Bridging the Poles: Education Linked with Research

A Report on the Workshop

23-25 June 2004
Washington, D.C.

Stephanie Pfirman, Barnard College
Robin Bell, Lamont-Doherty Earth Observatory, Columbia University
Margie Turrin, Lamont-Doherty Earth Observatory, Columbia University
Poonam Maru, Barnard College

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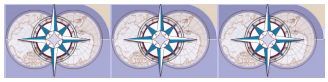


APPENDICES

Special thanks to all those in the polar/research/education communities who allowed their images to be included this report. For a list of credits for images not noted in the text please see Image Credits at the end of this report (p. 93-94).

Executive Summary

If the 65 educators, scientists and media specialists who gathered at the "Bridging the Poles" workshop in Washington, DC on June 23-25, 2004 have their way, a semi-trailer truck labeled "Got Snow?" would traverse the country during the International Polar Year (IPY) of 2007-2009 loaded with polar gear, interactive activities, and a snowmaker. We would significantly increase the number of Arctic residents—especially indigenous Alaskans—with PhDs. We would build exchange programs between inner city youths and polar residents. Polar exhibitions would open at natural history and art museums and zoos. And polar postage stamps, interactive polar computer games, national polar book-of-the-month recommendations, made-for-TV polar documentaries, and a polar youth forum, would bring the poles front and center to the public's attention. The goals of the NSF-sponsored workshop were to define strategies that will engage the next generation of polar scientists, engineers and leaders, and inspire the general public. Through a series of plenary talks and roundtable discussions, the workshop focused on: opportunities and needs for different levels, engaging diverse communities, leveraging the importance and excitement of polar science, and programs to feature nationally and internationally over the next 5 years. This workshop was the first major community effort to develop an integrated education and outreach program that would maximize the potential of the International Polar Year.

Discussions about opportunities and models for engaging different levels: grades K-5, 6-12, undergraduate non-science, undergraduate and graduate science majors, and the general public, emphasized capitalizing on the tremendous ability of polar themes to attract attention and the need for a broad, interdisciplinary approach. With their geographic foundation, the poles encompass multiple content areas ranging from science to culture and heritage. Workshop participants advocated capturing student interest and increasing science literacy in the general public by linking fascination with polar environments, to improving science, math, reading, and other skills, while integrating polar themes into state and national standards. Polar science can engage diverse groups of learners in science as a human endeavor, history and nature of science, science as inquiry, and science and technology. For advanced students, there are exciting opportunities in circumpolar distance learning with Web course delivery, as well as other programs such as the University of the Arctic's PhD networks and collaborative field courses. Beyond curricula, the use of polar themes in major competitions such as the National History Month, the National Ocean Sciences Bowl and Intel is a powerful way to expand attention on, and interest in, polar subjects. Other imaginative polar

Photo courtesy of science teacher Carol Landis (12/03) a mountain on the north rim of the Taylor Dry Valley, Antarctica, was framed by a hole in one of the wind-eroded rocks ventifacts) above Lake Bonney Camp.

education and outreach ideas discussed at the workshop include polar-themed McDonald's Happy Meals, circumpolar following of "A Day in the Life at the Poles," and junior Arctic and Antarctic councils.

Participants articulated the need of the polar science community to fully engage more diverse participation, including Arctic peoples and communities, underrepresented minorities, and women, as well as broadening economic and geographic involvement. Communication with Arctic indigenous people must extend beyond the simple transmittal of science results. Programs must advance the next generation of researchers from the Arctic who will investigate and communicate northern issues to global populations and decision makers. This theme of building capacity within communities, together with providing opportunities for personal contact and field experiences, making polar issues relevant at the community level, and developing mentoring and support systems was articulated by workshop participants for each target group. Common interests can bring diverse communities together. For example, Matthew Henson, the African American explorer who went to the North Pole with Robert E. Peary, played a crucial role in polar exploration at the turn of the last century, yet since his time minorities have remained underrepresented in polar science. A first step towards bridging the gap between inner city communities and communities in the Arctic was taken at the workshop when the leader of the Earth Conservation Corps' Matthew Henson Center in Washington DC established contact with Native Alaskans and together they began to plan exchange programs. Unlike many of the other sciences, user data collected through the experience of San Francisco's Exploratorium's Web-based "Live@", including "Science Live from Antarctica," indicates that polar themes, unlike many other science themes, draw a nearly gender-balanced audience. Polar education efforts should build on this latent interest to develop a more gender-diverse community.

Just as it is important to engage diverse audiences within their own community, establishing connections among local scientists, educators and informal outreach venues, can have long-lasting impacts. These connections build networks that sustain, and encourage further engagement on all sides. Especially important are providing opportunities for field experiences for students, teachers, and the media; these opportunities can build life-long advocates of the poles.

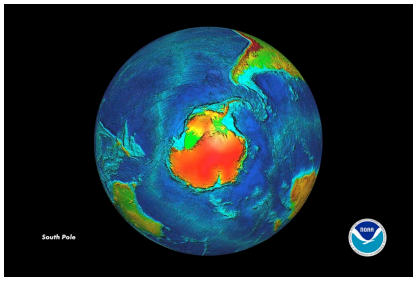
The group identified ways to leverage the importance and excitement of polar science, starting with what people think they know about polar organisms – and then moving beyond the charismatic megafauna of polar bears, penguins and whales to look at the diversity of adaptations to life in extreme environments. Participants discussed ways that major emerging science programs can be connected with meaningful education and outreach programming, and rolled out to the public as media events. Examples include: ANDRILL - drilling in the Ross Sea to recover key paleoclimatic records; and Ice Cube - a neutrino observatory at the South Pole. Polar environmental change, including SEARCH

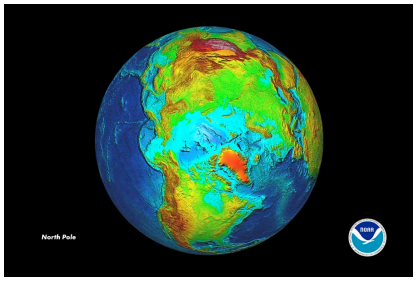
(Study of Environmental Arctic Change), links communities around the world with the worlds at the ends of the Earth, and underscores the feedback mechanisms of the poles on and also from the global system. “Think Globally/Act Locally” and the complementary “Think Locally/Act Globally” will be important themes for local, national and international IPY programming.

To ensure the success of polar education and outreach efforts, coordination of existing resources, linking communities and developing partnerships, access to data and content from the polar regions, securing funding to develop new programs, and sustaining programs after the conclusion of the IPY, are crucial. Education and outreach initiatives must be clearly defined with measurable outcomes so that IPY's promise in building capacity in Arctic communities, growing a new generation of polar researchers, and stimulating the public to know more — and care more — about the poles, is realized. Workshop participants recommended that interagency and international working groups on IPY education and outreach, with staff, be created to coordinate and leverage programs, and be integrated with research plans. A rich, sophisticated, multidisciplinary, international and multilingual one-stop Web portal should be developed to host research and education resources, opportunities, and advances, post reports from the field and curriculum material, serve as a central meeting point for a diverse suite of populations, and provide contacts for researchers, educators, the media, and the public at all levels. The media – television, radio and print – as well as educators, zoos and museums – are eager for timely, accessible, and meaningful content. Access to high quality content requires improved high bandwidth communications – this issue emerged repeatedly in the workshop as critical to timely and dynamic connections between the poles, the media and other communities.

In conclusion, to maximize the potential of the International Polar Year, workshop participants recommended integrating research, education and outreach efforts, at the international as well as national level, with the goal of building a coherent and exciting public presence during 2007-2009. Requests for proposals (RFPs) for the International Polar Year should encourage a broad spectrum of research, education, and outreach projects. The RFPs should be written to allow maximum flexibility in design and size: not all research programs need to have a major education component, and not all outreach programs need to have a major research component. Expensive, collaborative projects can have major national or even international impact when science programs are connected with press events, educational programming, and spin-offs of local programs. But small, individual projects can produce sustained transformation of local or target communities. There is a pressing need to start now to develop an integrated research/media/education strategy; establish partners among the research, media, and education communities; and diversify participation and audiences. Just as it takes time to define a research program and establish the logistics to carry it out, effective education and outreach programs take years to develop.

