

Research Article

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Bilateral collaboration between the Greenland (Kalaallit Nunaat) and United States Research Communities – from a vision to everyday practice

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Abstract

Each year, hundreds of international researchers enter Greenland to conduct scientific fieldwork. Historically, they have had little interaction with local communities and scientists at Greenland research institutes. Recognising that collaboration between Greenland and the United States can yield better research, consider more diverse perspectives, articulate the benefits of research to Greenland society, and train the next generation in a collaborative framework, representatives from both countries have been engaged in a series of events to cultivate bilateral relationships. Here, we describe the process of these events (workshops, conference sessions, and public dialogues), the findings, and the outcomes that have followed. Prior to this focused engagement, United States and Greenland scientists typically pursued their research independently. Since the engagement, more researchers from both countries have successfully partnered to obtain funding for collaborative research. Furthermore, development of a bilateral collaboration network is underway. The focused approach on bilateral engagement also proved essential for maintaining research and other activities during the global pandemic. When United States researchers were prevented from entering Greenland, their Greenland partners were able to continue the fieldwork, ensuring that progress was not lost. Future international projects can build on these successes to expand collaborative and interdisciplinary research in Greenland.

Introduction and Background

Historically, Greenland and United States (U.S.) scientists have pursued their research in and about Greenland independently, rarely crossing paths and even more rarely, collaborating on their goals (Holm, Grenoble, & Virginia, 2011). Locally referred to as “hit and run” or “fly-in fly-out” researchers (Nordic Council of Ministers, 1997; Graugaard, 2021), international scientists have been visiting Greenland since the late 1700s (Nordic Council of Ministers, 1997 and therein). American scientific expeditions to Greenland increased during World War II and the Cold War, and in modern times, regular visits from international scientists to Greenland are commonplace. The fly-in fly-out practices have typically resulted in mistrust of the visiting international scientists, and consequently also of the local Greenland scientists, probably because of the short period of time that a researcher spends in a specific area or with a specific group of people and the lack of communication with local communities (Nordic Council of Ministers, 1997). With these approaches, it has not previously been possible to co-develop research projects, and therefore, there was no anchoring of the science and its results in Greenland. And there was little support or championing of science within the local communities.

These scenarios are particularly true for natural scientists who often only transit through local communities as they access remote locations such as the Greenland Ice Sheet. Furthermore, collaborations with the local research community in Greenland have been rare because U.S. and international natural science research has focused largely on basic questions whereas scientists based in Greenland tend to work on more applied problems. Social scientists, by the nature of their work, have tended to be more collaborative with local communities and

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many have worked to overcome language barriers, understand cultural differences, and collaborate on research efforts (Culler, Lund, Nyman, & Virginia, 2019). This distinction is important and understanding it early on allowed the efforts described herein to focus on what had been successful for the social scientists and what was lacking in the approaches of natural scientists. However, greater emphasis by all scientific disciplines on co-production and meaningful engagement will improve local understanding of and attitudes towards scientific research. For the purposes of this manuscript, a “local community” is a village or municipality and its residents (the public), whereas the “local research community” refers to Greenland’s research institutions and its researchers.

Recently, the U.S. and Greenland research communities have been engaged in ongoing conversations and implementing activities and events to develop more collaborative research. The results, described herein, include new and stronger research collaborations and co-production of knowledge that also leverages resources and expertise of local community members. To understand the significance of these developments, it is important to first contextualise the research communities in question, their history, their culture, their knowledge, their research processes, and the construct (or structure) of research within their communities – in this case, both that of the Greenlanders and of the U.S. scientists.

Greenland research structure and culture

Greenland has 56,367 inhabitants (as of July 2020) scattered in towns and settlements along the coastline, with most living on the southern west coast (Greenland Statistics, 2020). The world’s largest island, with 81% covered by ice, has the lowest population density in the world. No roads exist between towns, and immigration is limited with only ~2% of the population being foreign nationals (Greenland Statistics, 2020). The majority of the population (~90%, Central Intelligence Agency, 2021) derives from Greenland Inuit, whose ancestors have inhabited the land for centuries. Studies providing genetic evidence show that modern-day Inuit in Greenland are direct descendants of the first Inuit pioneers of the Thule culture (Moltke et al., 2015). Closely related to Inuit in Alaska and Canada, Greenland’s Inuit refer to themselves as Kalaallit (Greenlanders) and speak the Inuit language, Kalaallisut, which is the official language. The second language of the country is Danish (International Work Group for Indigenous Affairs, 2020) due to the colonial past and Greenland’s present-day ties to Denmark as a Self-governing part of the Kingdom of Denmark.

