

ICARP II – SCIENCE PLAN 11

ARCTIC SCIENCE IN THE PUBLIC INTEREST



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PREFACE

The Second International Conference on Arctic Research Planning (ICARP II) was held in Copenhagen, Denmark from 10 November through 12 November 2005 and brought together over 450 scientists, policy makers, research managers, indigenous peoples, and others interested in and concerned about the future of arctic research. Through plenary sessions, breakout sessions and informal discussions, conference participants addressed long-term research planning challenges documented in twelve draft research plans. Following the conference drafting groups modified the plans to reflect input from the conference discussions and input from the ICARP II web site. This science plan is the culmination of the process.

ICARP II Science Plans

Science Plan 1	Arctic Economies and Sustainable Development
Science Plan 2	Indigenous Peoples and Change in the Arctic: Adaptation, Adjustment and Empowerment
Science Plan 3	Arctic Coastal Processes
Science Plan 4	Deep Central Basin of the Arctic Ocean
Science Plan 5	Arctic Margins and Gateways
Science Plan 6	Arctic Shelf Seas
Science Plan 7	Terrestrial Cryospheric & Hydrologic Processes and Systems
Science Plan 8	Terrestrial and Freshwater Biosphere and Biodiversity
Science Plan 9	Modeling and Predicting Arctic Weather and Climate
Science Plan 10	A Research Plan for the Study of Rapid Change, Resilience and Vulnerability in Social-Ecological Systems of the Arctic
Science Plan 11	Arctic Science in the Public Interest
Background Document	Contaminants

11.1. Introduction

In the past, arctic science was seen as a somewhat obscure field of study. It was relevant to researchers, provided exciting new discoveries, and contributed to national identity and pride. On the other hand, it often had only modest public relevance, both for those who lived in the Arctic, and those outside. That is now changing as the importance of the Arctic grows among those who seek to understand planetary processes (e.g., climate change and variability) in their attempt to create conditions that will permit the sustainable development of the region, and among those who seek to understand the forces that will invigorate the resilience of human communities faced with rapid and multidimensional change. As a result, there is a growing effort to find better ways for arctic science to interact with, and focus on, issues that are important in the public eye as well as to ensure that the insights generated in science are put to better use. An important method for communicating scientific results is by strengthening the education of arctic residents from primary school through to higher education.

Important initiatives have emerged in recent years, including the establishment of the International Arctic Science Committee (IASC), the International Arctic Social Sciences Association (IASSA), the working groups of the Arctic Council, and the Northern Research Forum (NRF), as well as the University of the Arctic. It is now timely to look at the successes and failures of these and other initiatives as well as to examine important concerns that have yet to receive focused attention. General knowledge of the role of science in contemporary societies and of science applied to policy-making and education in the Arctic will also benefit from study.

This science plan does not attempt to provide an exhaustive listing of the literature relevant to arctic science in the public interest; rather, it provides links that give an overview of the literature and showcases certain items.

11.2. Focus

Overall, the goal of this type of research should be to understand better the driving forces behind arctic science and its relationship to the public interest. The past becomes crucial to understanding present and future possibilities. A proper understanding of the relationship between arctic science and the public interest requires an understanding of the social, historical, cultural, economic, and political forces that drive arctic science.

When addressing arctic science in the public interest it is necessary to define the “publics,” and the “science,” as well as issues around “interest.” Generally, it can be stated that there are as many “publics,” as there are different “sciences,” and their relations are multidimensional. A continuum is assumed from the value base on which all decisions and choices are based, through the three related research processes of defining the issues, conducting the work, and communicating the results, to an analysis of the work’s impact. Based on this perspective of the research continuum, five key headings are identified for discussion:

- Understanding the image of the Arctic and of arctic science.
- The construction of research questions.
- The conduct of research in the Arctic.
- The control and communication of knowledge (ownership/sharing).
- The impacts and relevance of research.

Before each heading is addressed it is useful to discuss a general framework that would apply to all proposed research programs.

Defining the Public: In a wide sense, the public is all those who benefit from, have interest in, or are otherwise affected by science. That involves individuals, communities, and peoples and their

institutions, both inside and outside the Arctic. While this ICARP II science plan will not define publics in any limiting way, it is crucial that future research projects proposed in this area are clear in defining their relevant publics. In such contexts, it is important to define the public on a concrete level: for example, people living in the Arctic; people eating arctic fish (not necessarily the same as the previous group); people engaged in arctic politics and policies; people drilling oil or transporting garbage through the Arctic; even people who do not know that they are arctic stakeholders (UNEP-EEA, 2003). Many of these elements of the public are not people, but institutions and processes, and holistically can include such things as river ecosystems and flora and fauna.

For each of the five key headings – or issues – it is necessary to analyze history and to look also at the present, at best practices, and at research on what critical parameters will shape the future. History and realities are quite dissimilar across parts of the Arctic; studies must take this into account, apply circumpolar comparisons, and keep a focus on internal diversity. One example of a difference within the Arctic is the varying degrees of autonomy that have been returned to indigenous peoples and, hence, their opportunity to influence research agendas.