BRIDGING THE POLES





Introduction

The goals of the "Bridging the Poles" workshop of June 23-25, 2004 were to define strategies to engage the next generation of polar scientists, engineers and leaders, and inspire and educate the general public. The timeframe considered was the next five years, including maximizing the educational impact of the International Polar Year (IPY) in 2007-2009 (see inset below). The ca. 65 participants included K-12 educators, undergraduate professors, Arctic and Antarctic research scientists, Alaskan natives and residents, museum curators, representatives from agencies, the media and international programs.

The workshop focused on four major themes:
- Reaching different levels
- Engaging diverse communities
- Possibilities for thematic areas
- Programs to feature nationally and internationally

The 22 roundtable discussions on these topics resulted in numerous recommendations to engage both future scientists and the general public.

This report synthesizes opportunities for polar education and outreach identified at the workshop, recommends ways to maximize the impact of the IPY, and proposes "Next Steps" to develop polar education and outreach over the next five years.

Contributed ideas are compiled in an appendix (pgs. 50-64) as a resource for building communities and advancing common interests.

Polar Education and Outreach Objectives

Workshop participants identified major objectives of polar education and outreach that we believe can be achieved by 2010. These major objectives can be clustered into: targeting learners at all levels, engaging diverse communities, leveraging the importance and excitement of polar science, and creating infrastructure for effective education and outreach.

Objectives that **target learners at all levels** include:

- Increase and sustain public engagement in polar regions at all levels -- from kindergarteners to Elderhostel programs.
- Increase student achievement by linking fascination with poles to improving curriculum and other teaching resources, and improve students' science, math, and reading.
- Encourage lifelong scientific literacy through establishing an appreciation for science and nature by making connections between science and society early in life, and reinforcing those connections through varied media.

Objectives that involve **engaging diverse communities** include:

- Arctic residents, including indigenous populations, are meaningfully engaged in developing and implementing polar research, education, and outreach, including community concerns and traditional knowledge, with an increase in the number Arctic residents—especially indigenous Alaskans—with PhDs.
- The diversity of those interested in polar science is significantly broadened, to include Arctic indigenous peoples, minorities, women, elders, and youth.

Objectives that **leverage the importance and excitement of polar science** include:

- Students and the general public better understand the roles of the poles in global systems and recognize the relevance of polar processes to their lives.
- Rich combinations of qualitative and quantitative multidisciplinary and interdisciplinary polar data from diverse world views are accessible and used effectively in research and education.
- A new generation of polar scientists, engineers, and leaders is successfully engaged and researchers successfully communicate the human face of polar science.

Objectives for **effective education and outreach infrastructure** include:

- Dynamic, sustained, one-stop polar research and education web site is a central resource for content and contacts for all ages.
- Strong supportive partnerships evolve into a polar learning community with dynamic ongoing communication and collaboration among agencies, scientists, educators, media,

northern peoples, students, communities, different countries, and the general public, building on existing programs and networks and incorporating modern technologies, field experiences and innovative teaching methods.

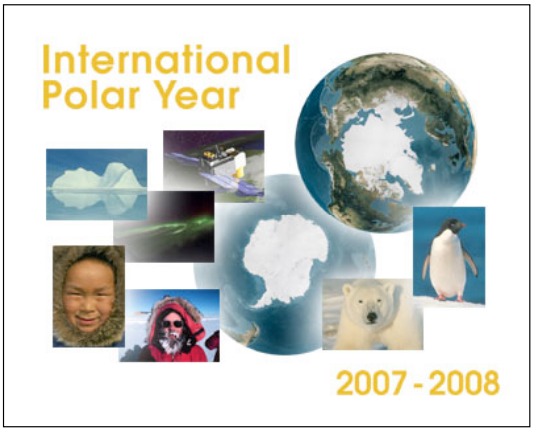
- Ensure the long-term involvement of educators and scientists, beyond the conclusion of the IPY, to sustain polar science and education at the mainstream.
- Develop research, education and outreach programs that are truly international and link communities around the globe through common interests.

A Vision for the International Polar Year 2007-2008 (2004)
Polar Research Board (PRB)
http://books.nap.edu/books/0309092124/html/pagetop

Environmental changes currently witnessed in the polar regions are vivid and in many cases greater than changes observed in the midlatitudes or tropics. The Arctic ice cover is decreasing in extent and area; some ice shelves in Antarctica are retreating and thinning; glaciers across the globe are shrinking; ecosystems are changing; Alaskan villages are being moved to higher ground in response to rising sea levels; and permafrost is causing the collapse of roads and buildings. We must understand these changes in the context of past changes in order to make decisions for the future. Yet we do not understand how or why many of the changes are occurring.

… IPY 2007-2008 [later extended to 2009] is envisioned to be an intense, coordinated campaign of polar observations, research and analysis that will be multidisciplinary in scope and international in participation. … It will be a watershed event and will use today's powerful research tools to better understand the key roles of the polar regions in global processes. Automated observatories, satellite-based remote sensing, autonomous vehicles, the Internet, and genomics are just a few of the innovative approaches for studying previously inaccessible realms. … Such a program will not only add to our scientific understanding, but also it will result in a world community with shared ownership in the results.

… It will serve as a mechanism to attract and develop a new generation of scientists and engineers with the versatility to tackle complex global issues. In addition, there clearly is an opportunity to organize an exciting range of educational and outreach activities designed to excite and engage the public, with a presence in classrooms around the world and in the media in varied and innovative formats.



Targeting Learners at All Levels

Discussions about opportunities and models for engaging different levels – grades K-5, 6-12, undergraduate non-science, undergraduate and graduate science majors, and the general public– emphasized capitalizing on the ability of polar themes to attract attention and the need for a broad, multi/interdisciplinary approach. With their geographic foundation, the poles encompass a range of content areas: from science to culture and heritage. Workshop participants advocated capturing student interest and increasing science literacy in the general public by linking fascination with polar environments, to improving science, math, reading, and other skills, and integrating polar themes into state and national standards. Polar programming can involve a diverse group of learners in multiple content areas: science as a human endeavor, history and nature of science, science as inquiry, and science and technology. Some projects have already prepared curriculum materials based on education standards using polar themes. For more advanced students, there are exciting opportunities in circumpolar distance learning with web course delivery, as well as other programs such as the University of the Arctic's PhD networks and collaborative field courses. Beyond curricula, the use of polar themes in major competitions such as the National History Month, the National Ocean Sciences Bowl and Intel is a powerful way to expand interest in, and attention on, polar subjects. To bring polar conditions to a wider audience, workshop participants came up with the idea of a semi trailer truck labeled: "Got Snow? – A Traveling Exhibition," outfitted with a snow making machine, polar gear and interactive activities, traveling around the country.

(image from AlaskaScienceOutreach.com: al-Ask-a-Scientist feature – designed for readers of all ages to submit questions.)

Just as it is important to engage diverse audiences within their own community, establishing connections among local scientists, educators and informal outreach venues, can have long-lasting impacts. These connections build a network that sustains, and encourages further engagement on all sides. Field experiences for students, teachers, and the media alike build life-long advocates of the poles. A rich, multidisciplinary and multilingual web portal where resources can be accessed and opportunities posted, would serve as a central meeting point for a diverse suite of populations and would provide the media – television, radio and print, as well as educators, zoos and museums – with timely, accessible, and meaningful content.

Grades K-5

The K-5 sector is important for polar education and outreach. Children of this age are fascinated with people and animals living in extreme conditions and they have not yet formed misconceptions/opinions about science. The integration of unique and unusual experiences like the polar sciences and the IPY is an excellent mechanism to engage youth. Connections between scientists and educators help make polar science come alive to students, and in turn, build a community of individuals involved in polar science. Scientists and educators need to be linked in such a way that they both see benefits from working together.

Specific Proposals:

- Build a community of polar researchers connected with teachers who can assist in outreach activities. Increase awareness that linking research with education and outreach is an integral part in the overall success of science education.
- Provide opportunities for different levels of commitment for scientists and involvement of educators (from emails to video clips to classroom visits and joint curriculum development) – individuals differ in their strengths, abilities and time – but establishing direct communications is important.

Students present their research to teachers at a regional workshop.

