Office of the Chief
Science Advisor of Canada

Bureau du conseiller
scientifique en chef du Canada

The Polar Continental Shelf Program and the Rapid Rise of Northern Research

Report from the Chief Science Advisor on emerging challenges and opportunities in Arctic and Subarctic scientific activity

Canada

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Message from the Chief Science Advisor

Canada is an Arctic nation. Its vast Arctic and Subarctic territory is of increasing economic, environmental, and geopolitical importance. Conducting research is one way for Canada to peacefully assert its sovereignty over its northernmost reaches, particularly when that research involves the active participation of local and Indigenous populations. Therefore, Canada would benefit from demonstrating global leadership in Arctic science.

Canadian leadership requires first that we do the right research, focused on finding solutions to issues and challenges of local and global impact. Leadership also requires that we do the research right, which includes involving local communities, using state-of-the-art tools and infrastructure, and acknowledging changing environments and evolving technologies in a dynamic, social and cultural context. A coordinated national approach enables both Arctic and Subarctic research to improve communities' well-being, spark technological innovation and support circumpolar diplomacy.

This report provides perspectives on these issues as they relate to the optimization of logistical support and resource deployment provided by the Polar Continental Shelf Program (PCSP). It is informed by the observations and deliberations of a group of science experts as well as by discussions and exchanges with territorial science advisors and representatives from Inuit Tapiriit Katanami. The report specifically addresses the PCSP, but its findings and recommendations are relevant to broader aspects of Arctic and Subarctic research.

For more than 60 years, the Government of Canada has played a central role in supporting northern scientific research. In the years to come, it can also play a central role in making Canada a globally recognized leader in Arctic and Subarctic science.

Mona Nemer, C.M., C.Q., FRSC
Chief Science Advisor of Canada

A note on geographic denominations

The geographic area relevant to this report is referred to as the Arctic, the Subarctic, and the North.

The Arctic and Subarctic are used as much as possible to designate areas that reflect ecoclimatic regions. Generally speaking, the Arctic is the area above the Arctic circle, i.e. approximately 66 degrees north, and the Subarctic designates the region below the Arctic circle that extends south to the line of discontinuous permafrost.

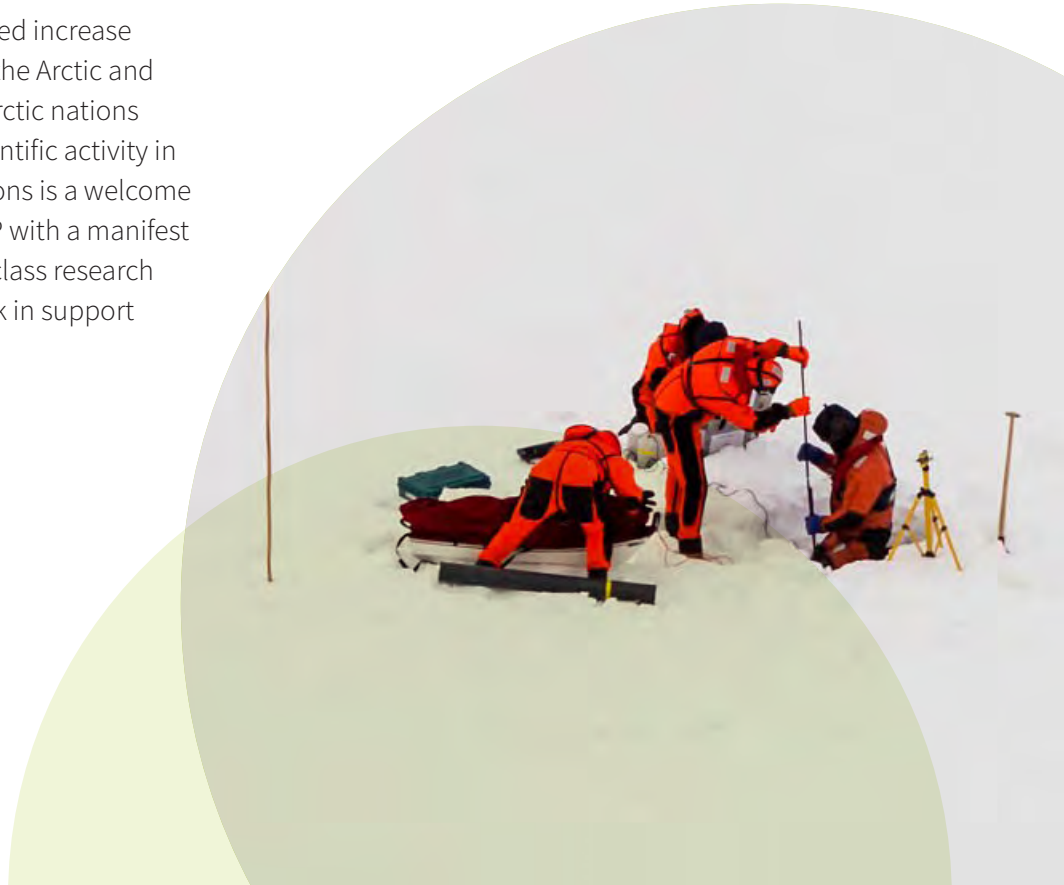
The North is used to designate a political or socio-economic area. In its most limited definition, the political North is composed of the three territories north of the 60th parallel. The Standard Geographical Classification used by Statistics Canada designates the socio-economic North, extending below the 60th parallel to include designated regions in the northernmost reaches of some provinces.