Many issues are unique to the Arctic, but others may find parallels in other parts of the world. This ICARP II science plan focuses on issues where the Arctic may differ from the rest of the world; thus, comparison with the rest of the world is relevant, for example, in areas where globalization of economies comes into play with the Aborigines and Maori in Australasia, with the Inca in Central America, and with tribes in Africa.

On all levels, an interdisciplinary approach is crucial. While traditional disciplines are important, divisions tend to isolate both research and results. Research projects that examine arctic science in the public interest need to build links between disciplines so that a proper multidisciplinary understanding of driving forces is realized.

Given the nature of these questions and the fact that no thorough studies have been conducted in all the areas identified herein, it may be timely to secure or identify funds for a pan-Arctic assessment of science, research, and northern peoples that looks to address most, if not all, of these questions together.

Finally, the Arctic is a region where, in the past, many voices have been muted. In order to understand properly the possibilities of using arctic science in the public interest, these muted voices must now be heard. Indeed, research must become a tool for empowerment.

11.3. Key Scientific Questions

11.3.1. Understanding the Image of the Arctic and Arctic Science

The relationship between the public and arctic science is in many ways both expressed and determined by the images of the Arctic and the public's relations to these images. The public outside the Arctic has images of the North that are often formed by science, national identity, sovereignty, national pride, and resource pools, while people living in the Arctic have images of their homelands with their cultures, resources, and opportunities for a good life. Scientists' images of the Arctic may be driven by field seasons, access to funding, global politics, and science agendas.

The issue of northern images is fundamental in forming research priorities and identities and perceptions of all stakeholders. These images have an important impact on both arctic science and on people living in the Arctic. More research should be done to understand how they are formed as well as the consequences of these images on various interests, and how they make parties act. Literature that demonstrates various aspects of images of the Arctic includes Tennberg (2003), AHDR (2004), Möller and Pehkonen (2003), Björnsson et al. (2000), Krupnik and Jolly (2002), McDonald et al. (1997), and Bravo and Sörlin (2002).

Studies should enable a better understanding of the major forces shaping these images. The following examples illustrate northern images that need documentation.

External images:

- *What images exist of the Arctic outside the Arctic?*
- *How is the Arctic seen in international spheres, for example, in UN conventions and other agreements?*
- *What is the image of arctic science?*
- *What new images are developing?*

Internal images:

- *What are the various self-images that exist of people living in the Arctic?*
- *What are the various self-images of scientists active in the Arctic?*
- *What is the image of arctic science among northerners?*
- *What new images are developing?*
- *How is the science and public perceived by government and private actors?*

Questions to be asked about the images:

- *How are these images shaped?*
- *Where do these images come from?*
- *Which publics are involved?*
- *Who creates them and why?*
- *What, and why, are there differences between the different (self-)images?*
- *What are the inter-linkages?*
- *What are the regional differences in images?*
- *How have the images changed over time?*

The Scientific Approach

How best can these questions be answered? The following are suggested research programs to understand better the images of the Arctic and of arctic science and how these images have and will affect the region.

Identifying the External Images of the Arctic and How They Are Produced

To identify the images of the Arctic that exist in the greater world, an understanding of what “publics” exist and how they perceive the Arctic and the role of science in the Arctic in the past, present, and future is required; also required is an understanding of the processes by which these images have been and are currently being formed. In many ways an expansion on the way that the Arab world benefited by Edward Said’s deconstruction of Orientalism in the West, the peoples of the Arctic and scientists working in the Arctic can both benefit from an analysis of what the Arctic means to the “general public.”

The Arctic area has been described and analyzed by European travelers and scientists from the fourteenth century. A few (i.e., Olaus Magnus, Johannes Schefferus, Carl von Linnæus) became very influential and formed the image of the people and the land of the Arctic for centuries. Historiography and content analysis are methodologies that can be used to identify the core texts that, nationally and internationally, have created the images of the Arctic for those living outside the area.

These same methodologies can be used to understand the processes by which the images have been produced: what social, political, and cultural forces affected the production of these images?

Linkages: While there have been no international comparisons of arctic images, many of the arctic nations have seen individual researchers look at the image of the Arctic within national cultures. In

Canada, Margaret Atwood has pointed out the importance of the imaginary North in English-Canadian literature (Atwood, 1995). The US Naval Arctic Research Laboratory has produced retrospective overviews of more than fifty years of relationship between researchers and arctic residents (Curtin, 1998). In Sweden, Sverker Sörlin has analyzed the image of Norrland in the development of Swedish nationalism (Sorlin, 1988), and the Arctic Human Development Report (AHDR, 2004) has a good introductory overview of arctic images. Attempts should be made to link these national analyses.

Perhaps the most important research currently being done in this area is that of the group led by Michael Bravo and Sverker Sörlin. Since the mid-1990s a group of researchers have been examining the role of science in developing national narratives about the Arctic. The value of their work, which is part historiography, part history of science, and part post-colonial analysis, is best shown in their book *Narrating the Arctic: A Cultural History of Nordic Scientific Practices* (Bravo and Sörlin, 2002).