- Use graduate students as a bridge between scientists and educators: NSF Graduate Teaching Fellows in K-12 Education (GK-12) project a good resource.
- Networking is essential. Regional workshops – teacher to teacher, teacher with scientist and project – show teachers how to bring polar information to a local level.

Grades 6-12

Grades 6-12 are in a balancing state. In these grades, teachers need time to teach required material, both to meet standards and to prepare students for assessment. There is an opportunity to develop problem solving and inquiry-based units focused on polar themes that will help both students and teachers meet requirements in interesting ways. Polar themes can also be integrated into existing programs accepted by school districts, where standards are already aligned

Specific Proposals:

- Incorporate polar science into existing programs (GLOBE, CoVis, National Ocean Science Bowl).
- Engage more teachers. Expand Teachers Experiencing Antarctica and the Arctic (TEA) opportunities. Develop a listserv to provide units that teachers can use in the classroom.
- Balance "wow" factor of state-of-the-art technology used in polar science with students' understanding that technology is a tool, not a substitute for understanding science.

- Complement state standards assessments with polar problem solving units that demonstrate inquiry-based science.
- Attend professional meetings of educators with polar resources to display and give away (e.g. National Science Teacher's Association: NSTA).

Undergraduate Non-Science Students

Polar themes and activities can be included in undergraduate curricula in a number of way. Many undergraduate institutions require that students complete some sort of general science course. For most students, this is their last encounter with science. This is a perfect opportunity to explore polar issues since they can be broad in scientific focus and relate to large scientific questions that have relevance to the general population.

William H. Johnson. Cmd. Peary and Henson at the North Pole, c. 1945. Smithsonian American Art Museum

Polar themes can also be integrated into history, art, and intensive writing programs: reading the early polar exploration literature, reliving expeditions, understanding artists' representations of the known (e.g. by the Inuit) vs. the unknown (e.g. survival conditions).

Specific Proposals:

- Pose rich questions about broad connections to scientific issues, methods, etc. that educators can use internationally, as well as nationally, that help students learn science and help students make connections to their lives, culture, and communities.
- For undergraduate general science courses: develop curriculum elements that use polar themes to set an interesting context for learning science, help students see connections between science and the world around them, and help students to learn how science works (i.e. latent heat of melting and 0ºC summer temperature in central Arctic).
- Have educators and researchers provide resources to a central clearinghouse so that they can be used more widely. Provide materials to help teachers work with students on interdisciplinary classroom investigations that extends their own content knowledge.

Undergraduate Science Majors

Two major areas of opportunity for undergraduate science majors are incorporating more polar science into standard courses, and giving students either hands-on or virtual polar field experiences. Developing opportunities for introductory science courses is important, as this is where students often determine whether to continue in this career or pursue something else. Research and field experiences need to be created for the upper level students.

Specific Proposals:

- For the broad-brush introductory courses:
  - Create a web-based clearinghouse for polar opportunities and resources – field courses etc. and research opportunities. Develop online lectures with associated activities, e.g. "live from the field," targeted for use in specific introductory classes.
  - Provide financial incentives for polar researchers to work with educators to create modules for distribution and textbook inclusion, or stand-alone activities.

- For the focused upper year students the following opportunities should be enhanced:
    - Utilize NSF Research Experiences for Undergraduates (REU) opportunities.
    - Enhance information exchange about educational and research programs and other opportunities in the Arctic, Antarctic and the lower 48 states.

Graduate

Graduate students are a tremendous resource, but one that is somewhat limited. Polar field opportunities should be offered to undergraduates, or as short courses to post-baccalaureate students, so that potential graduate students are captured at that early stage. Engaging this community in field research as liaisons with education, outreach, and community relations is important.

Specific Proposals:

- Capture graduates through undergraduate and post-baccalaureate opportunities, including short courses, field opportunities, and internships.
- Enhance ongoing circumpolar research and education initiatives, like that of Barrow Arctic Science Consortium (BASC) and the University of the Arctic, especially the PhD networks, creative polar-related webcourse offerings, and opportunities for earning advanced degrees through part time study and research.
- Create a bi-polar portal to facilitate access to and development of polar opportunities, including listservs such as ANSWER (for the Antarctic) and ArcticInfo.
- Provide training in ethical conduct – for people and the environment: ensure that all who work in polar regions are aware of NSF, Inuit Circumpolar Conference, and Alaskan Native Knowledge Network guidelines.
- Educate graduate students about best practices in education and outreach.
- Polar research, because it is place-based and logistics often requires sharing by multiple disciplines, is often interdisciplinary. Are interdisciplinary graduate degrees viable? Systemic change would be required to realize this fully.

General Public – Informal Education

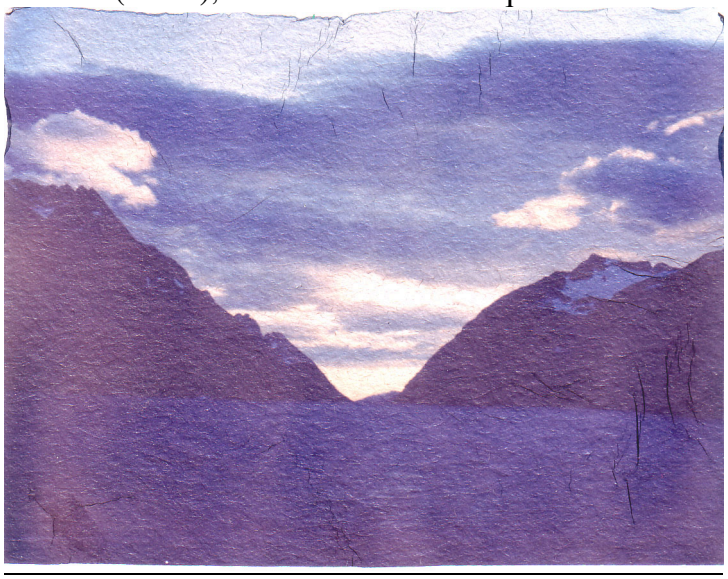
Polar topics have terrific public appeal. Outreach through informal education venues (museums, zoos, TV, radio, print media) should be pursued through a coordinated media strategy. But informal education of the general public through these venues typically reaches a self-selected audience. While many people are fascinated with polar themes, how do you draw others in, who are not currently interested in the poles, including the broader international community? Research is needed on how to broaden and diversify public interest.

Specific Proposals:

- Learn what the public understands currently, and identify their misconceptions. Do not ignore what people are curious about, even if it always starts out with penguins and polar

bears. Build from what engages attention. Develop universal messages, as well as information with targeted relevance: i.e. communicate the science process, not just the results.

- Examine the audience currently participating in programs focused on polar themes. Survey them to find out why those who participate, are there, and develop a strategy to gather others. Capitalize on female interest in polar regions.
- Coordinate a media strategy with general themes: make the poles feel real, personal, and dynamic. Make the poles "real" by providing a sense of place, using images and technology. Focus on people: residents, scientists, etc. to make poles "personal" – more than 50% of visitors surveyed in "Science Live from Antarctica" said they like to hear scientists speak about their work. Let scientists speak for themselves, and show the human interest stories too. Highlight dynamics and change: climate, environment, and society. A coordinated media strategy requires staff and materials designed for general public.
- Tap into the wide variety of available resources (images, stories, artifacts), and a distributed approach. Museum exhibitions on polar arts/scientists should be traveling shows. Public libraries should contain polar books on their summer reading lists.
- Target to have CNN, Fox, MSNBC etc. include a science news spot in their regular news program (a spot separate and distinct from medicine). Regular news broadcasts with science coverage would increase awareness and acceptance of science.
- Engage the media and informal educators: present polar materials at professional conferences (e.g. Association of Science and Technology Centers (ASTC), American Association of Museums (AAM), American Zoo and Aquarium Association (AZA).



Strategies to Engage Diverse Communities in Polar Science

Following investments in general science education stimulated by Sputnik and the International Geophysical Year of 1957, women emerged on the polar science scene in the 1980's. Seeking to understand changes in Arctic climate, ice and biota in the 1990's, researchers turned to native elders to learn from their observations and analysis. Despite these recent developments, women and indigenous peoples remain underrepresented in polar research. Workshop participants articulated the clear need of the polar science community to actively engage more diverse participation, including Arctic peoples and communities, underrepresented minorities, and women, as well as broadening economic and geographic involvement. Communication with Arctic indigenous peoples must include developing a new generation of researchers from the Arctic who actively investigate and communicate northern issues to global populations and decision makers. This theme of building capacity within communities, together with providing opportunities for personal contact and field experiences, making polar issues relevant at the community level, and developing mentoring and support systems, was articulated for each target group.

