

## Arctic Sciences Division GPRA Highlights, FY 2008

### Northern Narratives: Social and Geographical Accounts from Norway, Iceland, and Canada (NORSAGA)

Highlight ID: 14798, Version: AC/GPA

This interdisciplinary project encompasses written historical records, natural science data and fieldwork focusing on traditional ecological knowledge. This year, the project leader, Astrid Ogilvie, together with principal investigators from Iceland and Canada, has worked to combine a variety of different northern narratives to tell a story of environmental and social change in three northerly locations. These are Norway, Iceland and Labrador/Nunatsiavut.

A journey to Labrador in the spring of 2007 to discuss changes in the location and nature of sea ice led to an unexpected discovery. The community of Makkovik (population 400) was settled in the 1890s by a Norwegian by the name of Torstein Kvaerna Andersen. His home was in Begnadalen, a valley which happens to be located in the Norway study area. This link was not known to Ogilvie before her visit to Makkovik, and makes comparison of the two locations especially interesting. She was accompanied by two members of the Labrador Institute, Martha MacDonald and Tim Borlase (former Director) who provided introductions to the local community. The residents were eager to share their opinions on sea-ice changes and almost all of them commented on how things seemed very different in the last 5-10 years. These changes were invariably negative: the ice could not be trusted; travel was more difficult; snow houses were difficult to build now; the old ways were disappearing and the children did not learn them. The vagaries of the climate impacted the researchers as blizzards prevented the planned journeys to Hopedale and Nain. Hopefully these locations will be visited in 2008.

It seems that NORSAGA fieldwork in the Vestre Slidre district of Valdres in Norway is taking place just in time. A major focus of this part of the project is to document the practice of transhumance; which involves taking the cattle to the rich mountain pastures every summer. The project's main contacts for this practice have told us that they may not continue beyond next summer. A new development in other parts of Norway is to incorporate the mountain pasture experience with tourism. With transhumance no longer vital for the mechanized dairy industry, now tourists will have the opportunity to stay on a working farm and experience a life rooted in the past (while enjoying all modern conveniences!) As well as speaking with local people in the region about current environmental and social changes, the project is documenting past climate change. The discovery of a farm diary from the area has led to a late-winter to early-spring temperature reconstruction for southeastern Norway from 1758 to 2006 based on ice-break up data from Lake Randsfjord (Nordli *et al.*, 2007). The lowest temperatures of the series are seen in the early 19<sup>th</sup> century. The warmth observed in the 1990s and at the start of the 21<sup>st</sup> century is unprecedented during the whole series.

The Iceland component of NORSAGA considers changing perceptions of environmental and social change in Icelandic fishing communities and brings a further contemporary focus to the project. A major emphasis is a study of the introduction of whale watching in place of whale hunting, and how local people reconcile traditional views of whales and whaling with what some argue is an economically viable option to fishing. This part of the project make use of both historical and archival data as well as results of previous and recent fieldwork in Icelandic fishing villages. As in the Norway component, a particularly important element is the use of historical data to reconstruct past climate.

Nordli, Ø. Lundstad, E, and Ogilvie, A.E.J. 2007. Late Winter-Early Spring Temperature Reconstructions for Southeastern Norway based on Lake Ice Break-Up. *Annals of Glaciology* 46, 404-408.

*Primary Strategic Outcome Goal:*

- Disciplinary/Interdisciplinary Research (Anything not covered by one of the 12 categories below.)
- International Collaborative Research

*Secondary Strategic Outcome Goals:*

*How does this highlight address the strategic outcome goal(s) as described in the [NSF Strategic Plan 2006-2011](#)?*

This research is providing a new body of data to examine how Arctic communities have adapted to environmental change. Through the use of historical documents and contemporary ethnographic narratives, the project will examine social changes as a response to climate induced changes in local environments. This research is ongoing, but preliminary results show that Arctic communities, historical and contemporary, are already altering their social and economic practices in response to climate change. This research is part of Discovery and advancing the frontiers of knowledge, as well as fostering and expanding international collaboration as part of Learning.

***Does this highlight represent transformative or potentially transformative research? If so, please explain why. For more information, see [Report to Congress: Transformative Research at the National Science Foundation, April 16, 2008](#) and [Important Notice 130: Transformative Research](#)***  
No

*How well does the proposed activity broaden the participation of underrepresented groups (e.g., gender, ethnicity, disability, geographic, etc?)*  
No

*What may be the benefits of the proposed activity to society?*  
Yes

This research will provide greater insights to policy makers and communities on social and economic adaptation to environmental change, which will help frame the discussion on the affects of climate change and lead to more informed decision-making and solutions.  
OPP/ARC 2008

*Program Officer:* Anna Kerttula De Echave

*NSF Award Numbers:*

[0638897](#)

Award Title: Northern Narratives: Social and Geographical Accounts from Norway, Iceland and Canada

PI: Astrid Ogilvie, [Astrid.Ogilvie@colorado.edu](mailto:Astrid.Ogilvie@colorado.edu)

Institution Name: University of Colorado at Boulder

State Code: CO

PE Codes: 5221

[0629500](#)

Award Title: Collaborative Research: Syntheses of Sea-Ice, Climate and Human Systems in the Arctic and Subarctic [SYNICE]

PI: Astrid Ogilvie, [Astrid.Ogilvie@colorado.edu](mailto:Astrid.Ogilvie@colorado.edu)