Identifying the Internal Images of the Arctic and How They Are Produced

While the outside world may have certain images of the Arctic, arctic peoples and communities have their own images. A full understanding of the perception of their homelands – especially in comparison to the images held by the outside world – would better enable arctic science to serve the interests of these communities. Analysis of the diversity of these views would help to understand the differences that exist between these communities and how the communities perceive themselves in relation to the rest of the Arctic, the science, and the rest of the world. The goal should be to understand how the forces that shape these differences have been working in the past and in the present, and how they may work in the future.

Qualitative and quantitative content analysis can be used to understand better the internal images of the Arctic and their construction. Ethnographic methods have long been used in the Arctic to understand the nature of northern peoples and communities; these methods are increasingly being applied to investigate the “narratives” of these communities (Bravo and Sörlin, 2002, p. 5).

Linkages: Comprehensive international surveys that use both qualitative and quantitative methodologies, such as the Survey of Living Conditions in the Arctic, or SLiCA (Poppel et al., 2000), could provide valuable data on subjective perceptions of the Arctic. Indeed, a first step would be the analysis of data collected by SLiCA that deal with subjective perceptions of lifestyle and the environment. Denisov et al. (2000), meanwhile, discussed the linkage between scientific knowledge and decision-making.

11.3.2. The Construction of Research Questions

Research is funded for a reason. Social forces shape the research questions that drive arctic science. They are constructed to serve several purposes. Issues like sovereignty, the national interest, and the large resource economy, local rights, access to jobs, but also genuine search for knowledge are important drivers. It is reasonable to assume that individuals or organizations that were or are part of what might be called the “dominant society” have for the most part driven arctic science. It is likely that other views and forms of knowledge, particularly of any society with oral traditions, has had less influence in forming the questions and securing funding to find the answers. Independent of whether or not this view is correct it is time to have a closer look at how the research questions are shaped, whether they get addressed, and if there are questions that never get asked.

The following are five main issues, along with some examples of questions that could be addressed for each issue.

Who asks?

- *Who is forming and defining the question?*
- *Who forms the research priorities?*
- *Who possesses the ability to plan and organize even the asking?*

- *How does this vary from region to region?*
- *Are there any institutional characteristics that have led to any pattern(s) of who asks the questions and what kinds of questions are asked?*
- *Who, for example, are drivers behind ICARP II and IPY?*

Why ask?

- *What are the driving forces behind arctic researchers, and why are the research issues that are raised put forward and not others?*
- *What are the roles of local, regional, and international politics in the formulation of research questions, including apparently non-political research?*
- *What is the role of basic science knowledge in driving and shaping arctic politics? How does this vary within the Arctic?*
- *What were the motives behind ICARP I and ICARP II, and the series of polar years? Do the respective motives differ?*

What is researched?

- *Why do governments, agencies, and private sectors fund arctic research? (Is it out of interest in issues like global resources, transport routes, sovereignty, or even national pride? or is it to support regional development?)*
- *Who decides who gets research funding?*
- *What are the roles of availability of research infrastructure, and the concept of field seasons in selecting what issues actually get studied?*
- *Is there an institutionalized pattern of allocating funds that excludes support for other ways of knowing?*
- *Are there cases in which economic or political power has guided research towards one side in important arctic research issues?*

What is not asked?

- *What questions are never asked?*
- *Who should form the priorities? And how does this vary within the arctic region?*
- *Who gets to ask the research questions and who does not, and why?*
- *What has been the role of traditional knowledge and the carriers of this knowledge in the construction of the major arctic science research questions?*
- *How many of the research questions are the result of local initiatives?*
- *What is the effect of northern dependency on southern science? How has this dependency changed and how does it vary from situation to situation?*

What could be changed?

- *Arctic science research questions rely on funding in order for the research to be undertaken. What mechanism is used to fund research needs? Are they effective, trustworthy, and relevant?*
- *What questions were asked but not funded, and why? If the questions were good, what could be done to ensure there is opportunity to study them in the future?*
- *What can be done to improve the ability of different peoples and communities of the Arctic to form the research questions?*
- *What has been the effect of stakeholder inclusion in research? Is it effective and relevant?*

The Scientific Approach

How best can these questions be answered? The following are suggested research programs to understand better how research questions related to the Arctic are decided upon.

A History of Arctic Science

A key project to understand how social forces shape arctic science would be a history of arctic science. According to Bravo and Sörlin (2002), relatively little has been written about the history of science in the Arctic. A first step in the understanding of research question construction would, therefore, be a general history of arctic science.

The history of arctic science has, for the most part, been written by individuals who were or are part of what might be called the “dominant society” and it generally reflects the views, insights, biases, and epistemology of the dominant society. It is likely that other views, particularly of any society with oral traditions, are not documented in written form. As an example, the research agendas proposed by the Northwest Territories and Nunavut (Canada) were once strongly social and cultural, while they have now moved towards distinctive economic orientations. Central governments have tended to emphasize sovereignty, the national interest, and the large resource economy. Priorities have fluctuated with the Cold War, energy security, and terrorism. In this research it is important to include the recollections of local residents who have had involvement with arctic science and scientists.