Networking diverse communities together through common interests can have long-lasting impact. For example, at the turn of the last century Matthew Henson played a crucial role in attempting to attain the North Pole, yet since that time minorities have remained underrepresented in polar science. A first step towards bridging the gap between inner city communities and communities in the Arctic was taken at the workshop where the leader of the Earth Conservation Corps' Matthew Henson Center in Washington DC established contact with Native Alaskans and began to plan exchange programs. Unlike many of the other sciences, user data collected through the experience of San Francisco Exploratorium's web-based "Live@" including "Science Live from Antarctica," indicates that polar themes draw a nearly gender-balanced audience. Polar education efforts should build on this latent interest to develop a more gender-diverse scientific community.

Arctic Natives and Residents

In order to engage Arctic Natives and residents, workshop participants recommended gaining their active involvement in future working group meetings, and working to develop the respect and confidence of the native community and its residents. Mutual respect is essential for the science community to work with them. Science capacity within indigenous communities must be expanded so that native persons design and conduct research projects for native populations.

Specific Proposals:

- Develop a better working relationship between the indigenous community and the science community by carefully planning the timing and cultural structuring of meetings and events,

and ensuring that researchers and planners have some background/training in cultural sensitivity and ethics such as existing guidelines from NSF, Alaska Native Knowledge Network (ANKN), and international first peoples organizations (http://www.ankn.uaf.edu, http://www.nsf.gov/od/opp/arctic/conduct.jsp). Highlight paradigmatic stories of respectful and successful collaborations between native communities and scientific communities. Develop a historical overview extending from the first IPY to the International Geophysical Year (IGY) and through current day.

- Focus on building capacity *within* indigenous communities for conducting research (including local collection of data) and education/outreach in both traditional and non-traditional venues. Community-based educational components should be developed for existing and planned long-term observation networks, structured like GLOBE projects and tailored by community members to address community relevant issues, and to involve both native elders and scientists. Arctic research projects by native people, for native people, will involve finding funding sources and connecting them with native communities. There can be varied tracks for community-based science education ranging from informal to certificate-track to graduate degree-track. Develop opportunities for all types of students.
- Recognizing that the Native peoples have knowledge and tradition to share with other populations is an important first step towards their involvement. Their presence in the field of education, both traditional and non-traditional will assist in encouraging more Natives, and in providing a bridge to other cultures. Science information existing in their people through their elders and collective knowledge and practices has a place in current and future research. Respect for preserving their traditions must be considered in any program.

Minorities

Building involvement in polar activities by minority communities requires actively reaching out to them, and ensuring that research and activities have relevance to their specific interests. Existing community agencies and activities can be a vehicle for numerous and repeated exposures on their home ground. Locating these agencies and local needs will involve physically going to communities and exploring possibilities face-to-face. Ongoing support systems for engaged minorities need to be established that will sustain them throughout their involvement in research.

Specific Proposals:

- Focus groups can help in identifying ways to encourage minorities in their involvement in polar science and emphasize its relevance to them and their communities, and to develop local connections. Connect through professional minority associations. Find ways to offer hands-on, field participation by community members. Encouragement and recognition for

involvement in science and research can have a major impact, anything from offering day care and meals to a modest stipend. It is important not to set the level so high at the beginning that people without a strong background are intimidated and therefore unwilling to participate. Courses can be restructured so that they are designed to be more informative than evaluation oriented. Seminar series with following group discussions, or individual presentations might be an alternative design to courses focused on traditional testing and evaluation.


Matthew Henson Center, Washington D.C.

- Better preparation in math and science is essential, especially in the grades K-6 as this is when the foundation for future learning is established. Integrating science and math with other fields is one way to expand relevance and motivation.
- Once people are involved it is important to develop a network of mentors to serve as active role models. Develop vignettes on minorities involved in science – their background, accomplishments and challenges to share with newcomers. Train non-minority scholars in successful approaches to mentoring minority students.

Gender Diversity

Polar exploration and science has historically been a field comprised predominantly of males, but strong female engagement in programs like the Exploratorium's "Science Live from Antarctica," indicates that women have substantial interest in polar themes. This is a two-fold issue comprised of both the issues facing women choosing any science as a profession, as well as the issues facing woman who chose polar science. A change in the general culture and acceptance of science-oriented girls would address both issues. Systemic changes include broadbased goals such as: highlighting the successful women in science and encouraging them to serve as mentors to other women, more women in senior science positions to serve as role models, more support for women with children who must do polar field work, "Reprogramming" parents so that they encourage girls to play with Legos and other technical toys, and teaching math and science in context in middle schools so that females and minorities don't lose interest and miss out on building their foundation for college science. Addressing these and other items that have been raised in recent studies on women in science, will help with recruiting and retaining more women interested in polar science as well. Enhancing gender diversity also includes involving more male K-12 teachers as well as engaging more women in polar research.

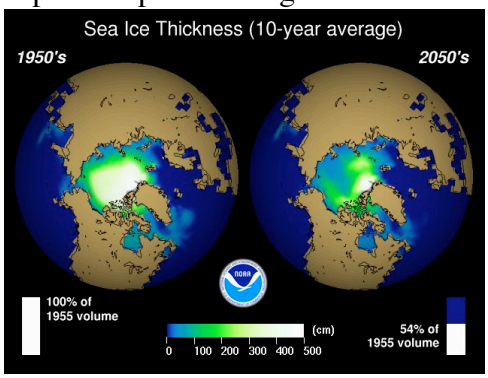
Specific Proposals:

- In order to understand what attracts women to polar science, collect data from the women presently in polar science. Survey female researchers to ask what inspired them to do what they do. Develop vignettes to share on these individuals, their background, accomplishments and challenges.

- Investigate why so many women are underemployed. Recognize contributions of part time employees and increase their status. Consider salary equity and benefits: offer benefits to part time employees and adjuncts. Examine ways to offer educational opportunities to people with a wider range of availability, for example, MA, MS and certificate programs that can be completed part time and after hours. Establish part-time science programs for nights and Saturdays, with childcare, so that working women can attend.
- Educational programs should deliberately attempt to engage the female population in science as well as the male population. Target middle schools with a focus to engage them in meaningful activities, and to teach more math. Middle school is a time when females and minorities lose interest in science, math, and technology so it is especially important to keep them engaged and not allow them to fall behind.
- Informal educational opportunities are often a good way to engage individuals who might otherwise not be involved. Provide materials for museums, and zoos to engage the female audience, and take advantage of "virtual" experiences. Teach youth to appreciate nature at an earlier age (organize field trips, bring snow-making machines in the South, polar-themed coloring books,.). Create materials for wide distribution: recommended polar reading list, film lists.
- Develop a mentoring and support system. Encourage networking. Provide opportunities for teachers to work closely with researchers so that they can be role models for their students.

Geographic Diversity

From Louisiana to the Middle East and Asia, what are the keys to engaging people in diverse geographic settings in understanding and appreciating the poles? Engaging geographically diverse communities will involve personally connecting them to the research so that they see the relevance to their community. Focus on the impacts on the poles of decisions made elsewhere or the impact of polar change on other communities. Studies/activities that can be done in any location allow all individuals to be a part of the science research experience.



Specific Proposals:

- Meet with communities to find out what is important to them, how they relate to specific issues, and then make it personal. Identify issues and values that communities have in common with the poles, compare and contrast. Focus on connections between each community and the poles. For example, a rise in sea level caused by melting glaciers and ice sheets could directly affect the 1/3 to 1/2 of the US population that lives in

the coastal zone. Provide an open framework so that communities can select what is important to them to focus on (climate, biology, etc.) – communities relate to specific issues and should be able to plug their projects into this interest. Emphasize that local policies and practices are relevant to the changes in the global system and affect the poles.

- Provide contact information so that communities can connect with scientists and other like-minded communities to set up projects.

