our Living on Earth workshop and annual meeting.

Alaska EPSCoR is overseen by a State Committee on Research. The committee was recently reorganized and reconstituted in anticipation of submitting a Phase IV grant proposal. SCOR members are: Schweitzer; Alessa; UA Vice-president Dan Julius; UAF Vice-chancellor Buck Sharpton; Schweitzer; UAF Provost Susan Henrichs; UAA Provost Mike Driscoll; UAF Northern Engineering Director Dan White; Mead Treadwell of the US Arctic Research Commission; Doyon Limited Senior Vice-president Jim Johnsen; Alaska Department of Environmental Conservation Commissioner Larry Hartig; Alaska Department of Education and Early Development Commissioner Larry LeDoux; and Alaska Department of Natural Resources Deputy Commissioner Dick Lefebvre.

Of the 12 SCOR members, 10 are Caucasian males, one is a Caucasian female and one is a part-Native American female.

EPSCoR's outside consulting consists of independent evaluators Drs. Julia Melkers and Eric Welch (see above.) Members of EPSCoR's biology component also contract out to Alaska Biological Research Inc., a Fairbanks environmental research company, for some collaborative research work.

- **Jurisdictional and Other Support**

This RII benefits from the substantial resources of the University of Alaska's research infrastructure, including pre- and post-award offices, institutional research, and information technology. It partners with many of the education-outreach programs in place at the university. It uses capital equipment already in place such as the biology and physical science labs. Finally, it benefits from \$1,000,000-a year in voluntary commitment provided by the University of Alaska. These funds are used for all EPSCoR staff positions, meetings, evaluation and assessment, and some early-career and undergraduate awards.

- **Unobligated Funds**

We anticipate that approximately \$850,000-\$900,000 of cumulative funds will remain unobligated by June 30, 2009; this amount represents approximately 30% of the year two award. It constitutes a deliberate concession to our faculty: because summer is the prime research time in Alaska, a number of faculty members have requested that approximately \$250,000-\$300,000 in funding which was originally to be paid out by June 30 be extended until late August. This money will be paid out by September 1, 2009, leaving less than 20% of the year two award in unobligated funds. All of these remaining funds will be spent in the course of year three of the award.

The major reason for this remaining 20% of unobligated funds being unspent as of September 1 is delays in the hire of our tenure-track social science faculty at UAA and UAF. Both hires are now progressing: UAF just announced its hire for this position and UAA is currently interviewing finalists.

There is roughly \$200,000 (including F&A) in start-up money available for these positions, and we are thus on track to spend these funds over the course of year three. The remaining unobligated funds, which make up slightly more than 10% of year-two funds, will be spent for the same purposes as originally budgeted.

3. Jurisdiction-Specific Terms and Conditions

Condition 1

Using the last year of the previous RII award as a baseline, the annual and final progress reports must identify the numbers of women and members of other underrepresented groups as participants in the activities funded by the award, especially in leadership roles of the project and on external advisory boards. Progress reports must present the results of efforts to increase the participation of women and members of other underrepresented groups. Such reporting shall present information in the aggregate for the project, as well as information specific to each of the participating institutions. Future funding will be based, in part, on progress in increasing the number of women and other underrepresented groups in the activities funded by the award.

Response

Please note that the University of Alaska is one statewide institution.

For details of programs to increase the number of women and members of underrepresented groups in Alaska EPSCoR, please see the "Broadening Participation" section, above. In addition, Alaska EPSCoR has taken active steps to increase the number and role of women and members of other underrepresented groups in the sciences by:

- Appointing a part-Native American female as one of two co-principal Investigators on the project.
- Appointing a Native Alaskan female from a rural campus, an Asian-American female, and an Asian-American male to EPSCoR's 11-person management team, which also includes the principal investigators and the executive officer, who is a part-Hispanic female. Five out of 11 [45%] members of the team are thus from underrepresented groups; and four out of the 11 [36%] are women.
- Hiring or providing buyouts for 12 female faculty members, out of a total of 21 such faculty [57%].
- Appointing a female to Alaska EPSCoR's four-person external advisory committee.
- Working with a two-person evaluator team that includes one female.
- Funding post-docs who are both first-generation and non-traditional students.

Out of a total of 32 2008-09 Alaska EPSCoR graduate research fellows,

- 16 are women [50%].
- Three are Native Alaskans and four are Asian-Americans (22% are groups underrepresented by race).

- One is disabled [3%], four are first-generation students [13%] and eight are non-traditional students [25%].

Out of a total of 8 2009 Alaska EPSCoR undergraduate research fellows,

- Four are females [50%].
- All are Caucasian.
- One is disabled [18%], two are first-generation students [25%], and three are non-traditional students [38%].

Out of a total of nine 2009 Alaska EPSCoR early-career fellows,

- Five are females [56%].
- One is Hispanic, one is Asian-American and one is Native (33% are from groups underrepresented by race).

Condition 2

The project's annual and final reports must include evidence of linkages, coordination and collaboration with other NSF-funded projects that enhance the proposed research infrastructure improvement activities.

Response

This information is provided in the “Leveraging NSF Programs” section, above. In addition, the abovementioned “Living on Earth” workshop brought together EPSCoR personnel from 10 states to foster coordination both within and between EPSCoR jurisdictions.

Condition 3

The project's annual and final reports must include a description of efforts, accomplishments, commitments, and plans to ensure that the positive outcomes of the project will be sustained beyond the duration of the award. This may include quantitative data (e.g., numbers of new hires recruited and retained, proposal submissions, award success rates, students involved in research). The reports may also include descriptions of policies or programs proposed or implemented to enhance the competitive research culture, integrate research and education, and activate partnerships and alliances that increase research capacity and support.