Linkages: The group most relevant to promoting a history of arctic science appears to be that of Bravo/Sörlin. Additionally, the Alaska Native Science Commission has spent many years constructing databases that include the regional documentation of Alaska Native concerns, priorities, and recommendations with regard to research and local desires. There have been only a few relevant works written on different aspects of arctic science; one example is Trevor Levere’s work (Levere, 1993) on the institutionalization of scientific study in the Canadian Arctic during the nineteenth century.

A Sociology of Arctic Science

While understanding the history of arctic science would greatly help develop an arctic science that is more in the public interest, a more thorough appreciation of how arctic science follows or diverges from the public interest can be achieved through sociological analyses of arctic science. Sociologists of science such as Bruno Latour have provided tools to understand the social forces that shape the construction of research questions. This type of analysis could be useful in helping arctic science better understand itself. Important issues include identifying the players that define and sponsor research questions and relating them to policies and practices that influence the public (e.g., national and international funding agencies, industries, and media).

Linkages: The groups with most relevant linkages to promoting a sociology of arctic science appear to be that of Bravo/Sörlin, as well as the Alaska Native Science Commission.

The Politics of Arctic Research

Funding will flow if the political climate is right, so how is the political climate formed? Why do governments and other agencies fund arctic research? Why are some research areas funded and others not? Who decides who gets research funding? Is there any institutionalized pattern of allocating funds that excludes support for other ways of knowing? If so, why? What is the difference between (1) basic research, normally funded by national research councils; (2) policy-oriented research by national government and international agencies; (3) commercial/industrial research by national and international companies; and (4) regionally/locally funded research, often geared to support development or give arguments in regional policy? They are all questions that can be addressed by a study that examines the politics of research funding for arctic science.

For example, one can ask why political power has directed vast sums of money to space programs, to large arrays of antennas to wait for signals from other galaxies, to projects to identify neutrinos, or to projects to build wealth, while at present – even with the accumulated evidence of climate change in the Arctic and high contaminant levels in country foods – obtaining funding for the International Polar

Year or getting acceptance for solid follow-up to the Arctic Climate Impact Assessment (ACIA, 2004) are major challenges.

Linkages: National and international funding agencies in conjunction with arctic indigenous communities and organizations would be most interested in understanding the politics of arctic research funding.

The International Politics of Arctic Research

International cooperation plays an increasing role in arctic research, with the ICARP II process and the International Polar Year 2007/2008 two current examples. Knowledge production is also driven by the needs identified in international environmental negotiations, such as the UN Framework Convention on Climate Change. This raises questions about how the construction of research questions is influenced by international politics.

International regimes play an increasing role in international politics. Regimes are principles, norms, rules, and decision-making procedures around which actor expectations converge in a given issue area (Krasner, 1983). These norms and structures can encourage science to ask certain questions (or discourage it to ask others). But norms can be challenged by various actors. There is also a potential interplay among regimes, for example regimes focusing on different scales such as the global and the Arctic (Young, 2002). A research program focusing on the construction of research questions should thus include an analysis of the interplay among different international regimes, as well as a focus on the interactions between different actors and regimes.

In an ongoing research project, such an approach is used to study the framing of climate change in the Arctic, with a special focus on the Arctic Climate Impact Assessment (Nilsson, 2005). This project needs to be followed up by looking at the impact of the Arctic Climate Impact Assessment in the continued global and regional knowledge production and policy. A similar approach could be used to study other scientific assessments and international research collaborations. Especially useful would be projects that compare the dynamics in different issue areas. Moreover, to better understand the role played by current regimes in the Arctic, it would be useful with comparison to the international dynamics of knowledge production in other regions of the world.

The Role of Traditional Knowledge in the Selection and Construction of Research Questions

The importance of traditional knowledge in the gathering of data is now widely acknowledged by most arctic scientists. Starting in the 1970s, many projects have dealt with the documentation and use of indigenous knowledge. Indeed, the list of arctic scientists who have written on the epistemological benefits of indigenous knowledge is extensive. Despite this increase in legitimation, questions remain about the role of traditional knowledge in selecting and constructing the main research questions of arctic science. Huntington and Fernández-Giménez (1999) noted concerns over the use of this knowledge. There are questions about the degree of influence that these knowledge producers have over the decision-making with which they are involved. As the authors also noted, “Information based on Western scientific studies is still frequently regarded as superior, and the time and funds made available for the inclusion of Indigenous knowledge are often woefully inadequate.”

Further research is needed to promote effective ways of improving the use of traditional knowledge in constructing research questions and the methodologies used in the conduct of research. The research could include the following: (1) a content analysis of the key documents relating to the integration and use of traditional and scientific knowledge; (2) interviews with indigenous knowledge providers and scientists to enable a more in-depth understanding of these attempts; (3) a study of the representation on funding bodies; (4) studies (perhaps in the form of case studies) of attitudes towards traditional knowledge, for example, are some “knowledges” perceived as superior to others and is value of knowledge dependent on who actually formulates it on paper?