Socioeconomic Diversity

Scientific research, often requiring a PhD, seems beyond the reach to many socioeconomic groups. And so polar regions, literally at the ends of the earth, becomes an esoteric subject. To reach economically diverse communities will necessitate the better use of media and public information systems. The media and non-traditional educational opportunities should be a primary focus for reaching economically disadvantaged communities. Misconceptions about where scientists come from can be addressed through biographies of scientists who come from non-academic, and lower economic backgrounds. These biographies should be provided to teachers, parents and students.

Specific Proposals:

- Make connections between environment and local community – make it all relevant. Develop programs and activities that are appealing to all socioeconomic backgrounds.
- Create dramatizations about polar science for wide distribution to teachers and children. Make short public TV sections (like Sesame Street or Bill Nye) that teachers can use directly in their classroom. Give away posters with facts about the poles to teachers for use in classrooms (as well as PDF files, etc to download). Develop inexpensive programs and activities: fast food children's meals with polar toys, explorer games and play cards, polar tic-tac-toe (if answer correctly can put down an X or an O), polar checkerboard. Engage scholastic publishing with polar topics and free books (containing polar information). Tap community/recreation centers and camps to diversify the outreach through informal science.
- Make polar research more accessible. Address the misconceptions about where scientists in academia come from. Publish the low-income success stories. Have an option to make an audio tape essay for applications to advanced degrees, since some applicants may be more articulate in speaking than in writing.
- Be vigilant – make sure that communities have proper resources (especially technology). Involve both students and parents. Make school resources available during non-school hours.

International Diversity

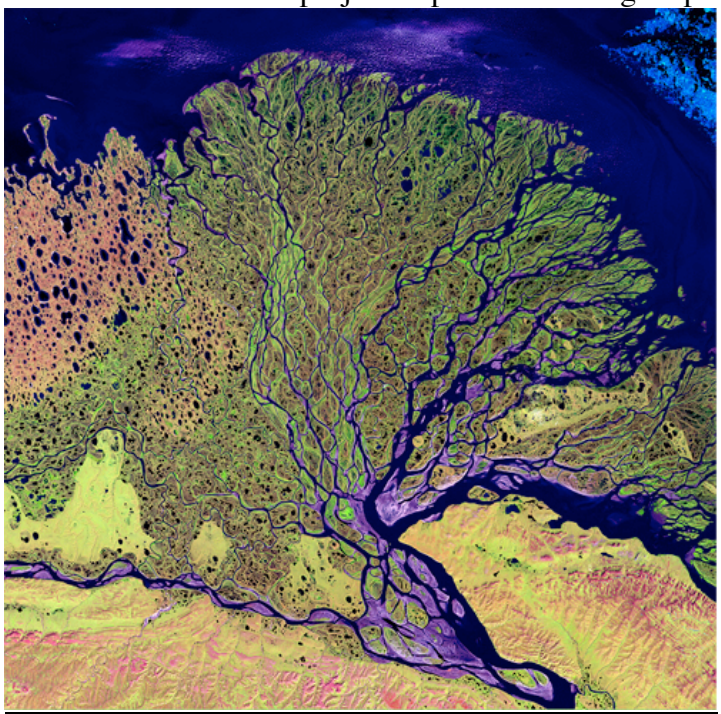
Existing international projects show the tremendous success of scientists around the world working together. Large-scale, far

International Research Council for Antarctica

reaching projects touch people around the world and highlight the fact that science is based on contributions from around the globe. The web and polar research, and specifically the IPY, all international by definition, are excellent vehicles for international outreach.

Specific Proposals:

- Focus on international issues that touch people across the world e.g., Antarctic Treaty, Ocean Drilling, Global Climate Change. Develop projects that allow citizens and/or students from around the world to contribute data or research (like project GLOBE), and then connect contributors with scientists, and provide them with information about how the data is being used, so they see that their contribution is valued. Work with large international groups who might be able to bring in financial support.
- Use communications that easily spans international boundaries. The web is global, and if language is a barrier, recruit young researchers from various countries to develop multilingual materials and translate for elders to break the barrier. Use non-Eurocentric language or symbols and photos and limited words (Japanese do this successfully). Use art and music to transcend language barriers.
- Engage international organizations, institutions and committees, for example, the Arctic Council, the University of the Arctic, the International Polar Foundation, Scientific Committee on Antarctic Research, International Arctic Sciences Committee.
- Promote and support the exchange of scientists and science students between countries for research and education. Prepare the scientists for the cultural differences they will face when they visit or relocate other countries. Increase international partnerships and understanding by encouraging students to study abroad as part of their science education and to collaborate in an international research project as part of their degree program.



Lena River Delta with Arctic Ocean on the top

Leveraging the Importance and Excitement of Polar Science

While much of the workshop discussion stressed the need for an interdisciplinary approach (see box), each discipline has its own attractions, which can be built on both in training the next generation of researchers and in engaging the general public. In a similar vein, while many programs can be bipolar, it is important to recognize, and capitalize on, differences between the poles. The Arctic has continents surrounding an ocean, and residents including indigenous peoples. The Antarctic is a continent shielded by vast fields of ice, with only a few logistics bases from which to launch programs.

Interdisciplinary Approach

Life, research, exploration, and discovery in the Arctic and Antarctic involve the intersection of many disciplines, spanning the complete range from anthropology to zoology. Field research requires sharing limited logistics platforms, base camps, and ships for extended periods of time, which facilitates interdisciplinary discussion and collaboration, and the opportunity for a "systems" approach to study in the polar regions. Because polar research encompasses such a range of disciplines, polar education and outreach is a perfect way to involve diverse groups of learners in multiple content areas. Future programs should build on this strength of polar research, cultivating a "sense of place" for researchers, educators, students and the general public, "pride of place" for Arctic residents—especially indigenous Alaskans, and a sense of connectedness, relevance, and impact on the poles/poles influence on the rest of the earth. Polar environmental change including SEARCH (study of environmental Arctic change) – understanding the feedbacks of the poles on and also from the global system – links communities around the world, with the worlds at the ends of the Earth.

An ice cave at Loudwater Cove on Anvers Island, near the Antarctic Peninsula.

There are many points of connection between these seemingly remote places and broad-ranging societal issues. Connecting global themes with local issues helps engagement at the community level. It is important that people in, for example, the Midwest, understand how their actions affect the poles and how they are affected by polar change. Develop initiatives with the thought "think globally/act locally" — international activities with national outlets. Make connections between protecting local environments by promoting healthy environments at the poles. Polar researchers and educators should learn about their own community and make connections with it to show how it impacts, and responds to polar regions.

People: Anthropology, Heritage, Society

Any focus on the people and heritage of the poles should be viewed in a holistic "wellness" approach. It is important to continually monitor and be aware of our impacts on each other and

to assess how to heal the land, relationships with different peoples, and communities. This will involve a systems-thinking approach that illustrates how all nationalities are connected, and how science, policy and human actions are connected.

Specific Proposals:

- Emphasize systems thinking and demonstrating the links between action and science and policies, and humans and natural systems. Monitoring the Earth's systems is how people stay connected with the impact we are having as a species. Develop programs that focus on monitoring as an activity that is normal to all people.
- Share seasonal changes, festivals, and unique events that occur in differing areas. Including the native customs as part of exhibits or tours is important in understanding their heritage and culture. "A day around the Poles" – a rotating spotlight on a normal day in specific areas: a snapshot of different people in differing locations, real people doing real things. Focus on similarities and differences. This could be linked with polar sunrise or sunset, and followed in a similar fashion as the turn of the Millennium.
- Look at change around the poles and examine what is different. Look at what life in the poles was like for indigenous populations and researchers during the first IPY more than 100 years ago, and the IGY 50 years ago.
- To have impact, coordinate efforts, develop synergy, look for ways to optimize activities on all levels, and work together – much as "tipping the boat" takes all parties working together.

Young student experiences dressing for field work in the Arctic

Biota

Start with what people think that they know about polar organisms – and then go beyond the charismatic megafauna of polars bears, penguins and whales to look at the diversity of adaptations to life in extreme environments. Take advantage of the "wow" factor of unusual biota and extreme conditions for life to entice the public.

