A Multi-prong Approach to Arctic Change Knowledge Transfer

Elena B. Sparrow, Larry D. Hinzman, John Walsh, David Atkinson, Vladimir Alexeev, and Jessie Cherry

The International Arctic Research Center
University of Alaska Fairbanks
Target Audience

- IARC EO
- K-12
- undergrad
- graduate
- young scientist
- scientist
- public
- stakeholders
- Post-doc
Strategies

- Scientific Conferences/Workshops-presenters, conveners
- Visiting Scientists program
- Scientific publications, reports
- Public lectures, lunch meetings, community meetings
- Popular press- magazines, newspapers
- Radio and television interviews
- Display booths, IARC tour
- Other Public Events
- Brochures
- Web site
Study: Arctic seabed methane stores destabilizing, venting

Methane Hydrate Feedbacks Chapter in WWF International Arctic Programme Report

NABOS Cruise 2009
Multidecadal Variability In The Arctic and North Atlantic Climate System

Expeditions In Research - NABOS In the Laptev and East Siberian Seas

Expedition In the Beaufort Sea Aboard the USCGC Healy

Research Highlights: www.iarc.uaf.edu
Spotlight: www.iarc.uaf.edu

National Geographic Announces it's Emerging Explorers For 2009 – Katey Walters

Earth & Sky Radio Series highlights Arctic research with an interview with IARC Director, Larry Hinzman

Outstanding Senior Student Award - Alice Orlich is the recipient of the 2009 Marion Frances Boswell Award
Strategies: Formal/informal Education
short to long term interactions

- Email/phone exchanges
- School visits
- Seminars
- Videoconferences, web chats/forums
- Engaging students in climate change
  and earth system science research
March 5, 2007; April 8, 2008: Linking scientists to students via a Pole to Pole Video conferences, follow-up Web Chats and Web Forums
Alaska, USA: Fairbanks-64.4293 N, Healy, 63.8738 N, Shageluk, 62.6067 N, Wasilla, 61.5888 N, Ushuaia, Argentina: 54.8170 S,
International Professional Development Workshops
For Teachers on the IPY Seasons and Biomes
Project
The *Ice Seasonality Protocols* were created as part of the GLOBE Seasons and Biomes Project.

**MODEL:** Promote inquiry-based learning; students learn to do science by being scientists.

**SCIENCE GOAL:** To monitor the freeze-up and break-up on local ponds/lakes and stream/rivers to determine the freeze-up date, the break-up date and the ice cover duration.

**PARTICIPANTS:** The *Ice Seasonality Protocols* are applicable primarily to the northern and mid-latitudes (i.e., Tundra, Taiga and Montane biomes).

The protocol’s primary observation technique can be used in other student projects anywhere in the world.

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**IN THE FIELD**

Frequent observations (every few days):

- Estimate/describe border ice cover (%)
- Determine/describe ice types in the open channel
- Describe snow on ice conditions
- Take standard set of photographs

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These environmental benchmarks have been used by scientists to demonstrate global warming in the Northern Hemisphere (later freeze-up and earlier break-up).

(Source: Magnuson et al., Science, 2000)
Permafrost monitoring K12 outreach program

Kenji Yoshikawa 1, Isamu Saito 2, Elena Spacare 3, and Vladimir Remanovsky 4
1 Water and Environmental Research Center, University of Alaska Fairbanks
2 International Arctic Research Center, University of Alaska Fairbanks
3 Geophysical Institute, University of Alaska Fairbanks

Permafrost will be one of the important indicators for monitoring climate change. The main objective of this project is to establish long-term permafrost monitoring stations at schools along the circumpolar permafrost region.

Changes in permafrost conditions affect local hydrological regimes and can alter entire ecosystems. The purpose of the long-term permafrost observation is fitting for future science objectives, and also benefit students and teachers in remote village schools by providing an opportunity for earth science education and lessons, as well as data collection that relates to the changing environment that they live in.

Permafrost Monitoring Station Installation

We use 2 data loggers and 1 temperature sensor in each station. Students are involved in setting up the loggers (1/3) and sensors (1/3) for the monitoring stations. They also help to locate the school and the thermistor, and read data in the base link to complete the monitoring stations. Each station will involve duplicate sensors by students and teachers.

