

13. GLOBAL CHANGE EDUCATION

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The first stated goal of the Alaska/Bering Sea Regional Workshop on Climate Change Impacts is “to educate the stakeholders about the importance of the effects of climate change on issues of particular concern to them.” This important educational goal does not end with the close of the workshop, but remains a central task. Educating the general public regarding the findings of the workshop as well as informing them about the broader implications of climate change on Alaska and the Bering Sea must be an ongoing activity.

During the Workshop it was recognized that stakeholder education must be a two-way process, one in which stakeholders became active participants and contributors to improving our understanding of climate change, as well as recipients of research findings. Stakeholders were seen as a potential source of critical observations and data of value to the climate change research community. Stakeholders, if provided with appropriate training and equipment, could become a source of specific types of data from data-sparse regions. Although the academic community may feel the need to fully understand all aspects of climate change before attempting to educate the public, workshop participants believed that now is the time to begin educating stakeholder groups regarding climate change issues and impacts, even if we don't fully understand cause and effect relationships.

The concept of climate change is vague to the average person, due to a number of reasons. Often the media presents climate change issues as controversial and unproven, even among members of the research community studying the problem. A common view is that if scientists who are climate change specialists can't agree on what is happening, why should we worry about it. A second perception is that climate change involves global processes that are poorly understood, and are largely beyond our control, at least at the local or regional level. Often the problems associated with climate change are seen by the public as somehow involving tropical deforestation, ozone depletion in the Antarctic, increasing global CO₂, etc., and are not considered as relevant to Alaska. In addition, climate change problems are seen as very complicated and are considered to be too difficult to be easily understood by the non-academic person. Finally, the public perceives the problems of climate change, if real, as far in the future and not of immediate concern. Clearly, a concerted effort to educate the public, using non-technical terms and relevant examples, is a critical need, and thus, a strong finding and recommendation of this workshop.

The workshop has recognized that certain stakeholder groups may be able to provide a significant source of observations and information for use in the study of climate change impacts in Alaska and the Bering Sea. Native peoples have lived in the same region for several generations, and because of their reliance on hunting and fishing, are likely to be aware of any change in migratory patterns of animals over the past several decades or longer. Additionally, their local knowledge regarding changing patterns of the ice edge, ice flow formation and timing, changes in snow cover, vegetation, fish, marine mammal and other changes may provide researchers critical data for monitoring the regional impacts of climate change. Because of their subsistence lifestyle, and their long-term occupation of a given area, the native people will be able to provide an invaluable source of “ground truth” data for their region. They are the local experts for their home areas. It was also recognized that a

workshop format is not the best way to elicit their input. Other, more traditional methods will need to be employed in order to incorporate the indigenous people as active participants in this two-way educational process and integrate the Native knowledge and ways of knowing with western science.

A tightly-focused outreach education program is recommended. This educational program must be designed to meet specific stakeholder needs, and as well as to facilitate their active participation in the program (both as contributors and recipients of information). This program must be jointly developed by research scientists, formal educators, and the intended stakeholder groups. This program must focus on developing hands-on, relevant activities, presented in direct, easily-understood language which describe climate change issues and likely impacts important to the specific stakeholder group. In addition, such a program will need to address specific educational needs. Mining executives will need one type of program, while K-12 classroom students and teachers will need another. Such an educational program does not exist at present, although some existing programs may serve as useful models. One of these is the GLOBE (Global Learning and Observations to Benefit the Environment) program for K-12 students.

GLOBE is a hands-on, school based international environmental science and education program involving students in primary and secondary schools throughout the world. It connects students, teachers and scientists around the world for research collaboration and cross-cultural enrichment. Almost 4,000 schools in over 50 countries are participating in global environmental research and contributing to a "global" picture of the health of the earth as students monitor their local environment. To implement the GLOBE program, K-12 teachers receive training and educational materials developed by a team of GLOBE scientists and educators. These include skill level-appropriate procedures for standardized scientific measurements, learning activities that emphasize science concepts and process skills, and background information about environmental science and education.

GLOBE environmental measurements include the following:

1. Atmosphere/Climate Studies
 - a. air temperature (current, daily maximum and minimum)
 - b. precipitation (rain/snow, daily amounts, pH)
 - c. Clouds (cloud cover and type)
2. Hydrology Studies
 - a. surface water temperature
 - b. surface water chemistry (pH, alkalinity, dissolved oxygen, salinity, nitrates, electrical conductivity)
 - c. transparency
3. Soils Studies
 - a. soil moisture
 - b. soil temperaturesoil characterization (structure, color, consistence, texture, bulk density, particle size distribution, pH, fertility)
4. Land Cover/Biology Studies
 - a. biometry (tree height & circumference, canopy, ground cover, species ID)
 - b. land cover (correlation of *in situ* measurements with remote sensing data)

GLOBE provides a scientific, non-advocacy approach to studying some of the Earth's challenging environmental topics. This program is one of those chosen by the Alaska Global Change Education Committee to use in providing environmental education curriculum to Alaska classrooms. The Center for Global Change and Arctic System Research at the University of Alaska Fairbanks has a cooperative agreement (Alaska Globe Franchise) with GLOBE, to recruit GLOBE schools, train GLOBE teachers and mentor GLOBE students throughout Alaska. There is no exchange of funds between the two institutions. GLOBE which is multifederally funded (NOAA, NASA, NSF, EPA, Department of Education,) will provide training for Alaska GLOBE trainers, teacher guidebooks and other educational resource materials, and access to the complete network of GLOBE servers (Student Data Server, Visualization server, Data Archive, Help Desk) as well as access to GLOBE scientists, teachers and students. The Alaska GLOBE Franchise will provide the teacher training and student mentoring pending availability of funding and other resources.