Parborlasia corrugatus (Proboscis worm) - an example of Antarctic gigantism

Specific Proposals:

- Assess what people already know, what they don't know, and build from that. For example, what kinds of life exist under the ice?
- Emphasize diversity, abundance, and distribution of marine and terrestrial life; include fossil records such as Antarctic trees and Arctic dinosaurs. Examine fossil records from the

poles using ANDRILL and show how you can use biota as temperature proxies. Show how plate tectonics and isolation affected Antarctic development

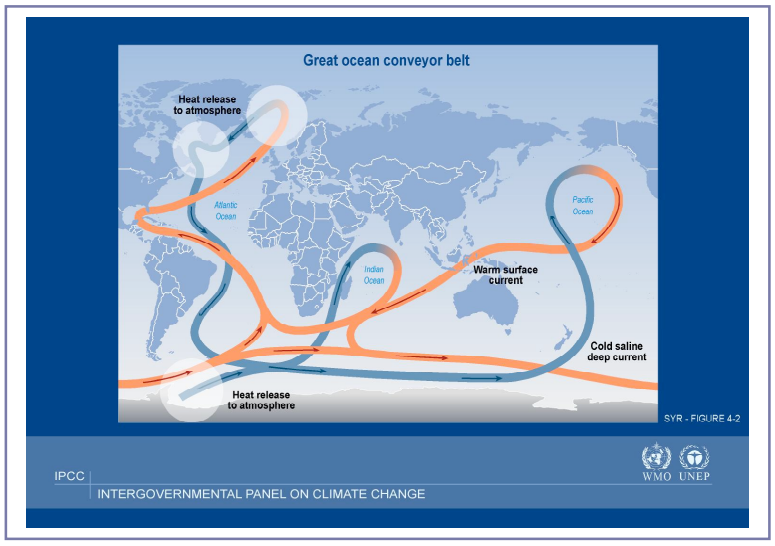
- Life in extreme environments: use this concept to hook the media. Explain interesting adaptations to survive – and thrive – in severe environments and links to climate change
- Use and re-release excellent materials that already exist: e.g. Audubon, National Geographic, Peterson's Guides. Involve tour companies/field guides for tourists and adventurers
- Create a polar postage stamp series with polar flora and fauna (as well as history and current research)

Ocean

How do the polar oceans affect the rest of the world? How do humans affect the polar oceans? What are the impacts of these changes? Show the connections between the Arctic, the Antarctic, and the rest of the world. Show how these connections have changed through time, and how much time they take to change.

Specific Proposals:

- Focus on the effects of changes in polar oceans: deep circulation and abrupt climate change, changes in sea levels and coastal ecosystems, their interconnection and impact on human societies and international security and commerce
- Encourage stakeholders to promote the important role of polar oceans to the broadest audience: industry, informal science community, professional organizations



- Encourage people with polar ocean resources and data to submit to Digital Library for Earth System Education (DLESE), National Science Data Library (NSDL) or other agent to make information widely available (see insert example).
- Develop curricula and activities that bring into the classroom the concepts of the layered ocean, and the importance of convection and thermohaline circulation.

Ice

Ice defines the poles: from permafrost and glaciers on land to sea ice in the ocean, ice is both a surface to walk on, live on, and a barrier to overcome. Because ice and snow are accessible to a majority of communities, local activities can be used to make connections to conditions at the

poles. Because it shifts phases so easily, ice is vulnerable to change. And ice has a sensory impact on people: they like to touch, see, and feel ice. Be creative with ice to bring it alive through exploration. Focus also on the power and danger that snow and ice can represent: the avalanche, the hidden glacier bas. These are all items that fascinate and thrill, offering an opportunity to engage the public.

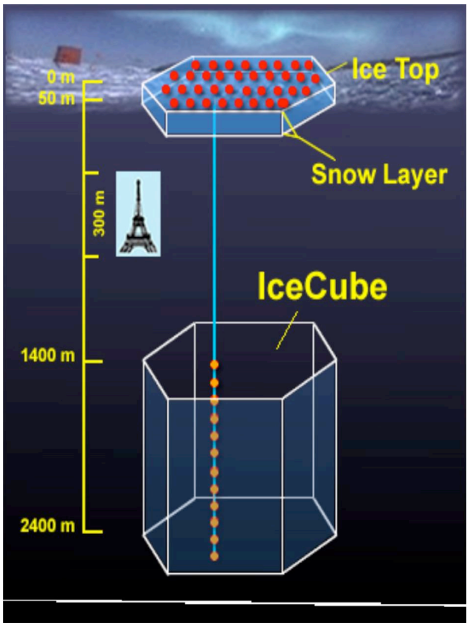
Specific Proposals:

- Focus on the link between surface run off (water) and snow precipitation. Seasonal storage of ice and snow and then a spring release. Place these local processes within a larger context
- Use the 5 senses to create hands-on approaches: take snow machines to southern areas to make snow for southerners, explore different types of ice that form locally and contrast them with ice in polar regions: lake, sea, glacier, etc. Make ice: freeze ice on cookie sheets or layer by layer in a tube to show how layers archive temporal changes

- Create problem-based learning units examining crystal growth, phase changes, glacier flow with silly putty. Integrate activities with learning standards
- Pair science and education together to provide a complete picture for students. Use maps, models, etc., to show how ice has affected the world we live in, including changes in climate and sea-level.
- Share personal experiences with students, i.e. Teachers and Researchers Exploring and Collaborating (TREC)) using webcams, journals, etc.

Geology, Geophysics, Meteorology, Space Science

From the solid earth to the atmosphere and space the poles play important roles in geodynamics and our understanding of earth and space systems. Many questions still remain: do the poles control climate? What really lies beneath the massive ice sheets of Antarctica, and the drift ice of the Arctic?



Specific Proposals:

- Use the poles as an observatory, i.e. messengers from space/ Ice Cube (international high energy neutrino observatory being built on the South Pole), Antarctic Muon and Neutrino Detector Array (AMANDA) and Balloon Observations of Millimetric Extragalactic Radiation and Geophysics

(BOOMERANG).

• Emphasize exploration of unknown territory (massive ice sheets hiding the Antarctic continent, mountain ranges and Lake Vostok; sea ice covering the Arctic and the Gakkel Ridge).

• Compare extreme environments with those on other planets and moons.

Maximizing the Impact of the IPY

To maximize the potential of the International Polar Year of 2007-2009, people need to work together to build a coherent and exciting public presence both locally and globally[1] Integration of research, education, and outreach efforts, at the international as well as national level, coordination of existing resources, linking communities and developing partnerships, access to data and content from the polar regions, securing funding to develop new programs, and sustaining programs after the conclusion of the IPY, are essential (international site - www.ipy.org; U. S. - www.us-ipy.org).

Leverage Polar Fascination

People of all ages and groups, are fascinated by the poles. The community can build excitement for science through the uniqueness of the poles and the international focus of the IPY. Charismatic wildlife, human resourcefulness in extreme environments, expansive fields of ice and snow, and daring explorers all capture the imagination. Linking this existing fascination with programs and activities developed in association with the IPY, can enhance knowledge of polar regions and interest in science. A diverse group of learners can be involved in science as a human endeavor, history and nature of science,

A Resolution in Celebration of the legacy of the International Geophysical Year of 1957, and the International Polar Years of 1932 and 1882 was submitted by Senator McCain and approved as Senate Resolution 466 - October 11, 2004.

The first IPY involving 12 nations, and the second IPY involving 40 nations, established internationally coordinated scientific campaigns. IGY, involving 66 nations and 60,000 scientists, was the largest international scientific endeavor undertaken to date, and left an ongoing legacy beyond measure.

Legacies of the IGY include satellite communications, modern weather forecasting and modern natural disaster prediction and management, from volcanic eruptions to El Nino. IGY included the launching of the first artificial satellites, Sputnik and Vanguard, founding the space age itself.

The decision to set aside Antarctica, an entire continent, for cooperative study, was the product of IGY. This pathbreaking decision of the IGY program alone– permanently institutionalized by the Antarctica Treaty–made the year a scientific triumph.

IGY clearly marked the development of international science through the unprecedented number of scientists from throughout the world who banded together to implement the IGY. Globally coordinated activities that today save millions of lives–such as the campaigns to contain and find cures for SARS and AIDS–owe their inspiration and working model to IGY. Scientific findings from thousands of locations, ranging from world research centers to remote field stations, were collected and organized by this global team, resulting in an unprecedented range of discoveries for human benefit.

