ARCTIC FUTURES 2050 EXECUTIVE SUMMARY

In September 2019, the Study of Environmental Arctic Change (SEARCH) brought together nearly 400 scientists, Indigenous Knowledge holders and leaders, and policy makers from 15 countries to explore Arctic research needs. With the premise that policy responses to changing Arctic environments need to be informed by Indigenous and scientific knowledge, Arctic Futures 2050 relied on formats that emphasized collaboration and discussion.

Three keynote presentations set the stage: Past and Future Environments of the Arctic, Indigenous Peoples and Arctic Environmental Change, and What Policy Makers Will Need to Know in 2050. Most of the subsequent presentations were moderated discussions among an Indigenous leader, a scientist, and a policy maker. That format allowed for a holistic exploration of five conference questions.

The main conference conclusion is that **holistic understanding and useful adaptation to rapid Arctic change requires bringing together scientists, Indigenous Knowledge holders, and policy makers in all phases of defining the problems, conducting research, and sharing knowledge.**

Here, we summarize key takeaways from the spoken and poster presentations organized by the five conference questions.

WHAT DO WE CURRENTLY KNOW/ NOT KNOW ABOUT THE CHANGING ARCTIC AND WHY DOES IT MATTER?

The most immediate and consequential changes in the Arctic—diminishing sea ice, ice sheets, glaciers, and permafrost—have both local and global impacts. Widespread consequences include restructuring ecosystems, climate disruptions, and global sea level rise. Discussions highlighted the interlinked ecological and social implications of such changes, which included especially vivid descriptions of Arctic Indigenous People facing loss of life, tradition, and culture.

SEARCH scientists detailed some observed and predicted changes in the physical environment as the Arctic warms at more than twice the global rate:

A panel discussion on Implications of Changing Marine Ecosystems. *Photo by Joed Polly, ARCUS.*

- Diminished **sea ice** over the past few decades is responsible for 50% of the warming observed in the Arctic and 17% of global warming. Sea ice is a defining characteristic of the Arctic and a potent force in regulating climate;[1]
- Thawing **permafrost**, accelerated by abrupt ground collapse in ice-rich soils, is on track to damage one third of the infrastructure in the northern permafrost region and add on the order of 75 ppm additional carbon dioxide to the atmosphere in this century;[2] and
- Greenland has lost more **land ice** than it accumulated over the past 20 years.[3]

Specific observations of environmental change from across the Arctic provided additional details and highlighted regional variations in the magnitude of change and its consequences. Arctic marine fisheries were described by several presenters in terms of local and national economies. Others emphasized that such climate impacts are taking place in the context of other pressures, including social and commercial disputes and government policies.

Panels also discussed how changes are engendering adaptive responses in policy, economics, and cultural practices. Discussions pointed to examples such as changes to fishing policies, subsistence whaling, food insecurity, the establishment of conservation areas, and control and remediation of erosion.

[1] Matthew Druckenmiller
[2] Ted Schuur
[3] Twila Moon

WHAT RESEARCH IS NEEDED TO INFORM RESPONSES TO ARCTIC CHANGE?

The scale and pace of environmental change was cited in numerous calls for accelerated Arctic research in the natural and social sciences. Specific research needs discussed included:

- predicting future states of sea ice, land ice, permafrost, and wildfires;
- mechanisms generating Arctic storms and predicting storms;
- bathymetric charting;
- pathways and risks of climate engineering;
- human health impacts of environmental change;
- impacts of environmental changes and harvests on fisheries; and
- impacts of increased Arctic shipping.

Many Indigenous presenters prioritized topics directly impacting the well-being of Arctic residents, such as air pollution, coastal erosion, increasing ship traffic, and food insecurity. Priorities of scientists included a greater emphasis on understanding Earth system processes and on forecasting future environmental states. Those making public policy decisions—such as planning mitigation and adaptation to rising sea levels—prioritized research that could narrow the range of future projections.

Co-production of knowledge by scientists, Indigenous Peoples, and policy makers will be necessary to focus priorities, and conference discussions recognized both the importance and the challenge of more meaningful co-production of knowledge. Four promising approaches discussed included:

1. collaboratively developing frameworks for communicating the confidence of predictions, especially those that would entail higher adaptation costs;
2. employing table-top and scenario exercises to clarify the research needed to address particular societal concerns;
3. collaboratively modeling the threats to communities and their consequences; and
4. a framework to evaluate the extent to which research is "new, urgent, and impactful."[4]

These approaches would all require or benefit from collaboration of scientists, Indigenous Peoples, and policy makers. Suggested pathways for collaboration included recognizing the value of Indigenous Knowledge to understand the Arctic environment; researchers working with local communities to identify research that is locally relevant and timely; framing research to consider social values; expanding environmental research that explicitly includes consideration of issues of human well-being; and building communities of practice that would link scientific, Indigenous, and policy experts together around shared interests and concerns. Barriers to collaboration between scientists, Indigenous Peoples, and policy makers include aspects of the academic reward system, inadequate compensation for Indigenous Knowledge holders, a lack of capacity in Indigenous communities, and the demands on the time of policy makers.

WHAT CHALLENGES CONFRONT POLICY MAKERS IN THE RAPIDLY CHANGING ARCTIC?

The pace of environmental change in the Arctic challenges government responses. Presenters noted that policy makers need assistance in making proper use of environmental data, and they need to be held accountable.

Presenters also considered the challenges of aligning policy decisions with a rapidly changing environment. Mitigation measures typically will take time to implement, whereas adaptation measures—including support for adaptation in Arctic communities—could happen more quickly. Experts with considerable experience at the science and policy interface emphasized the importance of policy makers appreciating the rapid pace and serious consequences of Arctic change. An Indigenous leader suggested that policy makers, scientists, and Indigenous People need to learn each other's terminology.[5] Policy makers and scientists agreed and gave the specific example of the varying uses of the term "uncertainty" with respect to scientific findings.