Linkages: Such a project would benefit by a linkage to the work of the Alaskan Native Science Commission. Originally conceived in 1993, the commission was created to bring together research and science in partnership with the Alaskan indigenous community. It serves as a clearing house for proposed research, as an information base for ongoing and past research, and as an archive for significant research involving the Alaska indigenous community. They provide information and referral and networking services for researchers seeking active partners in the indigenous community. Other linkages could be made with research offices of indigenous organizations such as the Gwich'in Social and Cultural Institute. Documentation used in impact assessments of resource development projects may, for example, be a worthy object to study.

11.3.3. The Conduct of Research in the Arctic

The past thirty years have witnessed a significant change in attitudes towards conducting research in the Arctic. Researchers have increasingly come to realize that research can have a significant effect on certain populations. Most research-related institutions and organizations have established ethical principles to guide research in the Arctic. They exist both nationally and in the circumpolar community in, for example, the International Arctic Science Committee (IASC) and the International Arctic Social Sciences Association (IASSA). It is now time to examine, compare, and evaluate these guidelines. Relevant questions to ask, organized under three headings, are the following.

Guidelines:

- *What are the ethical bases for the rules that are set? How do they vary in different jurisdictions?*
- *Are these guidelines appropriate in terms of local cultural values?*
- *What are the intended and unintended effects of the research?*
- *Have changes in research conduct in the Arctic affected the involvement of the people, and, if yes, how has it changed and why has it changed?*

Involvement:

- *What are the various methods of “participatory” research and how useful have they been?*
- *How are new methodologies and technologies – including the Internet – introduced to the affected communities? If there has been discussion, has it been productive and useful according to the communities and the scientists?*
- *Has there been a change in the legal and practical ownership of science, i.e., what is done, how it is done, and who has rights to the results?*

Conduct:

- *How open to interdisciplinarity and circumpolarity is arctic science?*
- *Has the conduct of research in the Arctic used “holistic” and circumpolar approaches?*
- *Are there differences between the Arctic and other parts of the world?*

The Scientific Approach

How best can these questions be answered? The following are suggested research programs.

A Survey and Social Impact Assessment of Research Ethics Guidelines

Many arctic nations have devoted attention to developing ethical guidelines for arctic research. In addition, guidelines have been developed by international actors, national/multinational corporations, and indigenous peoples. Examples include the ethical principles from IASSA and the Akwé: Kon Voluntary Guidelines (Secretariat of the Convention on Biological Diversity, 2004) for cultural, environmental, and social impact assessments in indigenous peoples' areas. Arctic science would benefit by a study that examined and compared the varying ethical guidelines. Such a study would form a useful baseline and much could be learned from an analysis of the differences that exist between these guidelines and a discussion of the reasons for these differences.

This study should be followed by an examination of the usefulness of these guidelines. Investigation should focus on how they are being implemented and the impact that these guidelines have had on arctic science, arctic scientists, and arctic communities. Have such guidelines improved relationships with and relevance for, local communities in the Arctic? Such an analysis would assist research agents in any re-examination of existing guidelines and would assist arctic communities in evaluating the effectiveness of the guidelines.

An analysis of the existing research ethics guidelines can be achieved using content analysis and historiographic methods. An appropriate social impact assessment of research ethics guidelines would be best achieved using a questionnaire survey and interviews.

Linkages: A survey of existing research ethics guidelines can be greatly facilitated by creating linkages with those organizations that have produced these guidelines, in particular national funding agencies and other research organizations. The social impact assessment of existing research ethics guidelines also can be facilitated greatly by the leadership of arctic peoples and communities. UN guidelines and standards may also be valuable to establish a base of standards.

A Study of Ownership of, and Rights to, Research Results

(This section is also relevant for section 11.3.4 and is described there.)

A Survey and Social Impact Assessment of Participatory Research in Arctic Science

Understanding of research conduct in the Arctic would benefit from a better understanding of the methods used to allow arctic residents to participate in research conducted in their region. As a first stage this could be achieved through a survey of participatory research in the Arctic. This survey would identify and describe the different arrangements by which researchers have attempted to involve the regional population. The survey would enable a comparison of how these arrangements differ by country and by discipline. Once a survey of the different practices identifies the varying methods, the impact of these methods can be determined. A social impact assessment of participatory research in the Arctic should document the techniques that work and those that are not as efficient. A series of best cases could be established to assist researchers and communities in establishing more effective means of local participation.

An analysis and assessment of the existing participatory research methods can be achieved using content analysis, historiographic methods, and questionnaire surveys. Also, this work should be guided by the Akwé: Kon Voluntary Guidelines (Secretariat of the Convention on Biological Diversity, 2004) for cultural, environmental, and social impact assessments in indigenous peoples' areas.

11.3.4. The Control and Communication of Knowledge

Knowledge is a form of empowerment. It can also be a form of disempowerment, and therefore rights and access to knowledge is essential. How have ownership, legitimation, dissimulation, and dissemination of knowledge in and about the Arctic been effected in the past? How are they effected today, and how would they best be effected in the future? The development and application of knowledge is a vital part of economic development. Can arctic science be used to build knowledge-based economies in the North?