Sporadic contact and retail trade among Inuit and whalers from Europe began in the 15th century (Gad, 1954a). With systematic colonisation initiated by the King of Denmark in 1721 (Gad, 1954b), the Inuit were introduced to the western world view and ways of life. After the United Nations was founded, and global decolonisation commenced, Greenland became a Danish constituency in 1953, but a push for greater autonomy from Denmark arose with Danish assimilation policies in the 1950s–1970s (Olsen & Shadian, 2016). A political movement in Greenland culminated with the adoption of the Home Rule Act in 1978, with which the Government of Greenland (Naalakkersuisut) and the Parliament of Greenland (Inatsisartut) were established. Consequently, Greenland has been a self-governing country within the Danish Realm since 1979 with sovereignty and administration over different areas including education, scientific research, health, fisheries, environment, and climate, among others. In 2009, Greenland entered into a new era with the Self-Government Act, which gave Greenland

Table 1. A list of the major Greenlandic organisations, institutions, and current arrangement of government ministries that support and conduct research

| |
|---|
| 1. Greenland Survey Asiaq |
| 2. The Arctic Gateway Isaaffik |
| 3. Center for Arctic Technology Arctic DTU – Ilinniarteqarfik Sisimiut |
| 4. Queen Ingrid’s Hospital Dronning Ingridip Napparsimmavissua |
| 5. Geological Survey of Denmark and Greenland – GEUS, Nuuk Office |
| 6. Greenland National Museum & Archives Nunatta Katersugaasivaa Allagaateqarfialu |
| 7. Greenland Representation in D.C. Kalaallit Nunaata Washington, D.C.-mi Sinniisoqarfia |
| 8. Greenland Research Council Nunatsinni Ilisimatusarnermik Siunnersuisoqatigiit |
| 9. University of Greenland Ilisimatusarfik |
| 10. Greenland Centre for Health Research |
| 11. Greenland Perspective |
| 12. Institute of Education Sciences Inerisaavik |
| 13. The Arctic Hub |
| 14. Greenland Institute of Natural Resources Pinngortitaleriffik |
| 15. Greenland Climate Research Centre Silap Pissusianik Ilisimatusarfik |
| 16. Statistics Greenland Kalaallit Nunaanni Naatsorsueqqissaartarfik |
| 17. Mineral Resources Authority Aatsitassanuat Oqartussat |
| 18. Ministry of Agriculture, Self-Sufficiency, Energy, and Environment Nunalerinermut, Imminut Pilersornermut, Nukissiuinut Avatangiisinullu Naalakkersuisoqarfik |
| 19. Ministry of Mineral Resources and Justice Aatsitassanuat Inatsisillu Atuutsinneqarnerannut Naalakkersuisoqarfik |
| 20. Ministry of Education, Culture, Sport and Church Ilinniartitaanermut, Kultureqarnermut, Timersornermut Ilageeqarnermullu Naalakkersuisoqarfik |
| 21. Ministry of Fisheries and Hunting Aalisarnermut Piniarnermullu Naalakkersuisoqarfik |

further self-determination within the Kingdom of Denmark (Danish Parliament, 2009).

The creation of Greenland’s research policy was first discussed by the Greenland National Council (Landsrådet) in 1955 to examine the effects of several Reforms in Greenland after 1945. This led, among other things, to the establishment of the “Advisory Committee on Social Research in Greenland” in the 1960s. In 1974, the National Council suggested the establishment of a cultural and social research institute. After the introduction of the Home rule government in 1979, a new period began, with the establishment and consolidation of research institutions in Greenland (Nordic Council of Ministers, 1997).

Most of Greenland’s current research institutions were established between 1979 and 1994 (Table 1). More recently, the institutions have begun housing various research centres which are funded by a mixture of internal and external funds.

Nunatsinni Ilisimatusarnermik Siunnersuisoqatigiit (Greenland Research Council), a national and independent organisation, was established by the Inatsisartut through legislation no. 5 on 29 November 2013 (Inatsisartut, 2013). Research and granting of research funds forms the legal basis for the Greenland Research Council, with the overall purpose of promoting and strengthening research that is rooted in and benefits Greenland. The Research Council finances research and provides research professional advice to Naalakkersuisut and Inatsisartut. The Council’s work ranges from an overall coordination and prioritisation of research efforts in Greenland to the strengthening of research collaborations within and outside of Greenland, as well as the promotion of collaborations between public and private research, and increased dissemination of Greenland’s research (Nunatsinni Ilisimatusarnermik Siunnersuisoqatigiit, 2020).