Drilling equipment

Other field activities and classes

Avalanche research camp

Avalanche

Avalanche

Frost tube record

Probing the active layer

Acknowledgements: This project was funded by the National Science Foundation, EPSCoR, TP4 program and NASA FY13 program. We thank UAF Mechanical Engineering machine shop, Fred Morang for his support, Kent Hagen for setting up the permafrost system and Ken Hollingsworth and Sam Johnson for helping with the permafrost system. The project also received support from the Alaska Environmental Protection Agency (EPA) and DAS for logistical support. Our special thanks go to many of the school teachers and school district staff who made this project possible.

www.uaf.edu/permafrost
The Alaska Lake Ice and Snow Observatory Network (ALISON) was created to meet the needs of Alaska teachers who wanted winter science activities for their students.

MODEL: Students learning to do science by being scientists.

SCIENCE GOAL: To determine the heat flux from frozen lakes around Alaska

PARTICIPANTS

IN THE FIELD

1. ice thickness measurement
2. snow surface temperatures
21. snow depths
21. ice surface temperatures
3. snow samples

IN THE CLASSROOM

ALISON
Alaska Lake Ice & Snow Observatory Network

ALISON Guide to Heat and Energy Activities for the Classroom

Marc Swanson (Seward Elementary, retired)
Cheryl Aaboet (Wasilla High School)

Total number of sites: 11
Urban: 6
Native communities: 4
Rural: 5
Climatic Regions: 4

The thermal resistance of metals.
The specific heat of soil and water.
Understanding the heat capacity of water.

Slide prepared by Kim Morris
PolarTREC Teacher with researchers on the SEDNA Ice Camp
Arctic Expedition for K-12 Teachers
Strategies: Formal/informal Education

- Summer schools
IARC Summer Schools

Field work
Classroom

8 summer schools in the past 7 years
2010 IARC Summer School: Arctic in a changing climate: Physical and biological linkages to permafrost
2009 Summer Field School - IARC and RAP

Global-to-Local Interactions:
Social-Ecological Resilience in a
Rapidly Changing North
2008 IARC summer school: Modeling of Arctic Climate (Fairbanks and Barrow)

On the ice at Barrow
2007 IARC summer school:
Environmental Studies in the Boreal Forest
Central Biosphere Forest Reserve,
Fedorovskoe, Tver area, Russia (16-28 July)
• Mentors of postdoctoral fellows
• Member advisory board and mentor panels in APECS
• Developed graduate level course on arctic climate system, and on research methods for interdisciplinary research
• Advisors or members of graduate student committee
• Research fellowships for undergraduate and graduate students
Poster Presentations of Research Fellowship Awardees
Center for Global Change and IARC

Anna Liljedahl - funded 2nd year projects
Erin Trochim

Markus Janout - new projects funded
Laura Brosius
Other Strategies

- Testimony on climate change and policy
  - Alaska Governor’s Cabinet
  - Alaska and Arkansas congressional delegation
  - other U.S. legislators.

- Outreach to science and other groups
  - North Slope Science Initiative
  - US Fish and Wildlife Service
  - American Water Resources Association
  - Pacific Association of American Geographers

- Outreach to Stakeholders
  - Interior Issues Climate Change TaskForce
Stakeholders and Climate Change Project

- Climate change observations and impacts at a local level
- Collaborative exchange between local residents and IARC scientists
- Interior and coastal communities
- Public forums & web products

Charlie Campbell at fish camp
Yukon River, Alaska

Meeting w/ Ft. Yukon Tribal Council
# Stakeholders and Climate Change Project

## Observations of Change and Impacts in Tanana

*Summarized by Charlie Campbell*

<table>
<thead>
<tr>
<th>Season</th>
<th>Fall</th>
<th>Winter</th>
<th>Spring</th>
<th>Summer</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Temperature</strong></td>
<td>Freeze-up</td>
<td>Temperatures →</td>
<td>Break-up</td>
<td>Yukon River Temps</td>
</tr>
<tr>
<td><strong>Precipitation</strong></td>
<td>Drier</td>
<td>? ↓</td>
<td>? ←</td>
<td>? ↓</td>
</tr>
</tbody>
</table>

(UNsubstantiated impression of overall decrease in precipitation)
Water levels in ponds, creeks, water courses