Institution Name: University of Colorado at Boulder

State Code: CO

PE Codes: 5219

[0527732](#)

Award Title: HSD: Human and Social Dynamics in Myvatnssveit, Iceland, from the Settlement to the Present  
PI: Astrid Ogilvie, [Astrid.Ogilvie@colorado.edu](mailto:Astrid.Ogilvie@colorado.edu)  
Institution Name: University of Colorado at Boulder  
State Code: CO  
PE Codes: 7318

*NSF Contract Numbers:*

*NSF Investments:* Climate Change, International Polar Year (IPY)

## **Ice-albedo feedback and the loss of arctic sea-ice in 2007**

Highlight ID: 15844, Version: AC/GPA

In September 2007 a record minimum sea ice extent was observed in the Arctic - 23% less than the previous record set in 2005. Results from an array of autonomous ice mass balance buoys deployed as part of the Arctic Observing Network showed an extraordinarily large amount of bottom melting in the Beaufort Sea associated with this retreat. Over two meters of bottom melting was observed - six times the average value of the 1990s. This indicates that the local melting of the sea ice was largely the result of excess heat in the surficial ocean waters, not excess heat in the atmosphere. A synthesis of satellite observations and weather forecast data is consistent with sunlight absorbed in the upper ocean being the primary heat source for this melting. Calculations demonstrated that there was a 500% increase in solar heating of the upper ocean in 2007 compared to climatology.

The conditions in the Beaufort Sea — more open water leading to more solar heat absorbed resulting in more melting and more open water — is a classic ice-albedo feedback signature. The positive ice-albedo feedback can accelerate the ongoing reduction in Arctic sea ice. Understanding the nature of the changes in the Arctic sea ice cover is important, since it is an indicator and amplifier of global climate change. Changes in the Arctic sea ice extent are already impacting ecosystems, coastal erosion, transportation, and resource development.

*Primary Strategic Outcome Goal:*

- Disciplinary/Interdisciplinary Research (Anything not covered by one of the 12 categories below.)

*Secondary Strategic Outcome Goals:*

- Networking and Computational Resources Infrastructure and Services (formerly Shared Cyberinfrastructure Tools)

*How does this highlight address the strategic outcome goal(s) as described in the [NSF Strategic Plan 2006-2011](#)?*

This outcome utilizes new technology to verify the consistency of observed sea-ice changes of global importance with existing theories of climate system feedbacks.

***Does this highlight represent transformative or potentially transformative research? If so, please explain why. For more information, see [Report to Congress: Transformative Research at the National Science Foundation, April 16, 2008](#) and [Important Notice 130: Transformative Research](#)***

No

*How well does the proposed activity broaden the participation of underrepresented groups (e.g., gender, ethnicity, disability, geographic, etc?)*

No

*What may be the benefits of the proposed activity to society?*

No

OPP/ARC 2008

*Tags:* 2010 Transition Team and 2010 Budget

*Program Officer:* William Wiseman

*NSF Award Numbers:*

[0454674](#)

Award Title: Collaborative research on observing the morphological and optical characteristics of the summer Arctic ice cover during the 2005 Trans-Arctic Expedition.

PI: Donald Perovich, [perovich@crrel.usace.army.mil](mailto:perovich@crrel.usace.army.mil)

Institution Name: Department of Army Cold Regions Research & Engineering Lab

State Code: NH

PE Codes: 5280, 5205

[0531018](#)

Award Title: Collaborative Research on Sunlight and the Arctic Atmosphere-Ice-Ocean System

PI: Donald Perovich, [perovich@crrel.usace.army.mil](mailto:perovich@crrel.usace.army.mil)

Institution Name: Department of Army Cold Regions Research & Engineering Lab

State Code: NH

PE Codes: 5219

[0612391](#)

Award Title: Ice mass balance buoy network: Coordination with DAMOCLES

PI: Jacqueline Richter-Menge, [Jacqueline.A.Richter-Menge@army.mil](mailto:Jacqueline.A.Richter-Menge@army.mil)

Institution Name: Department of Army Cold Regions Research & Engineering Lab

State Code: NH

PE Codes: 5293, 5205

*NSF Contract Numbers:*

*NSF Investments:* Climate Change, Homeland Security, Human and Social Dynamics, International Polar Year (IPY), Sensor Research, Environment (including the importance of fresh water and dynamics of water processes)

## **Disappearing Ice Caps on Baffin Island**

Highlight ID: 15943, Version: AC/GPA

The ice caps on north-central Baffin Island, Arctic Canada, will be gone within a few decades according to Drs. Jason Briner (University at Buffalo), Gifford Miller (University of Colorado), and Dr. Miller's graduate student, Rebecca Anderson. Using aerial photos and satellite images collected over 50 years, they quantified the pace of ice cap retreat. Projecting these rates into the future, the team predicts that the ice caps will melt away completely by the middle of this century; some have already disappeared. Furthermore, it was discovered that the retreating ice caps are revealing a "fossilized" tundra landscape that has been entombed beneath the ice masses since they initially

grew. Radiocarbon dating reveals that some ice caps have existed since 350 AD and survived a relatively warm climatic period around 1000 AD, the Medieval Warm Period. These findings imply that present climatic warming is more severe than anytime since at least 350 AD. The pattern of over 50 radiocarbon dates on fossil tundra plants reveal the timing of major pulses of ice cap growth that suggest discrete periods of dramatic cooling. Although the ice caps were largest during periods of minimum solar irradiance, the pulses of growth coincide with major volcanic eruptions, consistent with the hypothesis that volcanism may play an important role in pushing the Arctic climate system across important thresholds, putting us a step closer in understanding the various influences on our complex climate system.