Since 2017, over 100 individual projects have been conducted by Greenland institutions such as Asiaq (Greenland Survey),

Pinnngortitaleriffik (Greenland Institute of Natural Resources, GINR), and Ilisimatusarfik (University of Greenland) (Table 1). Most of these projects are in locations along the coastal areas (Fig. 1(a)). Greenland's research institutes are listed in Table 1.

A national Greenland research strategy, defining long-term visions and goals for local, national, and international research in Greenland, is being developed. The strategy will form the framework for realising research policy objectives in the coming years. A national strategy and research policy objectives will create a common structure to conduct research and to improve coordination between institutions, opening up new opportunities and new activities. Ilisimatusarfik, Pinnngortitaleriffik, and Asiaq have had their own research strategies and frameworks. The lack of a national strategy, in many cases, has meant a lack of well-coordinated or supportive research of each respective institution's efforts, and therefore, it did not necessarily evolve into what otherwise could have been possible.

Due to the limited amount of Greenland resources allocated to research, both financial and human, it is difficult to conduct large-scale and/or equipment-demanding research projects with only Greenland resources. It is in many ways a necessity to collaborate with international partners. With the development of a strategy and policy objectives, it will be possible to define a common structure for collaboration to the benefit of multiple organisations or partners. It is also important to note the fact that, due to capacity limitations, Greenland researchers are unable to participate in all of the research that foreign institutions conduct in Greenland. It is therefore important to define what types of research and research projects that Greenlanders and Greenland's research institutions wish to perform and what types of projects can be disregarded or omitted, at least for now. The research culture in Greenland has not previously been developed to the extent that practitioners share knowledge and/or funding with other local institutions. Beginning the process of developing a national research strategy has provided opportunities for meeting, networking, and discussing these issues. The mutual understanding of the necessity of collaboration and framing the collaborations has already begun to improve.

The forthcoming research strategy will also contain an action plan with initiatives that will help realise the strategy's visions and goals. While the establishment of the International Arctic Hub (IAH) was an initiative by the Governments of Greenland and Denmark, the reinforcement (additional contribution, development, and strengthening) of IAH to create new opportunities and facilitate increased international cooperation in Arctic Research is one of the prioritised initiatives in the strategy (Naalakkersuisut 2019a, 2019b). This initiative aligns with the goals of the Arctic Council's Agreement on Enhancing International Arctic Scientific Cooperation (Arctic Council, 2017), which entered into force in May 2018.

United States research structure and culture in Greenland

U.S. scientists have been travelling to Greenland since at least the late 19th century and have had a regular presence since World War II (Nordic Council of Ministers, 1997). In the early days, efforts were focused on exploration and discovery (e.g. Peary expeditions, 1886, 1891, 1893, 1898), and by the mid-century era, research efforts mainly supported military operations (e.g. Operation Nanook, 1946; Benson traverses 1952-56, the secretive Project Iceworm at Camps Fistclench and Century 1957-1967, Greenland Ice Sheet Project (GISP) 1971-1981). Following the Cold War, attention turned to understanding climate history

and in recent decades to understanding the ongoing process of climate change (e.g. GISP2).

Currently, U.S. government agencies support approximately 50 research projects in Greenland per year. To conduct these annual projects, roughly 300 U.S. scientists enter Greenland to pursue fieldwork at over 80 locations around the country (many of these locations are semi-autonomous instruments, Figs. 1(b) and 2). The leading funding agencies are the National Science Foundation (NSF) and the National Aeronautics and Space Agency (NASA). Other funding agencies include the National Oceanic and Atmospheric Administration (NOAA), the Smithsonian Astrophysical Observatory (SAO), and the National Institutes of Health (NIH).

The NSF's Office of Polar Programs' (OPP) Research Support and Logistics (RSL) programme coordinates support of NSF-funded research as well as research funded by the other government agencies. RSL, whenever possible, relies on local Greenland infrastructure and resources (e.g. AirGreenland, Royal Arctic Line, Mittarfeqarfiit, Kangerlussuaq International Science Support (KISS)). However, with an area allotment permit issued by the Government of Greenland, NSF owns and operates the infrastructure and facilities at Summit Station (located at the centre of the Greenland ice sheet), the only high altitude, high latitude, inland, year-round observing station in the Arctic. While Summit Station does operate year-round, the majority of U.S. science in Greenland occurs in the coastal areas during the summer months between late April and mid-September (Figs. 1 and 2).