Introduction

Established in 1958, the Polar Continental Shelf Program (PCSP) provides logistics coordination and planning for eligible research initiatives in Canada's north. From its facility in Resolute Bay, the PCSP operates a hub-and-spoke web of support that spans Canada's entire Arctic and Subarctic regions. The PCSP provides direct support to selected researchers from the federal and territorial governments, universities, and northern organizations. Its offerings range from air transportation logistics to laboratory access to specialized field equipment. The PCSP endeavors to be Canada's centre of expertise for modern, innovative Arctic logistics, contributing to the advancement of scientific knowledge of the Canadian landmass and the exercise of Canadian sovereignty in Canada's North. This report is mainly focused on the PCSP's operations, but the observations and recommendations herein are relevant to the broader area of northern research in Canada.

The last 20 years have seen a marked increase in research interest and activity in the Arctic and Subarctic regions in Canada, the Arctic nations and beyond. The expansion of scientific activity in Canada's Arctic and Subarctic regions is a welcome development, presenting the PCSP with a manifest opportunity to help grow a world-class research infrastructure and logistics network in support of northern research excellence.

To do so, it is essential to recognize that the research landscape in which the PCSP has traditionally operated has now changed. This includes evolving research needs, enabling technologies, stakeholder diversity, changing institutional context, and increased community interest and involvement in research. Addressing complex challenges such as those supported by the PCSP must also recognize and support convergent research that brings together natural, life and social sciences in dynamic, multidisciplinary teams. Collaborations with local communities and organizations provide the best opportunity to translate research into societal benefits, including through building scientific capacity within northern communities. The PSCP must adapt to these evolving needs and changes to maintain its relevance and ensure it meets its initial vision and objectives.



Observed and predicted expansion of Arctic and Subarctic research

Scientific activities related to the Arctic have been increasing in both absolute and relative terms. Using the volume of scientific publication as a simple proxy, the amount of scientific activity related to the Arctic has increased 20 times since 1970 (Fig. 1). Moreover, the relative volume of Arctic science among all scientific activities, indicated by the percentage of Arctic-related publications relative to all scientific publications, has grown from 0.4% to 1% since 1970. This ratio encompasses the global production of science publications, not just publications with Canadian authorship.

In the coming years, the volume of research activity is expected to continue growing because of the increased accessibility, the economic opportunities, the connection of the Arctic with global climate processes, and the growing geopolitical importance of the region. The number of Arctic-related publications in 2020 was four times what it was in 2000. If that trend continues over the next 20 years, northern research alone could increase eightfold by 2040, requiring significant growth in logistical capacity.

The Arctic and Subarctic science community is also changing, be it in its composition, disciplines or research focus. Research support must meet the needs of a more diverse userbase and a more diverse set of research projects, and further promote greater equity, diversity and inclusion.

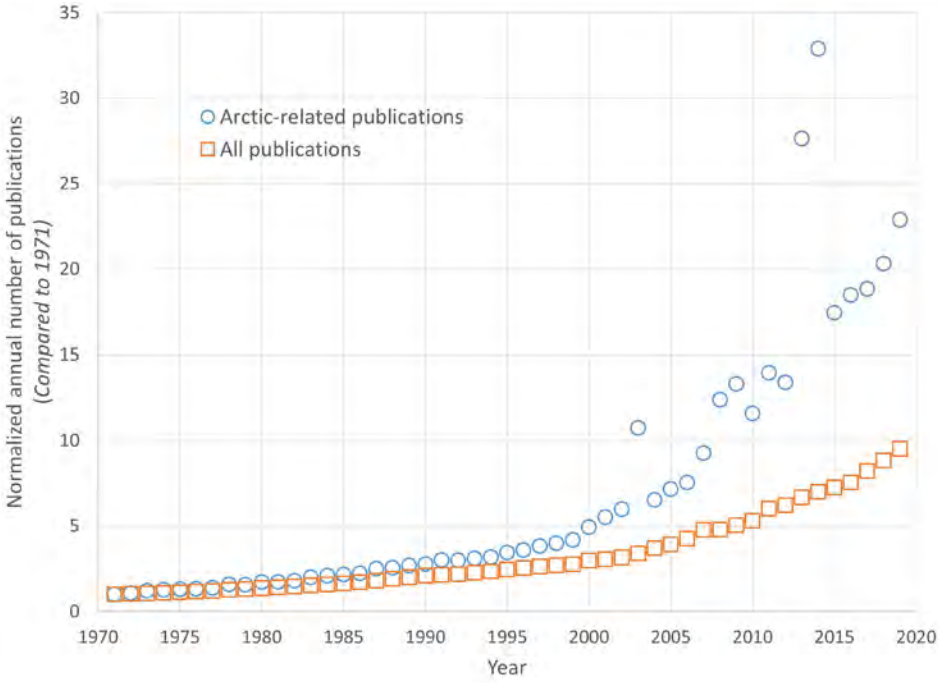


Figure 1. Arctic science publications have grown faster that the rest of science publications

The number of Arctic science publications in 2020 is 20 times what it was in 1971. Since about 2000, the growth rate of Arctic-related publications has been about double that of all publications. These results are based on counting publications with “Arctic” in the title or abstract on the Dimension publications database. The normalized annual number of publications presented in Figure 1 is obtained by dividing the number of publications from a given year by the number of publications in 1971. Arctic-related and total publications from 1971 in the Dimensions database amounted to 2,164 and 584,943, respectively.

Shifting practices and emerging needs in Arctic and Subarctic research

Climate change and globalization have been, and will continue to be, two principal drivers of environmental, social and economic change in Canada's north (Stephen 2018) and will drive the research agenda. With the overall impact of the Arctic on the planet's climate, both local and non-Arctic communities have a growing interest in understanding the region.