*Primary Strategic Outcome Goal:*

- Disciplinary/Interdisciplinary Research (Anything not covered by one of the 12 categories below.)

*Secondary Strategic Outcome Goals:*

- Graduate Education and Graduate Student Research

*How does this highlight address the strategic outcome goal(s) as described in the [NSF Strategic Plan 2006-2011](#)?*

The expanded understanding of high-latitude process response to forcing "improves our ability to live sustainably on Earth". Active student participation in the research has contributed to preparation of "a diverse, globally engaged STEM workforce".

***Does this highlight represent transformative or potentially transformative research? If so, please explain why. For more information, see [Report to Congress: Transformative Research at the National Science Foundation, April 16, 2008](#) and [Important Notice 130: Transformative Research](#)***  
No

*How well does the proposed activity broaden the participation of underrepresented groups (e.g., gender, ethnicity, disability, geographic, etc?)*  
No

*What may be the benefits of the proposed activity to society?*

Yes

Understanding the causes, amplitude, and rate of climate change will allow development of appropriate societal response scenarios.

OPP/ARC 2008

*Program Officer:* William Wiseman

*NSF Award Numbers:*

[0454601](#)

Award Title: Collaborative Research: A Holocene Context for Current Arctic Warming Derived from the Vanishing Plateau Ice Caps of North-Central Baffin Island

PI: Jason Briner, [jbriner@buffalo.edu](mailto:jbriner@buffalo.edu)

Institution Name: SUNY at Buffalo

State Code: NY

PE Codes: 5280

[0454662](#)

Award Title: Collaborative Research: A Holocene Context for Current Arctic Warming Derived from the Vanishing Plateau Ice Caps of North-Central Baffin Island  
PI: Gifford Miller, [gmill@colorado.edu](mailto:gmill@colorado.edu)  
Institution Name: University of Colorado at Boulder  
State Code: CO  
PE Codes: 5280, 5205

*NSF Contract Numbers:*

*NSF Investments:* Climate Change, International Polar Year (IPY), Environment (including the importance of fresh water and dynamics of water processes)

## Students teaching in the cold north

Highlight ID: 15985, Version: AC/GPA

With NSF research support, and special support for a graduate student and REU support for two undergraduate students, this project brought students into the arctic in the summer of 2007 to work on a project to reconstruct climate history. The goal of this research is to generate high-resolution climate records for the past two millennia using multiple proxies in order to place 20th and 21st century climate and environmental change into a long-term context. The students engaged in their own projects and in the group research in NE Baffin Island.

Taking advantage of their enthusiasm for the subject and their location, Elizabeth Thomas, James Noble, and Monica Ridgeway took the time to spend three extra days in a small Inuit village (Nunavut, Canada) conducting public outreach about the research they were doing. During this they visited virtually all grade levels for in-class presentations, and spent one Saturday with about 20 school children and some interested citizens at a lake site near the village for a coring demonstration.

This was presented in various press outlets including NSF.

[http://www.nsf.gov/discoveries/disc\\_images.jsp?cntn\\_id=110643&org=NSF](http://www.nsf.gov/discoveries/disc_images.jsp?cntn_id=110643&org=NSF)

*Primary Strategic Outcome Goal:*

- K-12 Education
- Undergraduate Education and Undergraduate Student Research
- Graduate Education and Graduate Student Research
- International Research Experiences for Undergraduate & Graduate Students
- Public Understanding of Science and Lifelong Learning

*Secondary Strategic Outcome Goals:*

- Disciplinary/Interdisciplinary Research (Anything not covered by one of the 12 categories below.)

How does this highlight address the strategic outcome goal(s) as described in the [NSF Strategic Plan 2006-2011](#)?

Cultivate a world-class, broadly inclusive science and engineering workforce, and expand the scientific literacy of all citizens.

**Does this highlight represent transformative or potentially transformative research? If so, please explain why. For more information, see [Report to Congress: Transformative Research at the National Science Foundation, April 16, 2008](#) and [Important Notice 130: Transformative Research](#)**

No

How well does the proposed activity broaden the participation of underrepresented groups (e.g., gender, ethnicity, disability, geographic, etc?)

Yes

Two of the students were young women and one of these was an African American from the inner city.

What may be the benefits of the proposed activity to society?

Yes

Understanding the trajectory of climate change in the past is important to provide context for current climate changes.