Response

Quantitative data

New hires recruited and retained: 6

Proposal submissions: 181

Awards: 54

Award success rate: 29.83%

Students involved in research: 43

Qualitative data

For information on EPSCoR's sustainability efforts, please see the "Sustainability and Project Outputs" section, above.

Condition 4

The project must cooperate with EPSCoR program evaluation efforts, providing common data and key outcomes necessary to assess program performance. Program-level evaluation activities complement, but do not displace, those required of individual projects.

Response

We are cooperating with NSF EPSCoR program evaluation efforts. Alaska EPSCoR has engaged the services of two evaluators, Drs. Melkers and Welch, whose evaluation activities are focused on the development of collaborative linkages. The Alaska EPSCoR office is collecting and reporting demographic data. Finally, an External Advisory Committee (EAC) has been established which has provided a first annual report.

Condition 5

Within three months of the effective date of the award, the cognizant NSF Program Officer will meet with the project leaders and participants for a strategic planning session. A draft strategic plan will be the outcome of this planning session. A final strategic plan will be submitted for NSF approval within two months following the planning session.

Response

We held the strategic planning session in July 2007 and submitted our strategic plan to NSF in December 2007.

4. Experimental/Computational Facilities

Personal computers have been purchased for each of our research areas. Biology is using RII funds for a DNA sequencer contract. Physical science has purchased Campbell Temperature Stations and plans to purchase a 3-D Frost Heave Cell and an MTS Machine Upgrade. Equipment is then available to RII-affiliated researchers at no charge.

A high-performance computer was obtained for use by Mark Altaweel, who is working with the Integration Core. The Bioinformatics Core has also received an operating system upgrade.

Alaska EPSCoR researchers also use facilities put in place by other NSF-funded programs, most notably UAF's Toolik Lake field station.

5. Publications and Patents

See FastLane

6. Honors and Awards

EPSCoR IPY GLOBE program students from the Innoko River School, a high school in rural Shageluk, Alaska, were given the Alaska Spirit of Youth award in the "science and environment" category for their contribution to a variety of research projects involving climate change and fire science. Spirit of Youth awards are given out by the Alaska Spirit of Youth Campaign, a nonprofit that recognizes young people who do outstanding work in their communities.

Alaska Rural Research Partnership instructor Chohla Moll was awarded "Teacher of the Year" honors by the Junior Science and Humanities Symposium.

ARRP student La Tia Jackson was awarded a prestigious Gates Millennium Scholarship, which covers all tuition and living expenses for any university in the United States straight through a Ph.D.

Elena Sparrow, head of Alaska EPSCoR's integration/outreach efforts, won the 2008 Emma Walton Distinguished Service Award, presented by the Alaska Science Teachers Association. The award recognizes educators who make extraordinary contributions to the advancement of science education. According to ASTA, Sparrow merited the award because of her record as "one of the strongest advocates for K-12 inquiry-based science education in the state of Alaska."

2008 Alaska EPSCoR Early-Career grantee Katey Walter was named a National Geographic Emerging Explorer for 2009. The prestigious Emerging Explorer program each year recognizes 10 young scientists, photographers and storytellers who are making a difference early in their careers.

EPSCoR management team member Mary Pete was honored as Person of the Year by the Tundra Women's Coalition, a Bethel nonprofit group committed to promoting a healthy social environment for the women, children and men of the Yukon-Kuskokwim Delta. According to the Coalition, the award is given annually to someone who "exemplifies the values of commitment to self-respect, family, community, equality, peace, self-determination and the worth of every person."

Employees at the UAF EPSCoR main office in Fairbanks were awarded the "Don't Be Fuelish" award by the Northern Alaska Environmental Center and the Fairbanks North Star Borough for their efforts in taking alternative transportation to work over the summer of 2008.

Alaska EPSCoR graduate fellow Tom Moran, who does communication and outreach work in the main EPSCoR office, was named an Exceptional Student Employee by the University of Alaska Fairbanks in fall 2008. He was the only employee so honored that semester.

Both EPSCoR Director Peter Schweitzer and Executive Officer Anne Sudkamp have been re-elected as members of the governing council of the International Arctic Social Sciences Association.

EPSCoR-funded undergraduate Michael Golub led a team which built an electric snowmobile which placed second overall in the “zero emissions” category at the SAE Clean Snowmobile Challenge, a national competition held in Michigan in April.

B. Highlights

As requested, the Highlights are being e-mailed separately to Joseph Schweitzer and to Uma Venkateswaran. The highlights were created in Adobe InDesign, which makes it difficult to convert them to PowerPoint or Word documents; Joseph Schweitzer has informed us it will be permissible to send them in PDF format. The original InDesign documents also will be sent to Joseph Schweitzer.

There are seven highlights, which will be sent both as one low-quality PDF and as seven individual, high-quality PDF's. Science highlights include “Bubbling with Possibilities,” about early-career grantee Katey Walter; “A Discovery of Glacial Proportions,” about a find made by four EPSCoR permafrost researchers; and “Trek of the Tundra Daisy,” about a remote anthropological study by EPSCoR graduate fellow Stacey Fritz.

Education highlights include “Finding Common Ground on Climate Change,” about a GLOBE Program videoconference, and “A Moving Combination,” about a unique EPSCoR-funded middle-school class.

Other highlights include “A Workshop with a View,” about EPSCoR's Living on Earth Conference, and “Nome-Based Education,” about a science conference held in an isolated Alaska town.

- **Appendices**

See attachments