The reduced extent of sea ice in the Arctic Ocean brings both challenges and opportunities. The opening of year-round maritime navigation will result in increased economic activity in certain sectors (e.g., resources such as oil and gas, shipping, tourism, fisheries and agriculture). At the same time, melting permafrost impacts community and transportation infrastructure, releases methane with unknown climate feedbacks and could expose new pathogens and impact human health and the food security of local communities. These developments are taking place in the context of increased geopolitical tensions, notably between the USA, Russia and China, which may lead to renewed military interest in the North. Greater economic and military attention may generate investments that could improve telecommunications, energy and transportation infrastructure, which in turn could benefit research and development activities.

These challenges and opportunities result in increased interest for advancing certain Arctic and Subarctic Science and Technology (S&T) goals, such as increasing knowledge of:

1. Northern terrestrial, freshwater and marine ecosystems in the context of climate and social change.
2. Connections between northern community wellness and environmental health.
3. Sustainable energy, technology and infrastructure solutions for the unique environmental, social and cultural conditions in the North.
4. The role of the North in the global system, e.g., climate, geopolitics.

Harnessing science to advance these goals is fostering a shift in the disciplinary mix of Arctic research. Not all disciplines have been growing the same way to address these themes. Compared to the 1981–1985 average, in 2016–2020, the earth sciences' share of total Arctic-related publications is 4.5% lower (from 26.8% to 22.3% of total), and biological sciences is 1.6% lower (from 24.3% to 22.7% of total). Over the same period, the environmental sciences' share of total Arctic-related publications increased 3% (from 6.2% to 9.2%), and that of engineering increased 2.6% (from 9.6% to 12.2% of total).

While these changes align roughly with the evolving focus of the S&T goals, meeting these goals requires a broad mobilization of the northern scientific community towards these common goals and a more integrated research program within and between the natural and social science disciplines.

Digital technologies are also playing a more prominent role in research through remote tools, such as space-based earth observation, and also via technologies that enhance fieldwork (e.g., drones, smart sensor networks, portable instruments). The use of such technologies increases the need

for local software and hardware expertise and broadband connectivity to support research and operations. Advanced techniques for remote sensing are promising, but the last 10 years have taught us that we still need direct on-the-ground fieldwork and community-based monitoring, as the satellite revolution has not enabled the measurement of some key variables. Among the most promising recent developments is a host of autonomous mobile sensors for the ocean and atmosphere that can be deployed relatively easily and inexpensively.[1]

The digital transformation of science is also about data and computation. Understanding the Arctic as a system requires the ability to compare data sets from disparate fields, regions, and times in order to be able to see connections, commonalities, and systematic differences. Data management requirements, long-term archiving, metadata quality, and techniques for using and visualizing data all need to continue improving so that data can be used more readily and more often. Given that many systems span disciplines and national borders, meeting Arctic research challenges relies on interdisciplinary and international data sharing, ensuring access to documents and data while respecting data sovereignty, including Indigenous data sovereignty.[2]

1. US National Research Council: *The Arctic in the Anthropocene: Emerging Research Questions* (Washington, D.C.: National Academies Press, 2014) https://doi.org/10.17226/18726

2. International Arctic Science Committee: "State of Arctic Science Report 2020." (Akureyri: International Arctic Science Committee Press, 2020) https://iasc.info/images/media/print/SAS2020_web.pdf

The existing science system: Integration, funding and opportunity

The federal government supports science conducted in the North in multiple ways and through multiple organizations. In addition to the PCSP, researchers can receive support from the Social Sciences and Humanities Research Council (SSHRC), the Natural Sciences and Engineering Research Council (NSERC), the Canadian Institutes of Health Research (CIHR), the Canada Foundation for Innovation (CFI) and Polar Knowledge Canada to name a few. This list excludes provincial, territorial and local sources of support.[3]

Organizations such as ArcticNet, the Arctic Institute of North America, and PermafrostNet bring together Arctic researchers studying human health and natural and social sciences in the Arctic. Research institutions located in the North, such as the Nunavut Research Institute, Aurora Research Institution, and Yukon University, are playing an increasing role in research and training.

Many federal departments and agencies have long-standing research and monitoring programs that advance their respective mandates and include activities conducted in the North. These departments include Natural Resources Canada, the National Research Council of Canada, Environment and Climate Change Canada, Fisheries and Oceans Canada, Health Canada and the Canadian Space Agency. Polar Knowledge Canada, created in June 2015 through the merger of the Canadian Polar Commission and the Canadian High Arctic Research Station initiative, was recently added to that group with an intention for it to become a hub of scientific research in the Canadian Arctic and to strengthen Canadian leadership in polar science and technology.

The community of scientists doing Arctic and Subarctic science depends on shared infrastructure for conducting their research, regardless of their project funder. For them, sustainable and up-to-date infrastructure, logistics and on the ground operations are of critical importance and often determine project viability.

A number of conditions makes it complex and costly to do science in the North. The North has a comparatively low population density: northern Canada is 0.03 inhabitants per square kilometre (0.07/km^2 for Yukon, 0.04/km^2 for the NWT, and 0.02/km^2 for Nunavut) compared to 3.7/km^2 for Canada. As a consequence, the North has limited transportation, energy and communication

3. Polar Knowledge Canada: “Funding for researchers” www.canada.ca/en/polar-knowledge/fundingforresearchers.html

infrastructure. It is geographically far from more densely populated areas. Access and living conditions are also made more difficult because of the cold climate.

From a science perspective, and as observed by others, "The diversity of Canada's Arctic ecosystems also presents a considerable organizational challenge." (Council of Canadian Academies and Expert Panel on the Canadian Arctic Research Initiative, 2008). In the past, the regional coverage of Arctic research has often been patchy because scientists have tended to select a limited geographical range of sites to which they can gain access. Cost has played a major role in limiting site selection.