Major issues include the following.

Control:

- *Who controls the knowledge that is produced by arctic science?*
- *Whose interests does this knowledge serve?*
- *Who holds the property rights?*

- *How are research findings used and utilized in decision-making (processes)?*
- *What forms of knowledge are seen as legitimate or valuable?*
- *Which forms are discounted? Why is this so?*
- *What is the place of traditional indigenous knowledge in arctic science?*
- *Who controls the economic benefits of knowledge developed in the Arctic?*

Communication:

- *How is knowledge communicated about the Arctic?*
- *To what extent is communication about arctic science organized as information “push”? To what extent is knowledge “pull” appreciated? Where and how is the exchange and actual mutual communication about arctic knowledge between science and the public encouraged?*
- *Who is the audience for the outcome of arctic science? Audiences may include communities and peoples but would also include organizations, institutions, and various socio-cultural groups, including scientists themselves.*
- *How are arctic peoples, communities, and populations impacted by the communication of this knowledge?*
- *What best practices and ethical guidelines exist for the communication of the knowledge to the various constituencies?*
- *What can arctic research, and communication thereof, do to become (more) relevant to different audiences?*
- *How are students and education targeted in the communication of arctic science and research?*
- *What are the best ways of communicating local knowledge to researchers? Language is a crucial part of knowledge control and communication. Does the language used by arctic science favor inclusiveness or does it serve to exclude certain populations?*

The Scientific Approach

How best can these questions be answered? The following are suggested research programs.

A Sociology of Arctic Science

Much about how knowledge is controlled and communicated could be understood from a sociological analysis of knowledge production. Sociological analysis would make it possible to understand who produces the knowledge, under what condition knowledge is seen as legitimate, what techniques are used to control the knowledge, and in whose interest knowledge is controlled. Finally, a sociology of arctic science would be able to isolate conflicts that develop relating to the control of knowledge as less powerful groups try to counter the knowledge power of more dominant groups.

A sociology of arctic science would use many of the same research methodologies of a history of arctic science. Relevant documents and archives could be analyzed sociologically using modern content analysis techniques. Analysis of the “narrative” of arctic science could use the same techniques used in the Bravo/Sörlin group research. In addition, novel techniques could be used, such as participant observation of arctic researchers and/or interviews.

A Study of Ownership of, and Rights to, Research Results

Every arctic nation has rules and regulations for ownership, copyrights, and access rights to research results, including material outcomes. In addition, international law and regulations exist and are under constant development. These laws and regulations may or may not aim at the same goals and support the same values as new guidelines in research ethics. Research traditions and copyright laws may, for example, give the rights of ownership or sharing, and communication, of findings not to those it concerns, and who may have provided oral knowledge, but to those who publish. Analysis of this will help in understanding past development in the relations between science and the public and is crucial

in identifying the challenges for future development of the relations between arctic science and the public interest.

An analysis of the existing laws and regulations can be achieved using content analysis methods. Historiographic methods can be used to understand the varying contexts that shaped the production of these guidelines. Scenario methodologies may be useful in producing possible futures for the development in the Arctic.

A Survey of Arctic Research Outreach Techniques

How knowledge is communicated, and to whom, is as crucial as the gathering of the knowledge itself. Research “outreach” techniques vary widely from academically refereed publications to town hall meetings in arctic communities. Choice of language in the communication may, for example, strongly influence the perception of ownership and relevance to the recipient. There is a need to survey the different techniques used to transmit knowledge gathered by arctic researchers and to determine their effectiveness. This will in turn assist researchers in developing communications plans that will support and explain their work and demonstrate its relevance more effectively.

An analysis of the existing research outreach techniques can be achieved using content analysis, historiographic methods, questionnaires, as well as anthropological approaches.

Use of the Internet in the Arctic

It would be extremely productive to discuss the possibilities of using the Internet to strengthen the co-operation between researchers and indigenous peoples, to make the transmission of knowledge and information more effective, and to broaden the involvement of the residents. Several researchers have already underlined the potential of these new technologies of communication for communities. Putnam (2000) showed how the Internet generates social capital and increases the capacity of a community to be mobilized for a given goal. Castells has also noted the potential of these technologies to support the development of certain communities but also noted the dangers of “the digital divide,” that is, the difference between the populations that have access to new technologies and the others (Castells, 1996, 2001). Also, Pekkala et al. (2004) has noted the dangers of exclusion that concern these technologies as well as the opportunities they provide.

Several projects tried to clarify the relationship between new technologies of communication and community vitality (e.g., Project Internet Catalonia (www.uoc.edu/in3/pic/eng/pic1.html) and the Netville Project (Hampton and Wellman, 2003)). A project defining the possibilities and limitations of Internet communication would be extremely useful to all parties in relation to the future coexistence and co-operation between researchers and the local people.

Questionnaire surveys and interviews of both the local participants in the research projects and the researchers themselves could provide important information about which techniques work best for each group. The upcoming Arctic Council ICT survey may be a valuable first step in this direction. The research techniques employed by Project Internet Catalonia and the Netville Project could be replicated.