OPP/ARC 2008

Program Officer: Neil Swanberg

NSF Award Numbers:

[0455024](#)

Award Title: Collaborative Research: A Synthesis of the Last 2000 Years of Climate Variability from Arctic Lakes

PI: Jason Briner, [jbriner@buffalo.edu](mailto:jbriner@buffalo.edu)

Institution Name: SUNY at Buffalo

State Code: NY

PE Codes: 5219, 5205

NSF Contract Numbers:

NSF Investments: Climate Change, Environment (including the importance of fresh water and dynamics of water processes)

## Students learning Chemistry in Barrow Alaska

Highlight ID: 15988, Version: AC/GPA

This project on halomethane gas exchange in northern Alaskan coastal ecosystems has provided scientific research opportunities for 4 undergraduates, including members of underrepresented groups in the sciences: 3 women and 1 Latino. There was provided valuable research opportunities for a Molecular and Environmental Biology major who participated in the first summer field campaign to Barrow, Alaska. He is currently in the Agricultural and Environmental Chemistry Ph.D. program at U.C. Davis. This research also provided an opportunity for independent research for an exceptional young woman who graduated with a double major in Physics and Atmospheric Sciences. She presented this work as an undergraduate at the American Geophysical Union meeting. Accepted into the nation's top earth and atmospheric science programs, she has chosen to attend University of Washington for graduate school. In addition, this research provided research experiences for another young woman, who recently graduated and will use her scientific skills as an environmental consultant; and one other student who graduated and is currently in medical school. This research has also provided research opportunities and training for 2 graduate students (both women).

While doing their research in the field they took advantage of the opportunity to engage in their research local high school students from a rural high school in Barrow, Alaska.

*Primary Strategic Outcome Goal:*

- K-12 Education
- Undergraduate Education and Undergraduate Student Research
- Graduate Education and Graduate Student Research
- Public Understanding of Science and Lifelong Learning

*Secondary Strategic Outcome Goals:*

- Disciplinary/Interdisciplinary Research (Anything not covered by one of the 12 categories below.)

*How does this highlight address the strategic outcome goal(s) as described in the [NSF Strategic Plan 2006-2011](#)?*

This is just a typical example of how OPP Arctic PIs are using their resources to engage people from under-represented groups in their research and to interact positively with younger students from local communities.

***Does this highlight represent transformative or potentially transformative research? If so, please explain why. For more information, see [Report to Congress: Transformative Research at the National Science Foundation, April 16, 2008](#) and [Important Notice 130: Transformative Research](#)***  
No

*How well does the proposed activity broaden the participation of underrepresented groups (e.g., gender, ethnicity, disability, geographic, etc?)*

Yes

Large representation of women and minorities in this effort.

*What may be the benefits of the proposed activity to society?*

No

OPP/ARC 2008

*Program Officer:* Neil Swanberg

*NSF Award Numbers:*

[0435870](#)

Award Title: Halomethane gas exchange in northern Alaskan coastal ecosystems

PI: Robert Rhew, [rrhew@atmos.berkeley.edu](mailto:rrhew@atmos.berkeley.edu)

Institution Name: University of California-Berkeley

State Code: CA

PE Codes: 5219

*NSF Contract Numbers:*

*NSF Investments:* Climate Change, Environment (including the importance of fresh water and dynamics of water processes)

# Is the Arctic Freshwater Cycle Intensifying?

Highlight ID: 15992, Version: AC/GPA

This project is an effort to coordinate the research activities of a group of about 20 projects that were funded under a special solicitation. One of their goals was to achieve a synthesis of the results that went beyond the research goals of the individual projects. To do so they posed the questions: "Is the Arctic Freshwater Cycle Intensifying?", "If So, Why?" and "What are the Implications?"

To answer these questions, researchers are investigating linkages among land, ocean, and atmosphere in the Arctic Hydrological Cycle. Working with an interdisciplinary group including engineers, chemists, hydrologists, oceanographers, atmospheric scientists, global modelers, this synthesis team attacked this problem by first establishing a hydrological budget for the arctic, examining past data sets and publications for changes in various components of the system, and then looking for trends in the changes that suggest an acceleration of the process. They also conducted heuristic modeling studies to generate questions to pose to complex computer models.

They conclude that the system is changing, and very probably doing so at an increasing pace. This may lead to significant impacts for humans and biotic systems in the arctic.

*Primary Strategic Outcome Goal:*

- Disciplinary/Interdisciplinary Research (Anything not covered by one of the 12 categories below.)

*Secondary Strategic Outcome Goals:*

- Public Understanding of Science and Lifelong Learning

*How does this highlight address the strategic outcome goal(s) as described in the [NSF Strategic Plan 2006-2011](#)?*

This work fosters research that will advance the frontiers of knowledge, emphasizing areas of greatest opportunity and potential benefit and establishing the nation as a global leader in fundamental and transformational science and engineering. Through its outreach efforts to mass media it also helps to expand the scientific literacy of all citizens.

***Does this highlight represent transformative or potentially transformative research? If so, please explain why. For more information, see [Report to Congress: Transformative Research at the National Science Foundation, April 16, 2008](#) and [Important Notice 130: Transformative Research](#)***

Yes

The approach this group has taken, and particularly its interdisciplinary nature, is changing the way the arctic research community thinks about the arctic system and is changing their approach to synthesis of results.

*How well does the proposed activity broaden the participation of underrepresented groups (e.g., gender, ethnicity, disability, geographic, etc?)*

No

*What may be the benefits of the proposed activity to society?*

Yes

Increased understanding of changes occurring in the Arctic are of critical importance to society as the system is changing rapidly and has major potential impact on real social and economic structures.