There is also a need to coordinate efforts between research programs and projects that rely on different types of logistics. For instance, to study complex interlinked phenomena in the Arctic and Subarctic, a project may require combining access to remote land locations with access to community-based science activities (e.g., population health or engineering) and ocean- or space-based logistics. It is unclear how coordination across these logistical streams would currently occur. Doing so could involve a planning approach that includes other organizations, such as the PCSP, which manages air-lift capacity, and the Coast Guard, which manages a fleet of vessels. Infrastructures and logistics also have to meet the needs of a more diverse userbase (following the principles of equity, diversity and inclusion), achieve better geographical coverage, and promote interdisciplinary and international research, among other things.

The international science community has a great interest in conducting research in the Canadian Arctic. In the absence of Canadian capacity and leadership on logistics, other countries will step in to fill the gap. This may lead to the undesirable situation where Canadian researchers will need to apply for support from other countries to access research sites in Canada's north, which may reflect badly on Canada's sovereignty argument.

Given its history and experience in logistics, the PCSP is ideally suited to play a leading role in coordinating solutions to these challenges. By sharing its expertise and engaging with other stakeholders, the PCSP can help grow a world-class network of research infrastructures and logistical organizations to further promote and support Arctic and Subarctic science. The hub-and-spoke model, reliant on a strong central hub location, has been the gold standard for organizing logistics in the North. But given the growth of local scientific institutions and of the overall number of scientific activities, it seems opportune to move to a more distributed, flexible, easier-to-scale and robust network model. This network is already forming and could benefit from the PCSP's commitment and expertise. The Canadian network of northern research operators used to list 112 facilities across the North; it would make sense to encourage its reactivation and expansion.

The advantages of a distributed network include greater flexibility and robustness in the face of change, augmenting or adjusting its hub-and-spoke system as science priorities and geographic targets evolve. This network approach would also make it easier to include new players, grow local capacity (e.g., by developing business relations with local service suppliers), and serve more diverse scientific needs (including diverse locations). The increase in marine traffic in the Arctic, for instance, may create

opportunities for scientific icebreakers in the North and for the creation of more ocean-based science logistics available to Canadians. More complex logistics connecting multiple actors and services may be required through a connected network of providers to meet researchers' needs for a broadened geographic distribution of the science sites.

Discussions with other northern organizations could advance the transition from a hub-and-spoke to a distributed network model. The recently created Canadian High Arctic Research Station (CHARS) in Cambridge Bay, while anchoring a less extensive network than the PCSP's, serves a location and sub-locations along the northwest passage. The CHARS framework puts a specific, higher-resolution focus on natural sciences in the geographic region around the CHARS campus, referred to as the CHARS Environmental Research Area (ERA). This area includes the communities of Ulukhaktok, Kugluktuk, Cambridge Bay, Gjoa Haven, Taloyoak and Kugaaruk.[4] The dynamics of remote-access logistics at the PCSP have not changed materially since the establishment of CHARS; in fact, the PCSP is supporting some CHARS-funded research projects.

The lack of coordination of Arctic and Subarctic research is seen as an important challenge by many actors of the research system. Greater scientific progress can be achieved by building on a shared long-term vision, common priorities, coherent and concerted efforts to support both the research projects and their logistical needs. Greater cooperation between institutions that support research in the North, which may be anchored in a shared strategy, could help move towards that goal. Collectively, the growing network of northern infrastructure and logistical support could be understood (and recognized) as one of the federal government's major research infrastructure commitments, which could in turn foster more integrated and concerted efforts.

4. Polar Knowledge Canada: "Science and Technology Framework 2020-2025" (Ottawa: PKC, 2019)

Collaboration with local communities and the decolonization of Arctic and Subarctic research

Collaboration with Indigenous peoples in the North is increasing across all types of research, and northern Indigenous communities are being provided with more opportunities to shape and conduct Arctic research themselves. This contributes to the greater inclusion of Indigenous and local knowledge in the understanding of Arctic and Subarctic systems science (impacts, risk, and governance needs). The demonstrated advantages of the true co-production of knowledge to advance important areas of research suggest that increased support for such engagement is needed.

There is a need to support efforts to work more closely with northern communities in order to identify research issues, and, where relevant, co-produce the knowledge to address them and help turn the knowledge into community benefits. In the foreseeable future, Arctic science will continue to be the subject of global as well as local interests.

In addition to supporting the population's self-determination goals, having the local population at the table is the best way to create synergies between global and local interests, and ensure that science promotes equality and fosters benefits for everyone.

PCSP has made important efforts in this regard, such as including a scoring criteria on Indigenous community involvement in its review of academic projects and providing support to ECCC's Inuit Field Training Program, but there is room for improvement. In the early 1990s, the PCSP established a traditional knowledge sub-program that has provided opportunities for communities, northern organizations and researchers to study topics relevant to Northerners. However, as Figure 2 shows, the Traditional Knowledge Program accounts for less than one per cent of PCSP-supported projects.