A Social Impact Analysis of Arctic Research Outreach Techniques

While a survey of the different techniques is useful, much can be gained from a project that attempts to evaluate the effects of these techniques on the different groups concerned. A social impact assessment on each of the vast variety of publics listed at the beginning of this ICARP II science plan would enable a better understanding of which techniques work and which are not as effective. A series of best cases could be established to assist researchers and communities in establishing more effective means of local participation, outreach, and international awareness.

One approach would be to analyze the decisions made using arctic research “products” and their effects, including their impact, on the various publics. A useful study could be made of the process whereby information from the Arctic Climate Impact Assessment and Arctic Human Development Report is used and incorporated in decision- and policy-making. Starting with the Arctic Council process, one could focus on the national processes of a couple of arctic countries as case studies.

Linkages: Information on these issues can be found through various websites, including the Alaska Native Science Commission (www.nativescience.org/); Alaska Traditional Knowledge and Native Foods Database (www.nativeknowledge.org/); the Alaska Native Knowledge Network (www.ankn.uaf.edu/); Alaskool (www.alaskool.org/); and the World Indigenous Peoples Conference on Education 2005 (www.wipce2005.com).

Increasing the Interest of a Broader Public

What science needs is an audience, or a public, that has an interest in science. There is a growing understanding among researchers for the need to engage in some kind of outreach. Arctic research cannot be developed in isolation. It is clear that science needs to improve its relations with the public in the areas of direct communication of results and in its relevance to the research needs of the public.

Access to funding, legitimacy of work, acceptance of interaction with communities, as well as the need to put knowledge to good use – including the carrying on of the knowledge itself – all call for some kind of communication and interaction. Science has traditionally used higher education as a means to carry on knowledge and to spread knowledge into the school systems and elsewhere, including politics, administration, and finally to a wider audience in a more popular form. This traditional “end of the pipe” model of outreach, aimed at sharing knowledge from the scientist to the (uninformed) public, needs to be challenged; there may be many needs also for the scientist to be enlightened by the public. This is, therefore, a recommendation for a set of activities that will focus on interaction both ways.

There are several publics where this interaction is needed, including the general public outside the Arctic – communities in the North, decision makers (they need background information for decision-making), other scientists in different fields, students (education, teaching), and tourists. (See section 11.2 for the definition of “public.”) Each of the publics needs diverse levels of research information. The use of focus groups can be helpful in understanding how an audience thinks and how it prefers to receive information. (The voice “you” is not used anywhere else.) For a set of selected audiences, a limited number of projects should be carried out to study outreach activities. For each of the selected audience groups, the studies proposed above should be carried out: (1) a sociology of arctic science; (2) a study of ownership of, and rights to, research results; (3) a survey of arctic research outreach techniques; (4) use of the Internet in the Arctic; (5) a social impact analysis of arctic research outreach techniques.

These studies would create the basis for improved training of arctic science actors to improve future interaction with the public. The needs and types of interaction will vary much between the various publics. Such a training program would in principle be outside the ICARP mandate, as it does not address a research need in itself; it addresses, rather, a need for the research to be understood and relevant so that the public would understand and support it.

11.3.5. Research Impacts

In the Arctic it is important to understand the impacts of the research itself and of the results of the research, as well as the impact of the communication of research results. The impacts occur on several levels including, but not limited to, the political, economic, cultural, social, and environmental levels, as well as on the research itself. Consequences may be intended and unintended.

It is now commonly accepted that new economic activities must undergo social and environmental assessments. There has been little work on the assessment of research impacts or research consequences on local communities or on global systems.

Examples of the influence of research in the North are many. Policies that are generated by governments and other organizations in the South often lead to forming science; the science outcomes in turn influence policies for the North. The presentation of the Northern Dimension by Finland to the European Commission is a good example. It has been said that the northern voice will only influence the centers of power in the South when it is directly relevant to southern interests. It must, therefore, be presented in a particular way. Several of the Arctic Council outcomes – the Stockholm Convention on Persistent Organic Pollutants (POPs) and the European Environmental Agency (EEA) Arctic report of 2003 (UNEP-EEA, 2003) – are examples of this process. What impact have they had in the South? What is the impact in communities, and are the impacts as intended? Research on migratory arctic species, whaling, the seal hunt, etc., has influenced southern opinions, and strong impacts on northern communities have been documented.

Key questions to be addressed include the following:

- *What are the various effects of research itself on the Arctic?*
- *What are the effects of research findings on the Arctic, intended and actual?*
- *What are the effects of the communication of research results, intended and actual?*
- *What are intended and unintended consequences of arctic research?*
- *What are the international impacts?*
- *What other questions could be related directly to the political consequences of arctic research?*
- *What type of research empowers what types of communities?*
- *Is research generally perceived to be a positive force by local communities in the Arctic? Why, or why not?*
- *How is arctic research used in policy development and decision-making?*

An Impact Assessment of Arctic Science

With new major research projects currently being completed, it is time to start to understand the effects that these projects have globally, regionally, and on the various communities in the North. Much can be learned by studying the impact of the *Arctic Human Development Report* (AHDR, 2004), Arctic Monitoring and Assessment Programme assessments (e.g., Macdonald et al., 2003), and the *Arctic Climate Impact Assessment* (ACIA, 2004) on the North. Studies of major infrastructure investments like icebreakers and research stations should also be assessed. In a few years it will also be relevant to study the impact of the International Polar Year, certainly its outreach activities. The above questions should be addressed for such projects.