OPP/ARC 2008

*Tags:* 2010 Transition Team and 2010 Budget

*Program Officer:* Neil Swanberg

*NSF Award Numbers:*

[0629323](#)

Award Title: Collaborative Research: Understanding Change in the Climate and Hydrology of the Arctic Land Region: Synthesizing the Results of the ARCSS Fresh Water Initiative Projects  
PI: Charles Vorosmarty, [charles.vorosmarty@unh.edu](mailto:charles.vorosmarty@unh.edu)  
Institution Name: University of New Hampshire  
State Code: NH  
PE Codes: 5219

[0228860](#)

Award Title: The Arctic Community-wide Hydrological Analysis and Monitoring Program (Arctic-CHAMP) Project Office  
PI: Charles Vorosmarty, [charles.vorosmarty@unh.edu](mailto:charles.vorosmarty@unh.edu)  
Institution Name: University of New Hampshire  
State Code: NH  
PE Codes: 5219

*NSF Contract Numbers:*

*NSF Investments:* Climate Change, Environment (including the importance of fresh water and dynamics of water processes)

## **UPSCALING PREDICTION OF NET CO<sub>2</sub> EXCHANGE IN HETEROGENEOUS ARCTIC LANDSCAPES**

Highlight ID: 16028, Version: AC/GPA

Accurate estimates of net CO<sub>2</sub> exchange, independent of vegetation composition, have been developed by G. R. Shaver for a variety of Arctic landscapes. Dr. Shaver and colleagues developed a model of net CO<sub>2</sub> flux by arctic landscapes using a measure of leaf area derived from NDVI (normalized-difference vegetation index - a ratio of reflectance in the red and near-infrared portions of the spectrum), the incoming photosynthetically active solar radiation, and air temperature. The model consistently explains ~80% of the variance in net CO<sub>2</sub> exchange across a wide range of vegetation in arctic Alaska and Sweden.

Arctic landscapes are characterized by extreme patchiness, often with sharply defined borders between very different ecosystem types. This patchiness makes it difficult to predict landscape-level carbon balance and its change in response to climate, yet such predictions are critical to understanding of how climate change will affect the arctic landscape and its feedbacks and interactions with the Arctic System. The success of the model at predicting net CO<sub>2</sub> flux, independent of any information on species composition, indicates a high level of convergence in plant canopy structure and function in the arctic landscape among very different arctic ecosystems. Furthermore, because the model predictions depend on variables that are readily measured remotely, at multiple scales from hand-held instruments to satellites, it shows great promise for observing large-area changes of CO<sub>2</sub> exchange across the Arctic.

*Primary Strategic Outcome Goal:*

- Disciplinary/Interdisciplinary Research (Anything not covered by one of the 12 categories below.)

*Secondary Strategic Outcome Goals:*

*How does this highlight address the strategic outcome goal(s) as described in the [NSF Strategic Plan 2006-2011](#)?*

Understanding the pathways and fate of carbon, particularly carbon dioxide, is essential to understanding how the climate system functions. The exchange of carbon dioxide between the atmosphere and flora traditionally has been measured at small scales over homogeneous plant plots. These results offer the possibility of extending these observations to much larger scales containing heterogeneous plant distributions using remote sensing.

***Does this highlight represent transformative or potentially transformative research? If so, please explain why. For more information, see [Report to Congress: Transformative Research at the National Science Foundation, April 16, 2008](#) and [Important Notice 130: Transformative Research](#)***  
No

*How well does the proposed activity broaden the participation of underrepresented groups (e.g., gender, ethnicity, disability, geographic, etc?)*  
No

*What may be the benefits of the proposed activity to society?*  
No  
OPP/ARC 2008

*Program Officer:* William Wiseman  
*NSF Award Numbers:*  
[0352897](#)

Award Title: Resource Allocation and Allometry of Plant Growth in the Arctic: Key Constraints on Change and Predictability of the Arctic System  
PI: Gaius Shaver, [gshaver@mbl.edu](mailto:gshaver@mbl.edu)  
Institution Name: Marine Biological Laboratory  
State Code: MA  
PE Codes: 5219

[0632139](#)

Award Title: IPY: Collaborative Research on Carbon, Water, and Energy Balance of the Arctic Landscape at Flagship Observatories and in a PanArctic Network  
PI: Gaius Shaver, [gshaver@mbl.edu](mailto:gshaver@mbl.edu)  
Institution Name: Marine Biological Laboratory  
State Code: MA  
PE Codes: 5293

*NSF Contract Numbers:*

*NSF Investments:* Climate Change, International Polar Year (IPY), Environment (including the importance of fresh water and dynamics of water processes)

## **Community Migration in the Arctic: Subsistence, Jobs and Well-Being**

Highlight ID: 16483, Version: AC/GPA

The indigenous population of the North American Arctic historically moved within traditional areas in response to changes in regional subsistence opportunities. Increased connections with regions outside the Arctic during the twentieth century increased the movement of people into and out of the Arctic. Social scientists from Alaska and Canada are engaged in a research effort to understand

the determinants of the modern migration behavior of the Inuit people of the North American Arctic. The research will also examine the consequences of Arctic migration for both the migrants and the communities of the Arctic.

Research on migration in the Arctic faces a number of challenges. Methods widely used to explain migration behavior in other areas are inadequate because they do not account for the mixed subsistence and cash economies of the Arctic region. Available data is also not up to the task of describing the complex migration patterns in the Arctic. Migration data needs to reflect the diversity of individual decisions, the variety of opportunities which face potential migrants, and origins both within and outside the region. This research project is attempting to address both of these challenges.

The investigators are modeling migration decisions as decisions which reflect relative well being in different places. Community characteristics, subsistence possibilities, as well as employment opportunities affect an individuals' evaluation of well-being. This model will help the team explain interesting differences in migration behavior across types of communities and between Inuit residents of northern Alaska and northern Canada. Migration is an important component of population change in the Arctic and a better understanding of the determinants of these flows will have benefits beyond the research. Local government officials in the region will be able to use the research to forecast future change in their population.