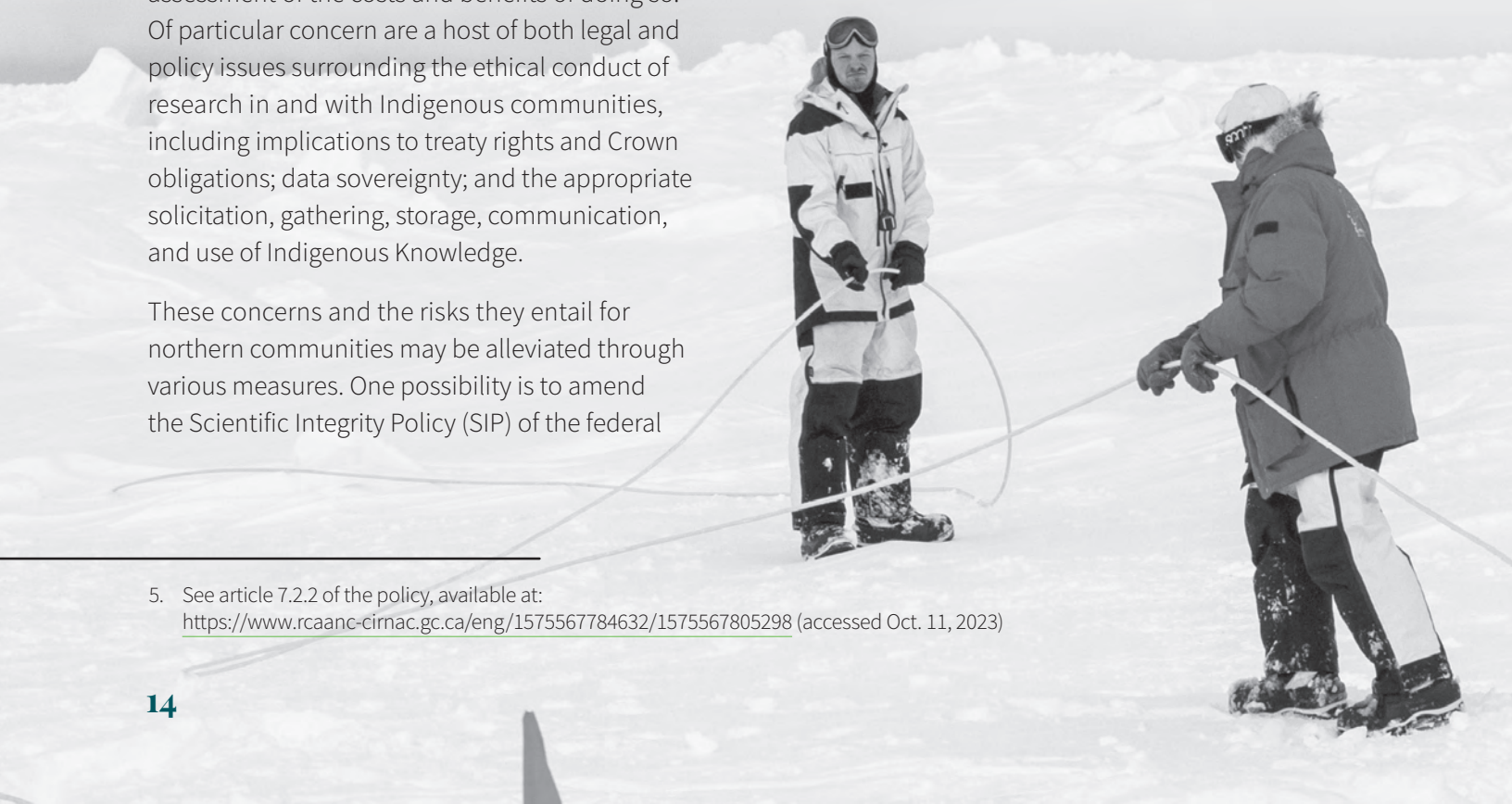
Figure 2. Breakdown of PCSP-supported projects in 2019 (Natural Resources Canada, 2020)

It is imperative to help enhance science capacity in the North so that scientific knowledge and human capability reside year-round in the Arctic and Subarctic regions. Northern communities should be encouraged to create local research bases that yield tangible benefits to local communities, address community questions, and support community-based science. Training can be provided for new and early-career investigators (including ideally a good proportion of Indigenous investigators) to ensure the future health of Canadian Arctic and Subarctic research. As research capacities continue to increase and local institutions continue to grow, northern researchers should take increasing leadership roles in guiding research activities and generating knowledge about the land and its peoples. The three territories are working to increase their capacity, infrastructure, and local knowledge base. Both the Yukon and the Northwest Territories have or are in the process of creating universities (Yukon University and Aurora College, which is transitioning to a polytechnic university).

For northern communities, active—indeed, pro-active—participation in research reflects the assessment of the costs and benefits of doing so. Of particular concern are a host of both legal and policy issues surrounding the ethical conduct of research in and with Indigenous communities, including implications to treaty rights and Crown obligations; data sovereignty; and the appropriate solicitation, gathering, storage, communication, and use of Indigenous Knowledge.

These concerns and the risks they entail for northern communities may be alleviated through various measures. One possibility is to amend the Scientific Integrity Policy (SIP) of the federal department in charge of the PCSP (i.e. Natural Resources Canada) to include specific provisions for the appropriate solicitation, gathering, communication, storage and use of Indigenous Knowledge that both reflect current best practices and anticipate future challenges. Such provisions might include and extend relevant provisions of Crown–Indigenous Relations and Northern Affairs Canada's Policy on Scientific and Indigenous Knowledge Integrity.[5] Indeed, given that more than 22 federal departments and agencies currently have SIPs in effect and that researchers and scientists from many of these departments are supported by the PCSP, there may be considerable value in revising the current Model Policy on Scientific Integrity, on which all federal departmental SIPs are based, to include provisions governing the appropriate solicitation, gathering, communication, storage, review and use of Indigenous Knowledge.