There is a coming together in the study of our planet and its diverse inhabitants through new integrative linkages that are being established among mathematics, physics, the geosciences, the life sciences, the social sciences, as well as the humanities. The potential scope and significance is only beginning to be perceived.

Therefore, the Senate resolves to endorse the concept of a worldwide campaign of scientific activity for 2007-2008 emphasizing activities directed to global environmental research, education, and protection…

Part of this wording is taken from House Rtp.108-422- "International Geophysical year 50th Anniversary " http://thomas.loc.gov/cgi-bin/cpquery/?anddb_id=cp108andr_n=hr422.108andsel=TOC_4

[1] Albert, M. et al., 2004, A Vision for the International Polar Year 2007-2008, U.S. National Committee for the International Polar Year 2007-2008, National Research Council, p. 112.

science as inquiry, and science and technology. The IPY is a perfect way to approach science education for school systems and the general public; the effort already aligns with education standards. Tapping into people's appreciation for nature and interest in nature/society interactions will help improve science literacy, promote understanding of heritage, develop community and "pride of place," gain an appreciation for environmental variability and change, link policy with stewardship, learn about technological advances, focus on the concept of Earth as a system, and see how predictions about future environmental conditions are developed from observations and models.

Meaningful Engagement

Education and outreach efforts should ensure that the IPY is truly meaningful to a diverse suite of communities. The IPY should be structured so that it is responsive to the interests and concerns of indigenous Arctic peoples, minorities, women, and people from developing countries – see earlier "Targeting All Learners" and "Engaging Diverse Communities" for specific proposals. Meaningful engagement of indigenous and non-indigenous residents of the Arctic is critical so that they are enthused to launch their own IPY-related efforts. To engage people in less developed countries, perhaps the community could establish a fund for their researchers, educators, and media representatives to participate in the IPY. Putting a face on polar researchers – those active during the first IPY of 1881 and the later International Geophysical Year (IGY) of 1957, as well as those conducting research today – makes their research more accessible, personal, and meaningful.

Education and outreach initiatives must be clearly defined with measurable outcomes so that IPY's promise in building capacity in

IPY Education and Outreach Infrastructure Needs

An IPY **education and outreach headquarters,** with a staff and a central office, should be created to coordinate and leverage programs. Linked with the headquarters should be an Interagency Working Group on IPY Education and Outreach, which also connects with international efforts. Continue coordination of polar education and outreach after the end of the IPY. In order to have impact beyond the conclusion of the IPY, we need to establish and maintain networks among scientists, educators, students, and communities, grow associated communities beyond Arctic regions, and involve all levels, from k through gray.

A **sophisticated one-stop web portal** should be developed for the IPY and beyond to serve polar content and contacts for researchers, educators, the media, and the public at all levels. It should be served through a vetted source, perhaps with an IPY brand. The site should collect education and outreach resources, highlight research and educational advances. Educational resources include curricula that are easily accessible, developed for all levels, linked to recent events and research programs, suits state/national standards, and maximizes the integration of research with education. The web portal should promote individual as well as group efforts and contacts, catalogue polar research, researchers, educators with identifiers for local contacts for setting up joint projects, and connect with data resources like DLESE. There need to be regular reports from the field, including research news and stories. Access to high quality content requires improved high bandwidth communications – this issue that emerged repeatedly as critical to timely and dynamic connections between the poles, the media and other communities. We need to plan for maintaining website after the IPY so that there is value added and enduring effect.

IPY **observatories** located at the poles are essential: there should be shared platforms for varied sciences and nations to pursue scientific inquiry, and host media and educators. We can build on existing observatories and networks, i.e. circumpolar environmental observatories, ocean observatory network, census of marine life. Existing stations need to be modernized to make them more environmentally friendly, and with better technology, i.e. high bandwidth communication capability. And we need to establish Arctic and Antarctic on site communications offices to support polar experiences for a diversity of participants: science writers, journalists, and educators.

Arctic communities, growing a new generation of polar researchers, and stimulating the public to know more – and care more – about the poles, is realized. For example, over the next 5-10 years, there should be a measurable increase in the number of Arctic residents completing graduate study in IPY-related fields.

Educational opportunities need to be explored at informal venues, such as museums, zoos, TV, radio, print media, and meetings of professional societies, as well as through traditional classrooms. There are different opportunities and needs for different levels, K-5, 6-12, undergraduate non-science majors, undergraduate science majors, and the general public. The general public can be engaged with made-for-TV documentaries, exhibitions at zoos and museums, and multilingual coffee table books.

Build Communities

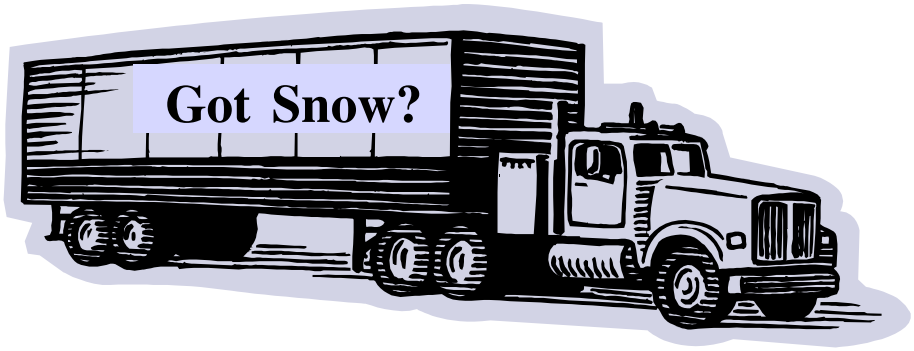
While the number of people living in, teaching about, and researching the polar regions is not large, the workshop brought together many people who had not previously met. Effective education and outreach requires establishing and maintaining connections among these disparate communities through joint programs and regular meetings, extending up to, through, and beyond the IPY of 2007-2009.

Both in the national and international arenas, attention should be paid to reaching diverse groups: ethnic minorities, girls/women as well as boys/men, and those from different geographic, socioeconomic, and cultural backgrounds. To increase interest in polar regions and polar science, and enhance the diversity of those interested, it is essential to meet with different groups, face-to-face, and determine how the poles are relevant to each group. Melting of polar glaciers will cause sea level to rise in New Orleans – a topic of interest to Louisianans. Black American Matthew Henson's journey inspires young adults in the Earth Conservation Corps along the Anacostia River in Washington, DC. Following a day in the life of a polar resident promotes awareness of distant locales, the people living and working in those places, while at the same time makes a personal connection for a variety of learners. To date the international community has not been tremendously successful in reaching groups not traditionally engaged in polar research and education. The US is in the position to take a leadership role on this issue.

Link Research and Education

To inspire interest in the poles and maximize the impact of the IPY, research needs to be linked with education and outreach. The IPY poses a rich suite of questions about scientific issues, methods, and themes that educators can use internationally, as well as nationally. IPY questions should be used to help students learn scientifically and help students make connections to their lives, culture, and communities. Through the IPY, students and the public can explore the rich heritage and history of poles, identify changes, consider societal issues with the potential to affect and interact with the polar regions, and learn what the polar regions can teach us about our Earth and Universe. Specific projects and activities can be created (i.e. comparison of artifacts from the first IPY,

IGY and today) to showcase just during the IPY, while others can become part of standard curricula. Issues like climate change and polar amplification of contaminants show connections between individual actions and the poles. Some other ideas include circumpolar focus on specific events such as solstices or equinoxes; creating "A day in the Life of the Poles" that lets students track "their" animals from day to day; a polar school blitz to have as many polar scientists visit as many schools as possible nationwide in a single day; a semi-truck labeled "Got Snow?" traversing the country loaded with polar gear, interactive activities and a snowmaker; interactive polar computer games; national polar book-of-the-month recommendation, a polar youth forum. See sections above and "Contributed Ideas" in the Appendix for more possibilities and contact information.