During the research period, project researchers have developed data sets from a variety of sources that allow them to describe the patterns and determinants of population movement into and out of the Arctic, as well as subsistence opportunities and community characteristics. A major data effort this past year has been the development of a household-level dataset from the 1990 and 2000 US Decennial Census Long Form data for the analysis of the movement and well being of Alaska Inupiat. Members of the team developed this data set as Special Sworn Status researchers of the US Census Bureau at the Center for Economic Studies. An important goal of the project is to develop a data set on Inupiat migration that will be available for community officials and other potential researchers.

Preliminary analysis of the Alaska migration data for the last part of the 1980s and 1990s provides the following interesting generalizations about migration behavior. There was significant migration between communities within the Arctic with the larger communities generally gaining population through migration while smaller communities lost population. Migrants in the Arctic were most likely to move within their home regions or census areas. The propensity to move from villages to regional centers was greater for women than for men. The propensity to make a move to a regional center was also greater for younger people. People moved within the region for different reasons; jobs dominate the reasons for moving to regional centers while family matters are more important for moving between villages.

There was significant movement out of the Arctic region to more urban regions of Alaska and other states. These flows, however, were not only one way; there were also significant return flows of Inupiat people moving back to the Arctic. While people moved away for jobs and education, they returned not only for work but also family reasons and the availability of subsistence opportunities. Inupiat migration seemed to follow a stepping stone pattern with most migration out of the Arctic coming from regional centers and most migration out of the state coming from the state's cities. Just like migration within the Arctic, the propensity to move out of the Arctic was greater for women and young people.

These generalizations provide hypotheses to be tested in the next phase of the project. In addition to hypotheses testing, the future phases of the project include combining household, community, and subsistence data sets. The research team will also create similar data sets and conduct analysis for the population of the Canadian Arctic. An important goal of this research is to provide both data and an understanding of migration behavior that will be useful to local residents and government officials.

*Primary Strategic Outcome Goal:*

- Disciplinary/Interdisciplinary Research (Anything not covered by one of the 12 categories below.)

- International Collaborative Research

*Secondary Strategic Outcome Goals:*

- Graduate Education and Graduate Student Research

*How does this highlight address the strategic outcome goal(s) as described in the [NSF Strategic Plan 2006-2011](#)?*

As part of Discovery, this research combines existing data in new ways to uncover patterns of population movements in a region where little research on migration behavior has been done in the past. Understanding population response to community changes and opportunities will be important in a region facing future potentially dramatic economic, social, and environmental changes.

***Does this highlight represent transformative or potentially transformative research? If so, please explain why. For more information, see [Report to Congress: Transformative Research at the National Science Foundation, April 16, 2008](#) and [Important Notice 130: Transformative Research](#)***

Yes

One of the stated goals of the project is transformation through the development of new methodological approaches to explaining community migration. In addition, the project will create a unique metadata source, created from the combination of datasets, that will enable future discovery by being made available for future research on a broad range of Arctic or indigenous issues at a significant savings of time and expense.

*How well does the proposed activity broaden the participation of underrepresented groups (e.g., gender, ethnicity, disability, geographic, etc?)*

Yes

The project research team is doing extensive outreach to local Inupiat and Inuit communities and local governments including the Alaska North Slope Borough, the Northwest Arctic Borough, and the Nunavut Territories in an effort to involve them in the research and to communicate research results. All of the communities are primarily indigenous populations and the governments are indigenous controlled, thus the research is an extensive effort to make science and scientific findings accessible to underrepresented groups.

*What may be the benefits of the proposed activity to society?*

Yes

By improving the quality and accessibility of census data, this research allow the three Arctic local governments to more effectively address the difficult problem of tracking and predicting population changes at the village level, information vital to facilities and services planning. In addition, policy makers will be able to better analyze the effects of their decisions on local rural communities. Finally, the research will use fitted values from private instruments to estimate the effect of non-response imputation in the US Census Bureau surveys - this has been recognized of value by the US Census Bureau.

OPP/ARC 2008

*Program Officer:* Anna Kerttula de Echave

*NSF Award Numbers:*

[0639211](#)

Award Title: Understanding Migration in the Circumpolar North (UMCN)

PI: Terry Huskey, [aflh@uaa.alaska.edu](mailto:aflh@uaa.alaska.edu)

Institution Name: University of Alaska Anchorage Campus

State Code: AK

PE Codes: 5221

[0457662](#)

Award Title: Migration in the Arctic: Subsistence, Jobs, and Well-Being in Urban and Rural Communities  
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Institution Name: University of Alaska Anchorage Campus  
State Code: AK  
PE Codes: I331, 5221, 5205

*NSF Contract Numbers:*

*NSF Investments:* Climate Change, International Polar Year (IPY)

## **Experiencing Climate Change: Assessing Knowledge, Resilience and Adaptation among the Viliui Sakha**

Highlight ID: 16486, Version: AC/GPA

The rapid rise of both broad public understanding and scientific verification about global climate change is in part due to data from Arctic regions and the testimony of Arctic peoples from areas undergoing the most profound environmental changes. In addition to the threats to the plants and animals of the Arctic, these areas for centuries have been inhabited by indigenous and non-indigenous peoples. As environmental change proceeds, these communities need to adapt to those changes. However, in many parts of the Arctic, there are insufficient resources, including appropriate information and knowledge about the global change proceeding, insufficient local capacity to make decisions in response to potential sudden change, and lack of access to monetary and other material sources to buffer inhabitants from the effects.