Local Indigenous populations have increasingly voiced their interest in participating in and leading research activities, which provides important



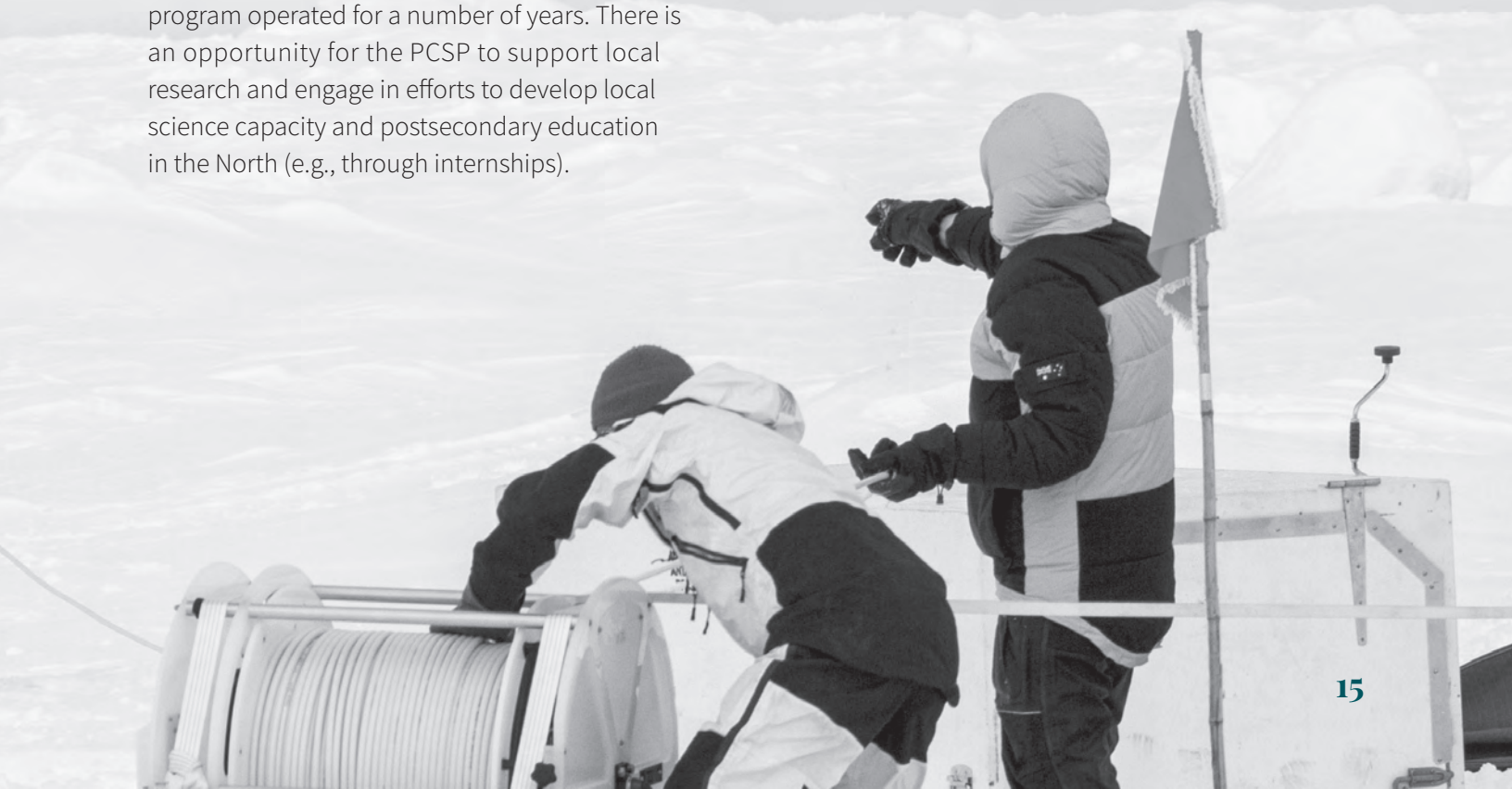
5. See article 7.2.2 of the policy, available at: https://www.rcaanc-cirnac.gc.ca/eng/1575567784632/1575567805298 (accessed Oct. 11, 2023)

opportunities for further expanding and diversifying research in the North. For instance, the Inuit Tapiriit Kanatami's National Inuit Strategy on Research outlines a roadmap to foster Inuit self-determination in research. Local contributions will accompany, and may be the only viable way to support, the growth of research activities at the needed rate. It may also influence which science questions are pursued and how science is conducted in the North for the next 20 years. In Canada, the reconciliation agenda makes it everyone's responsibility to support decolonization and the development of greater self-determination of Inuit and other Indigenous populations, and science can and must support reconciliation.

The PCSP can demonstrate its commitment to decolonization with actions such as prioritizing research logistics for teams that have demonstrated a clear commitment to meaningful engagement with Northerners and to the development of Indigenous science capacity. There is a direct need for more integration of Indigenous governments and communities in the PCSP funding framework. This can be achieved via an advisory board that includes local communities, such as the one the program operated for a number of years. There is an opportunity for the PCSP to support local research and engage in efforts to develop local science capacity and postsecondary education in the North (e.g., through internships).

The PCSP and the overall Canadian network of northern research operators can proactively engage non-science actors (e.g., industry, commercial transport and communication, and military) to create synergies to help meet common basic infrastructure needs. Science is increasingly digital, collaborative, multidisciplinary, and problem-oriented. Its basic infrastructure needs converge with those of local populations, starting with better digital and transportation infrastructure. As a growing proportion of scientists are expected to reside in the North and be part of local communities, they will come to share concerns with local communities about housing, health, post-secondary education institutions and so on.

There are punctual opportunities that can be leveraged to grow scientific research capacity. For example, a more open and ice-free Arctic Ocean creates growing opportunities for ship-based research, particularly as the Coast Guard is renewing its icebreaker fleet. A potential update of the North Warning System, as part of NORAD modernization, could also involve improved access to broadband communications technologies in the Far North and benefits for science operations.



Conclusion

The last 20 years have seen a marked increase in research interest and activity in the Arctic and Subarctic regions in Canada and across all nations. The expansion of scientific activity in Canada's Arctic and Subarctic regions presents the PCSP with a manifest opportunity to help grow a world-class research network in support of research excellence in Canada's north.