<table>
<thead>
<tr>
<th>Activity</th>
<th>Impacts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moose hunting Window</td>
<td>• longer affective moose hunting window</td>
</tr>
<tr>
<td></td>
<td>• later rut (?)</td>
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<tr>
<td></td>
<td>• later season of navigation</td>
</tr>
<tr>
<td></td>
<td>• driver walking overland &amp; around ponds &amp; lakes</td>
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<tr>
<td></td>
<td>• lower water levels in sloughs (?)</td>
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<tr>
<td></td>
<td>• less available pond vegetation for moose feed?</td>
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<tr>
<td></td>
<td>• later time on construction shut down</td>
</tr>
<tr>
<td>Trapping, travel</td>
<td>• earlier break-up &amp; end of winter travel</td>
</tr>
<tr>
<td></td>
<td>• more compressed season for geese hunting</td>
</tr>
<tr>
<td></td>
<td>• increased danger of thin ice developing quickly</td>
</tr>
<tr>
<td></td>
<td>• thinner ice thickness resulting in less destruction &amp; increased</td>
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<tr>
<td></td>
<td>• vegetation on Yukon River beaches from gentler break-up</td>
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<tr>
<td></td>
<td>• driftwood arrives right after ice – increased danger to collect by</td>
</tr>
<tr>
<td></td>
<td>• boat during run as ice cakes still</td>
</tr>
<tr>
<td>Geese Hunting Gathering Drift Wood</td>
<td>• so-called (end of) “June Rise” less reliable as source of drift</td>
</tr>
<tr>
<td></td>
<td>• warmer river temps and possible effects on salmon migration?</td>
</tr>
<tr>
<td></td>
<td>• Ocean tem &amp; circulation pattern changes resulting in changes in salmon run?</td>
</tr>
<tr>
<td>Summer Construction Window</td>
<td>• earlier break-up &amp; end of winter travel</td>
</tr>
<tr>
<td></td>
<td>• more compressed season for geese hunting</td>
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### Key

- Higher, warmer, more
- Lower, colder, less
- Earlier
- Later
- ? Increased Uncertainty
During the Western Alaska Interdisciplinary Science Conference and Forum 2009 In April 7-9, an IARC scientist (J. Cherry) organized a workshop on the need for a new entity known as the Bering Strait Research Consortium (BSRC).

Interest in BSRC has grown out of the needs of stakeholders and researchers to coordinate their efforts. BSRC could serve as a central forum for communication of cultural, health, economic, and scientific research activities to the public, data exchange, research synthesis, and research support information.
Communicating with the Public—other examples
Scientists discuss their research at the IPY Celebration

World Ice Sculpture Championship
IARC’s 10th Anniversary Celebration
Some Outcomes

- Student projects – class, group, individual
- Teacher abstract accepted for presentation to Oslo Science Conference
- Stakeholders, community members eager to extend what they have learned to the school children
Integration of different knowledge systems in student investigations
Effect of A Power Plant on Chena River Freeze-up

By Elizabeth Bennett

Other Parameters Measured:
Air temperature
Soil temperature,
Ground and River surface temperature
Water Temperature

Downstream of Power Plant

Upstream of Power Plant

12-01-2009
High School Students from Innoko River School presented Integrating Indigenous Athabaskan Deg Hitan Knowledge and GLOBE Measurements in an Alaskan Boreal Forest Study, at the GLOBE Learning Expedition in Capetown, South Africa
Students from Model Secondary School for the Deaf Collaborated with students from Indiana School for the Deaf on a Seasons and Biomes Budburst Study and were selected to present at the 2008 GLOBE Learning Expedition in South Africa.

Tyler, Joshua, Lateefah & Kelsey
Mentoring provides a platform for early career scientists to initiate their careers in polar research.

“In my experience, doing a post doc at IARC has increased my interest in polar research, as well as my understanding of the issues that need to be addressed in future research. This post doc position has also provided several opportunities for conducting interdisciplinary research in the Arctic and possibly in Antarctica”. IARC has awarded Ana an S. T. Lee travel grant to visit the Antarctic Research Center in New Zealand last spring for collaboration with ARC scientists.
Polar Science and Global Climate: An International Resource for Education and Outreach
Acknowledgements