[4]Gerald Geernaert
[5]Rosemary Ahtuangaruak

Conference discussions brought to light impediments to informing policy with knowledge, including:

- inadequate appreciation for Indigenous Knowledge and rights;
- mismatches in communication styles;
- disparities in information needs of policy makers and what is known; and
- misalignment between the spatial and temporal scales at which decision makers need predictions versus what models are able to deliver.

Many policy issues identified by North American participants involved inadequate use of Indigenous Knowledge, however, European participants tended to focus more on challenges in transnational collaboration while still acknowledging tensions over Saami rights in Sweden, Norway, and Finland.

Collaboration in knowledge acquisition and policy making is hindered by tensions regarding Indigenous rights and international rivalries. Several presentations underscored the importance of rebuilding trust between policy makers, scientists, and Indigenous communities. Doing so will require honest and perhaps difficult discussions. The conference took tentative steps in that direction, but much more effort is needed.

Many posters were designed in a "big ideas" format to convey take-home messages clearly, succinctly, and in nontechnical language. Photo by Joed Polly, ARCUS.

WHAT TOOLS CAN FACILITATE INFORMING DECISION MAKING?

To better inform decision making, participants identified tools relating to communication, co-production of knowledge, modeling, scenarios exercises, and remote sensing and other technologies.

Many presenters referred to the need for better **communication** between Indigenous Knowledge holders and scientists, and others addressed how knowledge holders could better communicate with policy makers. Developing effective and timely ways of communicating what is known about Arctic environmental change to policy makers was noted as essential.

Examples of Indigenous Knowledge informing policy included Inupiat whalers in Alaska informing management decisions by the International Whaling Commission, Inuit knowledge used in the delineation and establishment of a large marine protected area in Canada, and Saami herders informing ecological studies of reindeer. Those examples illustrated successes but also challenges of communication and, more fundamentally, building trusting relationships.

Conference attendees emphasized the importance of iterative discussions between researchers and those developing policies for adaptation. Such discussions can help policy makers distinguish new but not fully vetted research from research that is actionable by virtue of being broadly accepted or "settled" science. Conversely, dialogue can help researchers know where refinement of predictions will make significant differences in policy decisions.

Efforts on the part of the science community to better inform policy were described in spoken and poster presentations by academic, government, and boundary-spanning organizations. Examples included SEARCH's production of nontechnical briefs answering policy-relevant questions about environmental change in the Arctic; the German Arctic Office's "Dialogue Forums," where ministers in the German government are briefed on Arctic science; and Finland's Climate Panel, an independent group of scientists who inform the country's ministers on climate change science. One recommendation was

that an IPCC-like panel be created for Arctic change as a way to share knowledge and align Arctic policy internationally.[6]

Further, the importance of communicating what we know to the public at large was highlighted by several participants. Speakers suggested the need for public education and advancing science literacy.

Co-production of knowledge—combining Indigenous and scientific methods and engaging policy makers in framing questions—was embraced by many. Presenters emphasized that Indigenous Knowledge is distinct from scientific knowledge and should not be translated by scientists. A poster presentation elaborated on that point, highlighting that co-production of knowledge is distinct from multidisciplinary and multi-evidence-based approaches and also explained how co-production through equitable collaboration is important for "the holistic view needed to inform policy, resource management, and conservation."[7]

Spoken and poster presentations provided specific examples of how mathematical **models** extend the power of observations to predict future states of the Arctic. Presentations made clear the importance of models based on first principles in predicting the future of a system headed to a new state and pointed out that even the earliest versions of Earth system models predicted well the declines in sea ice that have since been observed. Improvements to climate models are ongoing and, in particular, could better incorporate Indigenous Knowledge.

The application of formal **scenarios exercises** for learning and informing decisions—including a table-top exercise—were demonstrated in presentations. One scenarios project presented took a pan-Arctic approach, while another focused on future scenarios in Arctic Russia. Other tools presented included structured decision-making approaches for considering social and economic implications.

The power of **remote sensing and other technologies** to track environmental change in the Arctic was emphasized in several presentations. Poster presentations described how remote sensing products are becoming more broadly accessible.

WHAT PARTNERSHIPS ARE POSSIBLE BETWEEN DECISION MAKERS AND KNOWLEDGE HOLDERS?

The importance of partnerships was a common conference theme. In an impassioned speech, Delbert Pungowiyi argued that the crisis of a rapidly changing Arctic requires "all hands on deck." He and many presenters emphasized the value of appropriate partnerships between Indigenous Peoples, scientists, and policy makers. Others outlined examples of past and present partnerships, as well as the need for new or improved partnerships crossing countries, disciplines, jurisdictions, and age groups. Those case histories suggested models for international cooperation and successful partnerships among Indigenous Knowledge holders, scientists, and policy makers.

CONCLUSIONS

Arctic Futures 2050 created a necessary opportunity for funders, researchers, Indigenous Knowledge holders and leaders, and policy makers to improve how Arctic policies are informed by scientific and Indigenous understanding. The conference was successful in providing that first opportunity, but ultimately it will have been successful to the degree to which it contributes to better and sustained co-production and use of knowledge. In a post-conference survey, about 90% of attendees rated the conference as very good to excellent, and many commented that the inclusion of scientists, Indigenous Knowledge holders, and policy makers was a powerful approach to understanding and responding to rapid Arctic change.

Find the conference program, posters, & session videos at
www.searcharcticscience.org

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[6]Markku Ollikainen
[7]Raychelle Aluaq Daniel, Carolina Behe, and Julie Raymond-Yakoubian