This report points to opportunities to increase Canada's scientific performance, which include:

A more strategic and coordinated effort in support of scientific research in Canada's north.

- Growing the scientific capacity and role of local communities in the northern science system;
- Increasing the overall logistical support to scientific research in the North to match the needs of the scientific community given the predicted growth in activities;
- Channelling this increase based on a shared long-term vision and common priorities that will ensure coherent and concerted efforts to support both the research projects and their logistical needs.

A strong northern research community of more diverse participants and new state-of-the-art tools, reflected in changing logistical needs.

- Acknowledging that the Arctic and Subarctic science community has changed; it has evolved in its composition, disciplines or research focus;
- Providing the specialized support capacity required by new digital technologies such as autonomous sensors and vehicles, including telecommunications infrastructure, data handling and computation capacity, that enhance fieldwork.

A qualitative change in how logistics are organized, enabling a more granular study of the North in a more agile, less centralized way, building on local capacity.

- Addressing the challenge of regional coverage of Arctic research, improving the geographical range of sites to which scientists can gain access to reflect the ecological and socio-economic diversity within the Arctic and Subarctic;
- Moving beyond the hub-and-spoke model towards a decentralized network model of logistical support, achieving greater flexibility and robustness in the face of change, and making it easier to include and grow local capacity, and serve more diverse scientific needs.

An Arctic and Subarctic research effort that leverages and contributes to other facets of Arctic and northern development.

- Recognizing that the scientific community's interests converge with the local population's interests with regard to basic telecommunications, energy, and transportation infrastructure;
- Exploring potential synergies with Canadian civilian and military investments in support of scientific research logistics in the North.

Canada is one of eight circumpolar nations whose territory reaches into the Arctic Circle, along with Denmark, Finland, Iceland, Norway, Sweden, Russia and the United States of America. They each have substantial northern research programs, as do many other northern hemisphere nations, such as the United Kingdom. Canada has one of the largest territorial claims in the Arctic. It should aspire to be a leader among circumpolar nations in terms of northern research, in much the same way as it strives to be a global leader in other disciplines. The PCSP has the opportunity to play a crucial role in meeting that aspiration.

The PCSP is currently an example of a component that functions independently but that could unlock greater capacity as part of a broader whole. For Canada to reach its potential, there is a need for better coordination among all the component organizations that support or participate in northern research and a need for greater involvement by local Indigenous populations in the North.

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Appendix A: The PCSP's contribution to Arctic and Subarctic science

The PCSP has its origins in the cold war era. PCSP was created in 1958, in the wake of the International Geophysical Year (1957–58, also referred to as the Third International Polar Year) and as part of the overall reaction to Soviet launch of Sputnik in 1957. Building Canada's territorial claim to the polar continental shelf in front of the UN was a significant policy driver for this program early on. Geophysical studies (e.g. gravitational mapping) dominated the first years of the program. By the 1970s, studies of wildlife, vegetation, and archeology that were supported by the PCSP were increasing in number. The drivers for Arctic and sub-Arctic science have been evolving over the last 6 decades, as has the PCSP program itself. Overall, the focus of S&T inquiry, and thus the logistics supports that PCSP provides, has shifted from understanding the Arctic, to understanding the changing Arctic, to opening the Arctic. Since 1986 PCSP's logistics function has been separated from the science program(s) it is enabling.

Today, PCSP provides advice, logistics coordination, and planning for eligible research initiatives in Canada's north (see Box 1) across a variety of disciplines. The program supports access to a broad set of field sites which goes far beyond CHARS (Fig. 3). From a science perspective, the PCSP's logistical support is particularly useful for research to be conducted outside of the proximity of research stations and communities. Such access to remote land locations is essential if Canada is to gather and generate comprehensive, integrated knowledge which reflects the rich variety of ecosystems that make up Canada's vast Arctic terrain, rather than a patchwork of local knowledge.

Box 1 – Polar Continental Shelf Program

The Polar Continental Shelf Program (PCSP) provides advice, logistics coordination, and planning for eligible research initiatives in Canada's north. If your logistics needs are beyond what a research station or local authority can provide, consider applying to the PCSP for logistics support during their annual application period, which usually occurs in October of the year preceding your field research project.

- Researchers from Canadian federal and territorial governments, universities, and northern organizations are eligible to apply for direct, in-kind support and logistics coordination from the PCSP (i.e. the PCSP may be able to defray all or a portion of direct logistics expenditures for projects).
- International researchers may apply for PCSP logistics coordination support in Canada's north that, if feasible, would be provided on a recoverable basis (i.e. all expenditures associated with the logistics provided for a project would be invoiced to the client).
- The PCSP can provide field equipment for loan to eligible projects for work in Canada's north, including communications equipment, camping gear, winter clothing, field vehicles and safety supplies.

Source: https://www.canada.ca/en/polar-knowledge/online-portal-for-researchers.html

A number of federal science-based departments and agencies operate Arctic-relevant programs. For instance, the National Defence and the Coast Guard are focused on Arctic sovereignty, the National Research Council has a northern infrastructure research and development program, and Transport Canada runs an aerial surveillance program. Some rely on the PCSP for logistics.

Selecting the right projects and optimizing logistics are so important given the combined high cost of and limited resources for conducting research in the North, coupled with the continued growth of Arctic and Subarctic scientific activities. The PCSP's project selection process, as summarized in the Independent Assessment of the Program, is quoted in Box 2. Evolving project scoring criteria and northern community engagement may offer opportunities for improving program outcomes.