This research is the result of two projects, one focusing on local resilience of post-Soviet indigenous communities and the other focusing on understanding what Viliui Sakha, one group of native people in northeastern Siberia, Russia, are observing about the environmental change in progress, how they are perceiving those changes as they increasingly interfere with local subsistence practices and indigenous understandings of the world, and what information they need to provide a more holistic understanding of global climate change to bolster their capacity to adapt. The research findings of the first project assisted the investigators in defining local Viliui sustainability as, "building local diversified economies, communities, and health via strong local leadership, a shared vision to work toward common goals, the reinstatement of local knowledge, and rights to land and resources." Once the researchers had a local definition of the Viliui vision for sustainable communities, they then collaborated with regional and local experts to design a project that could provide insight into how climate change may affect indigenous Arctic communities. The current research project has investigators working closely with local experts who have been generating climate change data for over a decade. The research team will work to both provide local communities with relevant downscaled data and to corroborate local observations in order to better understand which of their observations are a result of global processes and which are not. The project team is collaborating with local and regional policy representatives to provide them a more robust portrait of exactly how the global processes of climate change are affecting communities in the local context.

Viliui Sakha are native horse and cattle breeders inhabiting the Viliui River regions of northwestern Sakha Republic, northeastern Siberia, Russia. The four-village, three-year study is a collaborative effort involving the active participation of the targeted communities, field assistants, native specialists, an in-country research team, and an international collaborator. The project is founded on the PI, Susan Crate's fifteen years of ongoing research and work with rural Viliui Sakha communities and on her fluency in both the Sakha and Russian languages. In 2004, while surveying inhabitants of four villages for the previous 3 year community sustainability project, Crate found that 90% of participants expressed their concern about local climate change-that it was causing unprecedented change in their local areas and that it threatens to undermine subsistence. Based on preliminary interviews in the summer of 2005, elders cited the following observed changes in

climate and local ecosystem: temperatures "softening" (not as cold in winter or as hot in summer), increased precipitation (too much rain at the wrong times, too much snow in winter), increased thunder, increased humidity, more intense sunlight, and new species appearing from the south. These climate perturbations threaten the subsistence survival of rural Viliui Sakha who depend on harvesting a substantial amount of hay to fodder their herds and supplementing their diet with hunting, fishing, gardening and foraging.

These projects represents a novel approach to advancing knowledge by collaborating with rural native communities in northeastern Siberia, Russia to explore ways to address issues of global climate change. The study integrates research and education by advancing discovery and understanding while at the same time promoting teaching, training, and learning in at least four substantial ways: 1) by conducting field research with the active participation of four village communities and village-level research assistants; 2) by collaborating with an in-country research team; 3) by working with a research assistant and two graduate students for the project's duration; and 4) by collaborating with an international research partner. This research project is studying and documenting how Viliui Sakha, a geographically and ethnically underrepresented group, are orienting themselves to prepare for an uncertain future due to the local effects of Global Climate Change.

*Primary Strategic Outcome Goal:*

- Disciplinary/Interdisciplinary Research (Anything not covered by one of the 12 categories below.)
- International Collaborative Research

*Secondary Strategic Outcome Goals:*

- Public Understanding of Science and Lifelong Learning

*How does this highlight address the strategic outcome goal(s) as described in the [NSF Strategic Plan 2006-2011](#)?*

The collaborative research project with the Viliui Sakha on community vulnerability and resilience in the wake of climate change promotes Discovery by fostering research that strengthens our understanding of the links between human and environmental processes and improves our ability to live sustainably on Earth.

***Does this highlight represent transformative or potentially transformative research? If so, please explain why. For more information, see [Report to Congress: Transformative Research at the National Science Foundation, April 16, 2008](#) and [Important Notice 130: Transformative Research](#)***

Yes

This research is part of a broader Arctic research movement in the social and behavioral sciences and that is community collaborative research. The current project's design and implementation is the result of the PI's close relationships with the Viliui Sakha, which she allowed to participate in defining the goals for the project and in its research design. Although this is not an entirely new concept, the actual practice is transformative.

*How well does the proposed activity broaden the participation of underrepresented groups (e.g., gender, ethnicity, disability, geographic, etc?)*

Yes

This project is designed to maximize the participation of underrepresented groups in the social and behavioral sciences. The research team includes indigenous participants as collaborators, field assistants, native specialists, and in-country researchers.

*What may be the benefits of the proposed activity to society?*

Yes

Not only is there a societal benefit through increasing the broader participation of underrepresented groups in science (see previous discussion) but in addition, this project will inform Arctic communities about the effects of climate change and provide them with insights into how to prepare for an uncertain future.