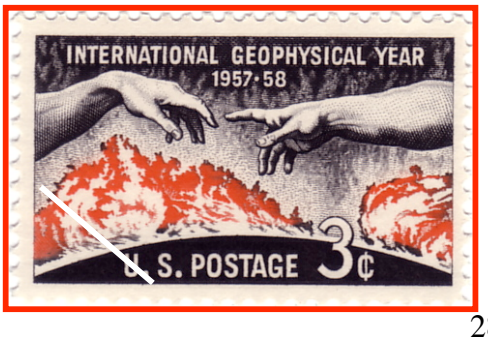


Partner with Media and Marketing

Given public interest in polar themes, the media should be a willing partner in focusing attention on the IPY – if they are provided with timely and high-quality content. An active and coordinated research, education, outreach and public relations effort should hold a major, simultaneous international launch event in March 2007, followed by a series of "splash" events. The IPY should get as much coverage as Mars Rover landings. How can this be achieved? One recommendation is to have a polar media conference, a science writer's conference, and/or a joint science writers and scientists conference and ask: How would you showcase IPY? Media engagement should tap all available resources including NSF Antarctic Artists and Writers, Department of Fisheries and Oceans journalists, educational journalists, public television and radio. A general marketing strategy should focus on joint exhibitions or exhibitions at high profile locations.

An IPY brand (seal of approval) and awards should be established. Marketing professionals should be engaged to develop and market the IPY brand. A brand, or logo, can catch the eye and from there build an understanding of what is behind the brand/logo – what it stands for. From educational resources to polar postage stamps, the IPY brand/logo could signify quality and connections with this international endeavor. Similarly, awards for exemplary IPY participation, could go to students, teachers, community organizers, the media and researchers. Connections with industry could broaden awareness through commercial outlets such as MacDonald's Happy Meals and Barbie dolls.

In addition to a brand/logo, a slogan should be adopted for IPY. The slogan should be part of all advertising for IPY events, and also part of a crop of environmental ads.



Next Steps

The community needs to start now to develop an integrated research/education/media strategy that will lead up to, and then be implemented during, the IPY of 2007-2009. Securing funding, establishing meaningful links with research programs and communities, constructing a portal/clearinghouse, involving agencies and industry, and developing exhibitions and documentaries all require substantial lead time. As a strategy is developed, the community needs to consider what education and outreach programs we want to remain in place in 2010 and the years following. First, both community and agency leaders need to be identified and working groups set up. Then these working groups should engage the community in identifying priorities and major collaborative programs. Concurrently, the community needs to work with the agencies to secure funding. From these ideas an implementation strategy can be developed, and Requests for Proposals distributed. Finally, the community needs to submit proposals, followed by implementation and evaluation.

Leadership, Community Building and Management

The "Planning for International Polar Year of 2007-2005" workshop on July 8-9, 2004, agreed that a crucial next step for the IPY was to increase the planning, including the possibility of a working group involving all the interested agencies. This action was taken in direct response to a recommendation from the Bridging the Poles workshop. Participants at the Bridging workshop also recommended establishment of an International Working Group on Polar Education and Outreach. Both of the national and international education and outreach committees need to work closely with planning efforts for the major science initiatives[2].

Through follow up workshops and communications, the education and research communities need to advertise the potential of the IPY and of polar education and outreach, and to start developing programmatic recommendations from the broad suite of options identified in this report. Educators and researchers should promote IPY to the broadest audience: industry, informal science and media communities, and professional organizations. Researchers and educators, including informal educators, should host special sessions at professional meetings on realizing the potential of the IPY.

Internationally, education and outreach efforts will be coordinated both through an Education and Outreach Task Force that will report to the overarching ICSU-WMO Joint International Polar Year Committee and through the International Polar Year Program Office. The Program Office will serve as a communication hub and hence will be a crucial link in developing integrative international education and outreach programs. With respect to national management, a central education and outreach body is needed with responsibility for coordinating among diverse communities, among agencies, among national and international science based committees. It should ensure regular communications with the broader polar community, through

[2] Bell, R. E. et al., 2004, planning for International Polar Year 2007-2008: Report of the implementation workshop, National Research Council, p. 51.

annual meetings, and a monthly/bi-monthly newsletter leading up to and during IPY. The US Interagency Task Force could agree to set aside support for such a coordinating effort.

Identify Programs and Priorities

Through follow up workshops and community proposals, the community should identify major collaborative programs to feature both nationally and internationally, and agree on a way to sequence and market their rollout. Programs to focus attention on the IPY need to be substantive, imaginative, and engaging to a broad audience. Events should be planned to complement research milestones, and to awaken public interest. The community should work towards establishing partners among the research, media, and education communities; and diversifying participation and audiences.

Develop an Implementation and Evaluation Strategy

As a community consensus emerges, it should be translated into an implementation and evaluation strategy, with a time line – just as it takes time to define a research program and establish the logistics to carry it out, effective education and outreach programs take years to develop. Communities need to work with institutions and agencies to fit polar education and outreach into their program plans for the next 5 years. It is important to think about how success will be measured, and so that baseline data can be collected before major programs begin.

Get Funding

To realize the potential of the IPY and polar education and outreach in general, requires funding, including support for new initiatives that join research, education and outreach projects, and support to maintain initiatives after the conclusion of the IPY. High-quality education and outreach programs are not cheap. A preliminary estimate would be 5-10% of the science budget of $10-60 million dollars. For example traveling museum exhibitions cost $2-3 million each, and factoring in logistics, a polar documentary can cost $1 million.

Recommendation for an Integrated IPY RFP

Requests for the proposals for the International Polar Year should encourage a broad spectrum of research, education, and outreach projects. The RFPs should be written to allow maximum flexibility in design and size: not all research programs need to have a major education component, and not all outreach programs need to have a major research component. Expensive, collaborative projects can have major national or even international impact when science programs are connected with press events, educational programming, and spin-offs of local programs. But small, individual projects can cause sustained transformation of local or target communities.

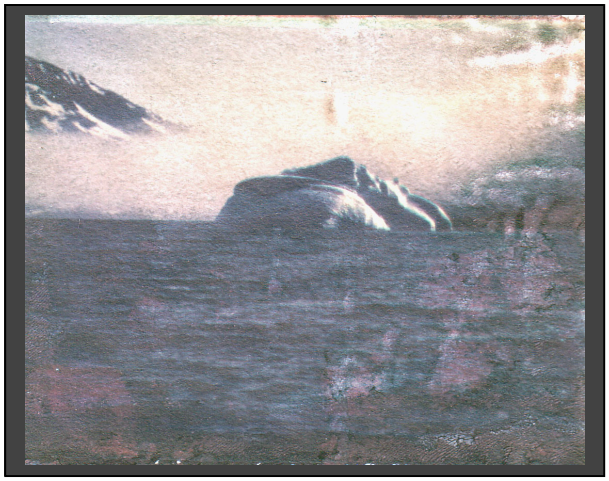
Implementation and Evaluation

It is important that the implementation of the IPY education and outreach activities be evaluated so that this experience can serve as a model that informs other such science and education initiatives. We must be able to look back at our objectives and measure our progress. Did we –

polar scientists and educators – succeed in reaching learners at all levels, engaging diverse communities, leveraging the importance and excitement of polar science, and establishing infrastructure for effective education and outreach? Do people know more – and care more – about the poles? Have we inspired a new generation of polar scientists?

Acronyms

AAM	American Association of Museums
ALISON	Alaska Lake Ice and Snow Observatory Network
AMANDA	Antarctic Muon and Neutrino Detector Array
ANDRILL	Antarctic Drilling
ANKN	Alaska Native Knowledge Network
ANSWER	Antarctic mailing list maintained by the Texas A&M University
ArcticInfo	Arctic mailing list maintained by the Arctic Research Consortium of the United States
ASTC	Association of Science and Technology Centers
AZA	American Zoo and Aquarium Association
BOOMERANG	Balloon Observations of Millimetric Extragalactic Radiation and Geophysics
BASC	Barrow Arctic Science Consortium
CoVis	Learning through Collaborative Visualization
DLESE	Digital Library for Earth System Education
IGY	International Geophysical Year
IPY	International Polar Year
GLOBE	Worldwide, hands-on science and education program
Ice Cube	International high energy neutrino observatory being built on the South Pole
NSDL	National Science Digital Library
NSF GK-12	NSF Graduate Teaching Fellows in K-12 Education
NSTA	National Science Teacher's Association
REU	NSF Research Experiences for Undergraduates
SEARCH	Study of Environmental Arctic Change
TEA	Teachers Experiencing Antarctica and the Arctic Program
TREC	Teachers and Researchers Exploring and Collaborating



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