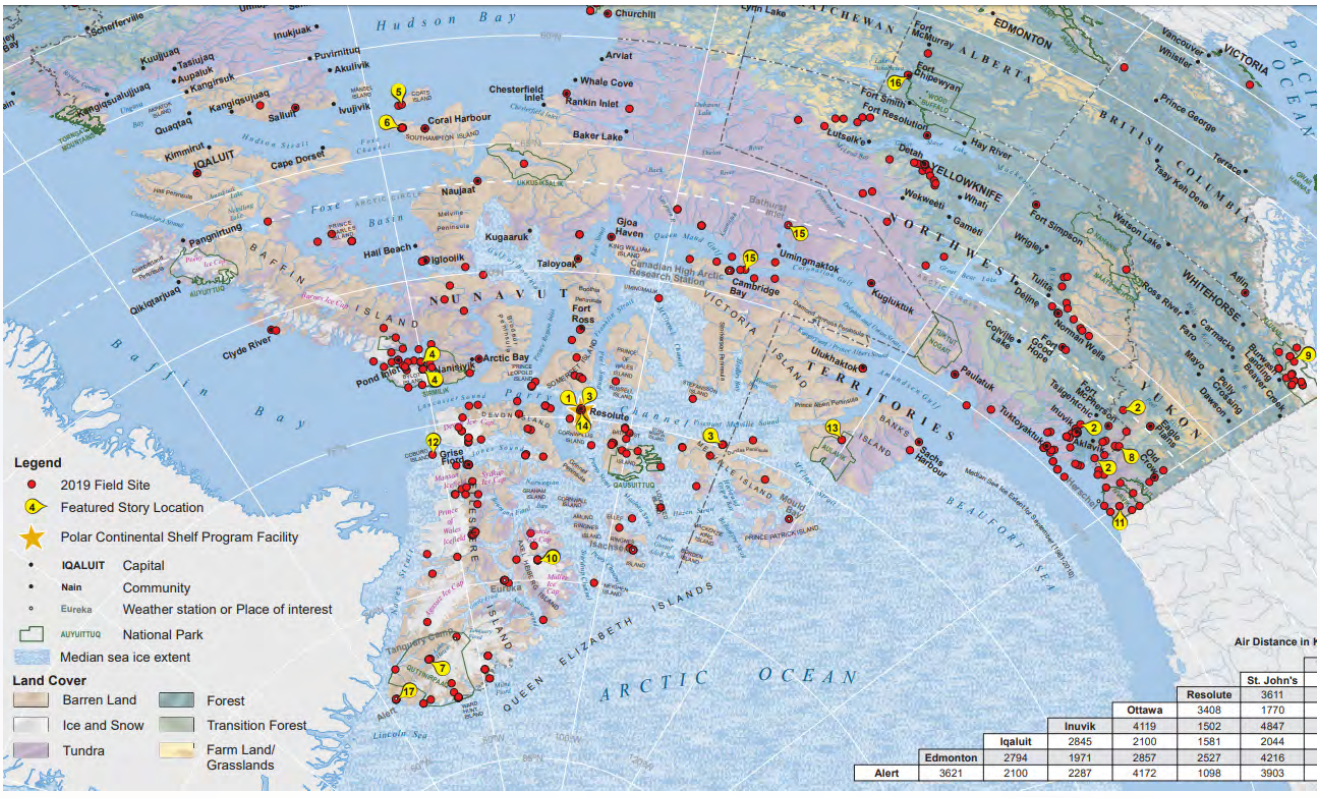

Figure 3. Field sites supported by the PCSP in 2019 (from annual science report)

Box 2 – PCSP Project Selection (as described in an independent assessment of the program)

All applications deemed within the mandate of the PCSP are subject to a project selection process. Projects are evaluated for logistics feasibility, including the timing and dates requested, details on health and safety plans and field methodologies, and the cost-effectiveness of PCSP coordination. The Program sets an annual target with respect to the allocation of the various user groups. According to documentation, the PCSP allocates its direct logistics support as follows: 42% to the federal government; 43% to Canadian universities; and 15% to territorial governments and northern organizations (including Indigenous organizations).

To prioritize government projects that are deemed feasible, the PCSP seeks advice from a coordinator at the director-general level, nominated by each federal or territorial government, for assistance with prioritizing projects for in-kind support. University projects are reviewed by a project review committee consisting of scientists from academia and government with expertise in Arctic science (with a balance of gender, area of expertise, career stage and institutions). Projects are ranked based on the Review Committee Scoring Guide, which includes criteria for feasibility (including health and safety, location, costs and logistics), scientific recognition (including awards, grants and publication records), overall quality of applications, number of students involved and degree of local involvement. Document review supported that the scoring guide was built using criteria consistent with those used by federal research funding councils.

Stakeholders interviewed as part of the assessment generally agreed that the PCSP's selection process for academic projects was adequate. Interviewees who served on the review panel had positive comments on its composition and the assessment process for university projects, although a few recommended adding northern or community representation. A number of interviewees stated that the review process disadvantages some categories of researchers, including community-based researchers, those working in the Western Arctic, social scientists and emerging researchers. The diversity aspect of the selection is further discussed in the GBA plus analysis section (Section 4.3.6). A few stakeholders mentioned that the advisory committee (disbanded in 2016) was an effective mechanism for the Program to learn about user/stakeholder needs and how other institutions were supporting northern research.

As part of the administrative data review, spreadsheets used to calculate the total scores were examined for the 2014–2020 field seasons. According to the information, 89% of all applications from non-federal users were accepted during the period. A review of the scores indicated that many were deemed strong by the selection committees. However, among the projects that were accepted for support, about 7% scored low for the quality of the science (score of 1.5 or less on a scale of 3). About 2% of the projects received low scores both for science and for student/community involvement.

Source: Independent Assessment of the Polar Continental Shelf Program (canada.ca)