The Alaska Global Change Education Program is being developed by a nine-member volunteer executive committee in response to a nationwide initiative to launch global change curricula across the country which originated from the first U.S. Global Change Education Conference in 1994, sponsored by various federal agencies and private non-profit organizations. This Conference brought together scientists and educators from all over the United States to share expertise in discussion of critical and significant global change issues and on ways of bringing this to the stakeholders attention. Kindergarten through junior college students and the general public were identified as highest priority audiences for education and outreach efforts. A team consisting of science teachers, a UAF scientist, an educator from the Alaska State Department of Education, and a community science educator from Alaska participated at the conference.

Alaska began an action plan to provide a state program in K-12 global change education. Through the efforts of a nine-member volunteer Alaska Global Change Education executive team (including the five original Alaska team members who attended the 1994 conference), funding for a global change education planning grant was obtained from the National Science Foundation (NSF), a 50-member team representing different federal and state agencies was organized, surveys were conducted, and education materials were researched as to availability and suitability for use in Alaska. Among the materials and programs reviewed and favorably considered, was the GLOBE Program. Since then members of the Alaska Global Change Education team have participated in the GLOBE Program as trainees and trainers.

The Alaska Global Change Education Executive Committee defined the mission statement for Global Change Education in Alaska as follows:

“All Alaskans are literate in global change and have the tools necessary to make well informed choices regarding the causes and impacts of global change in addition to the ability to adapt to these changes.

All formal and informal educators are able to teach and model global change learning in Alaska's schools and communities knowing changes throughout the world heavily impact the arctic and subarctic regions. In so doing, Alaska educators will help the people of the state move toward personal empowerment.”

Often research findings are written by scientists, to be read by other scientists. As such, these findings are largely ignored by the general public, or worse, misrepresented by the media. The front page article appearing in the local Fairbanks newspaper (The Daily News-Miner)

reporting on the Climate Change Impacts Workshop referred to global warming as being due to increased levels of carbon monoxide, and although correctly attributed to carbon dioxide in the next sentence, the reader is left to question which is correct. There is a great need for translating of the research data into meaningful information, easily-understood by non-academic stakeholders.

If stakeholder groups are to become sources of scientifically-meaningful data, these groups need to be informed regarding what types of data will be useful to research scientists, how to collect meaningful data, and what to do with it, once collected. Similar to the GLOBE program, clear, well-designed protocols will need to be developed by members of the research community, and combined with educationally-sound explanations/background on the issues and measurement activities so that the participants understand both the "how" and the "why" of what they are doing. Recommendations need to be made regarding the type of equipment to be used in making stakeholder measurements so that if properly made, the measurement will be meaningful as well as accurate. The use of calibrated equipment, used by all in the same way, is essential for insuring data quality.

To tap the traditional ecological knowledge of Native Alaskans and integrate this with western science in understanding, teaching and learning of global environmental changes, a project on global change education and Native ways of knowing was developed by the Alaska Global Change Education committee. Funding is being sought for this proposed work. Western and Native science and ways of knowing will be used. To provide global change education to students in rural Alaska, the GLOBE program and Native ways of Knowing/indigenous science protocols and learning activities that will be developed by native elders and educators who are involved in the Alaska Rural Systemic Initiative will be used. To include high latitude/Alaska specific environmental change issues, measurement protocols and science learning activities will also be developed by Alaska researchers and educators.

There is a scarcity of data regarding climate change in many areas of Alaska. One way of addressing this, is through the Alaska GLOBE program and the Global Change Education and Native Ways of Knowing Pilot Program, stakeholders i.e students will be a source of much needed data on environmental change and for "ground truth" for assessing satellite data. The first Alaska GLOBE teacher training will be held in Fairbanks Oct. 7-9, 1997. Teachers from the Fairbanks North Star Borough, Iditarod and Kenai Peninsula Borough School District have registered. This training is made possible by funding provided by the Fairbanks North Star and Kenai Peninsula Borough School Districts, the NSF funded Partners in Science Program, the Alaska Space Grant Program, the Center for Global Change and Arctic System Research, educational materials and resources from the GLOBE Program and through volunteer work.

Global change education is in its infancy stage in Alaska. The Alaska Department of Education does not even have an environmental science specialist nor is there a funded global change education coordinator in the state. At present there are only two undergraduate courses being offered at UAF on global change. An earth systems and global environmental change course for K-12 teachers was taught for one semester at UAF through funding from EPA and the efforts of the Alaska Global Change Education team. Other programs need to be developed for educating different groups of stakeholders. There is a need for additional resources in educating stakeholders regarding global change and its implications. Financial resources are needed for fostering and implementing global change education as well as the involvement and support from educators, scientists, technologists and community.