OPP/ARC 2008

*Tags:* 2010 Transition Team and 2010 Budget

*Program Officer:* Anna Kerttula de Echave

*NSF Award Numbers:*

[0710935](#)

Award Title: Assessing Knowledge, Resilience & Adaptation and Policy Needs in Northern Russian Villages Experiencing Unprecedented Climate Change  
PI: Susan Crate, [scrate@gmu.edu](mailto:scrate@gmu.edu)  
Institution Name: George Mason University  
State Code: VA  
PE Codes: 5221

[0532993](#)

Award Title: Investigating the Economic and Environmental Resilience of Viliui Sakha Villages: Building Capacity, Assessing Sustainability, and Gaining Knowledge  
PI: Susan Crate, [scrate1@gmu.edu](mailto:scrate1@gmu.edu)  
Institution Name: George Mason University  
State Code: VA  
PE Codes: 5221, 5205

*NSF Contract Numbers:*

*NSF Investments:* Climate Change, International Polar Year (IPY)

## **Adak Archaeology and Education Project**

Highlight ID: 16495, Version: AC/GPA

An international, interdisciplinary research team is addressing coupled natural and human systems on Adak Island, Aleutian Islands, Alaska. Funded by a grant from the National Science Foundation, Office of Polar Programs, Arctic Social Sciences Program, archaeologists, ecologists, and geologists with the Central Aleutians Archaeological and Paleobiological Project are testing and documenting:

- 1) long term change in subarctic Holocene environments,
- 2) consequent change in terrestrial and marine animal populations and diversity and
- 3) how human inhabitants of the archipelago responded to shifts in the distribution, diversity, and abundance of resources, and, in turn, impacted their resource base.

Archaeological evidence suggests Aleut hunter-gatherers first inhabited Adak Island 6,000 years ago. Recovered shell and bones indicate that the earliest hunter-gatherers in the Central Aleutians heavily relied on sea mammal and bird hunting, fishing, and shellfish collection. Much younger, archaeological sites, dating 3,500 years old or younger, represent semi-sedentary villages and seasonal encampments for salmon fishing. Worldwide, obsidian (volcanic glass) is a coveted raw material for stone tools because, when broken and formed, it possesses a very sharp cutting edge. The only known geological source of obsidian in the Aleutians is Okmok Caldera on Umnak Island or Akutan Island, some 800 km east of Adak. The chemical signature of recently discovered Adak obsidian artifacts matches the source obsidian from Akutan suggesting long distance transport of goods in the Aleutian archipelago by 3500 years ago.

The Bering Sea ecosystem is under severe stress possibly due to: 1) global warming, 2) over fishing by large commercial fisheries, 3) biotic disruptions or, 4) two or more of the above. Archaeologists with the Central Aleutians Project are performing DNA and stable isotope analyses on animal bones representing different time periods in Aleutian prehistory. Combined, these analyses can potentially

provide information on past population sizes and diets of prehistoric seals, sea lions, and sea otters-animals, whose numbers have rapidly diminished in the past several decades. Comprehensive research on long term human-environmental interactions in the Bering Sea region throughout the Holocene is imperative if we are to: understand the dynamics of Aleutian natural and human systems; effectively address the social, political, and economic issues that arise from changes in those system dynamics; and help formulate policy decisions for the region today.

In partnership with the Adak community and school, the Central Aleutians project has established the Adak Discovery Community for teachers, students, and their families. Through a Discovery Community program, this project brings the science, Native Americans, students and policy makers together in education and collaboration.

The Central Aleutians project views this as a reciprocal learning experience. Teachers, students and community members are advising scientists on current Aleutian environmental and social concerns. In return scientists are informing the local community about methodologies and scientific ideas employed in the CAAPP project. The Adak Discovery Community website [http://www.farmerbean.com/index.php?option=com\\_frontpage&Itemid1](http://www.farmerbean.com/index.php?option=com_frontpage&Itemid1) brings scientists and the community together to share information and findings following the field season.

*Primary Strategic Outcome Goal:*

- Disciplinary/Interdisciplinary Research (Anything not covered by one of the 12 categories below.)

*Secondary Strategic Outcome Goals:*

- K-12 Education
- Teacher Education and In-service Professional Development
- Undergraduate Education and Undergraduate Student Research
- Graduate Education and Graduate Student Research

*How does this highlight address the strategic outcome goal(s) as described in the [NSF Strategic Plan 2006-2011](#)?*

The Adak Archaeology and Paleobiology Project is research into long-term human adaptation to environmental change, as well as an examination of how humans impacted their environments. This research is an investment into Discovery that will strengthen our understanding of how human and environmental systems are coupled.

***Does this highlight represent transformative or potentially transformative research? If so, please explain why. For more information, see [Report to Congress: Transformative Research at the National Science Foundation, April 16, 2008](#) and [Important Notice 130: Transformative Research](#)***  
No

*How well does the proposed activity broaden the participation of underrepresented groups (e.g., gender, ethnicity, disability, geographic, etc?)*

Yes

This project included a strong K-12 educational component for local underrepresented Aleut community participation in science.

*What may be the benefits of the proposed activity to society?*

Yes

Gaining a deeper understanding of how humans adapted to environmental change and also affected change in their local ecology will give policy makers and community residents insight into our changing environment. Understanding how humans adapted in the past has the potential to inform us for the future.

OPP/ARC 2008

*Program Officer:* Anna Kerttula de Echave

*NSF Award Numbers:*

[0353065](#)

Award Title: Collaborative Research: The Central Aleutians Archaeological and Paleobiological Project

PI: Dixie West, [dlwest@ksu.edu](mailto:dlwest@ksu.edu)

Institution Name: University of Kansas Center for Research Inc

State Code: KS

PE Codes: 5221, 5205

*NSF Contract Numbers:*

*NSF Investments:* Climate Change