An assessment of research in the Arctic would make it possible to understand whether these projects are helping to bring about the consequences that are intended and whether there are any negative unintended consequences associated with the projects. Such an analysis would assist in understanding how projects can be used to empower arctic communities and to best influence political decision-making.

Various forms of impact assessment would be relevant approaches, including an analysis of relevant state and media discourse and questionnaire surveys; and interviews of both the local participants in the research projects and the researchers themselves could provide additional information on these impacts.

Linkages: Taiga Net's web page on sustainability of arctic communities (www.taiga.net/sustain).

11.4. Methodologies

This section is not comprehensive. It is intended to provide a short overview of methodologies that are relevant for most of the proposed research programs.

11.4.1. History

A history of arctic science is best achieved using the standard historical research methodologies. Primary archival searches and content analysis of relevant historical documents are particularly appropriate. Recollections can also be used to supplement the archival resources. Autobiographies, memoirs, diaries, and oral recollections would be useful sources of information.

11.4.2. Sociology

A sociology of arctic science would use many of the same research methodologies as a history of arctic science. Relevant archival documents could be analyzed sociologically using modern content analysis techniques. Analysis of the “narrative” of arctic science could utilize the same techniques used in the Bravo/Sörlin group research. In addition, novel techniques could be used such as participant observation of arctic researchers and/or interview surveys.

Once the core texts have been identified, more in-depth understanding of the impact of the texts could be gathered through the use of quantitative and qualitative content analysis techniques. Influenced largely by the writings of Michel Foucault, many researchers in the social sciences have shown the usefulness of discourse analysis, an interpretive form of qualitative content analysis, in understanding the underlying power structures contained in texts.

11.4.3. Politics

The politics of research funding could be researched using qualitative and quantitative content analysis methods. Discourse analysis has shown itself to be particularly useful in uncovering the political aspects of knowledge production. In addition to these techniques, interviews with funding bodies and scientists would enable a more in-depth understanding of intent and motives.

11.4.4. Ethnography

Ethnographic methods have long been used in the Arctic to understand the nature of northern peoples and communities. These methods are increasingly being used to investigate the “narratives” of these communities. They can also be used to understand the many issues raised in this report that reside within the research communities.

11.4.5. Impact Assessments

An appropriate social impact assessment of research ethics guidelines would best be achieved using a questionnaire survey of scientists, research administrators, local research actors, and arctic peoples and community leaders. Such a questionnaire survey would be based on a series of questions relating to key aspects of the research ethics guidelines and a series of open-ended questions about problems encountered with the guidelines. Ethnographic methods, including interviews, could be used to supplement the questionnaire survey and to delve deeper into identified problems. This process should be guided by the Akwé: Kon Voluntary Guidelines (Secretariat of the Convention on Biological Diversity, 2004) for cultural, environmental and social impact assessments in indigenous peoples’ areas.

11.5. Scientific Approach Field Work Program Requirements

Studies of arctic research require access to the relevant political and scientific arenas and actors. Similar to the requirements of other arctic field research involving people, they will require measures to build trust and ways to discuss who is or who should be involved in framing research questions and how.

11.6. Scientific Approach Observation and Monitoring Needs

Studies of arctic research will to a great extent rely on written documentation from research processes and the framing of research programs. The success of such research will thus depend on the processes actually being documented, on that documentation becoming available in the public domain, and on it being stored in ways that it can be easily retrieved. In addition to documentation, access to comparable socio-economic and development indicators is important to many of the questions discussed.

11.7. Scientific Approach Experimental Program Requirements

These requirements are yet to be determined.

11.8. Scientific Approach Modeling Program

These requirements are yet to be determined.

11.9. Scientific Approach Scenarios

These requirements are yet to be determined.

11.10. Scientific Approach Data Analysis and Management

Some data gathered in connection with the study of arctic research can be of a confidential nature because of political or other sensitivities. There is thus a need to find ways to handle data that both ensure the openness needed for quality control of the research and respects for promises of confidentiality. Good procedures will be essential for trust needed for successful field work.

11.11. Education and Outreach

Education and outreach are discussed above in relation to specific research areas. There is a general need to help researchers and arctic communities to understand better the driving forces behind arctic science and its relationship to the public interest.

11.12. Linkages / Users

The linkages and users are discussed above as part of each research area.

11.13. Outcomes / Achievements

The outcomes and achievements are discussed above as part of each research area.

11.14. Implementation

The implementation of this ICARP II science plan is discussed above as part of each research area.

11.15. Funding

Most of the research involved in this ICARP II science plan requires modest funding levels.

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