Past collaborations

While many U.S. scientists have engaged in the fly-in fly-out model, there have been several successful efforts by U.S. and Greenland researchers to lead projects collaboratively (Culler et al., 2019). Two examples of projects led by natural scientists with significant collaboration and community engagement are the Integrative Graduate Education and Research Traineeship (IGERT) programme in Polar Environmental Change and the Joint Science Education Project (JSEP) which is jointly funded by NSF and Naalakkersuisut. These projects are not typical research activities as they focus on education and training, but we briefly describe how elements of these programmes can help reshape future U.S.–Greenland collaborations. We also note that collaborations among U.S. and Greenland natural scientists are currently expanding. This is a result of recent funding solicitations from the U.S. NSF (National Science Foundation, 2020) that awards funding to projects that emphasise U.S. collaboration with Arctic partners and communities (See section below).

IGERT and JSEP

The IGERT and JSEP programmes have brought together students, educators, and natural scientists from the U.S. and Greenland for training and to conduct interdisciplinary research on environmental change in Greenland. Collaboration and community engagement are core to these projects, which share a goal of preparing the next generation of researchers to work more collaboratively. The IGERT programme in Polar Environmental Change trained 25 science and engineering Ph.D. students from the U.S. through a field course in Greenland, and a broader curriculum that was developed with Ilisimatusarfik (University of Greenland), the Inuit Circumpolar Council, and other partners in Greenland (Culler, Virginia, & Lipfert, 2014). During IGERT, several students from Ilisimatusarfik were hosted for an exchange at Dartmouth

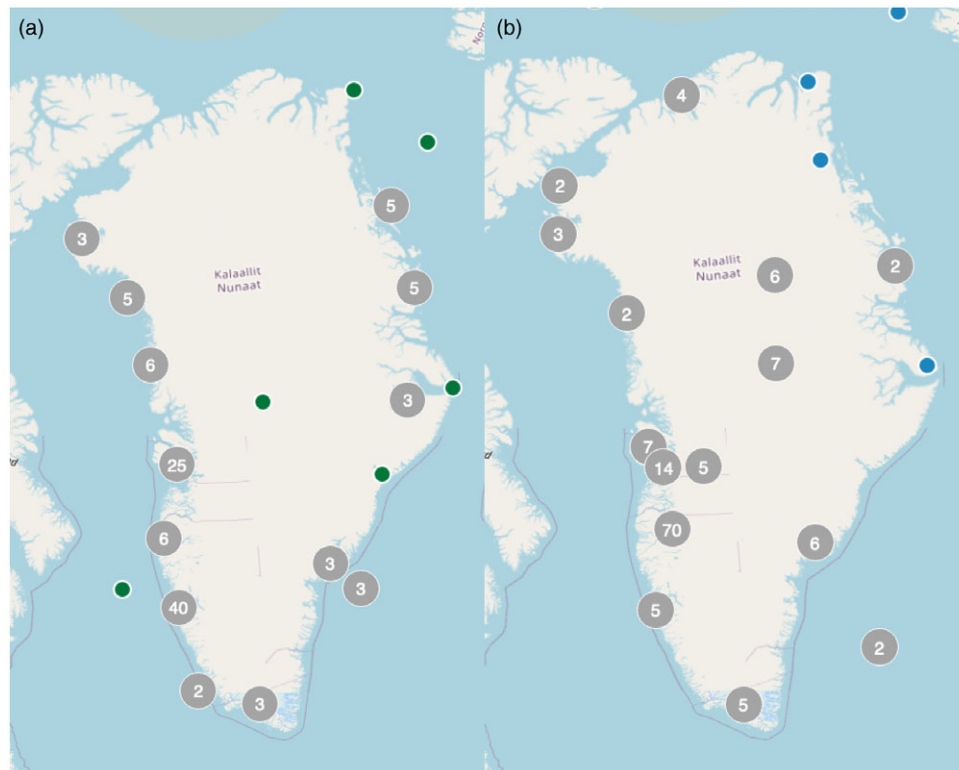


Fig. 1. (a) Map showing the number of projects conducted by Greenland institutes since 2017. (b) Map showing the number of U.S.-funded research projects in Greenland since 2017. Green/blue dots indicate one project at a site. Maps generated on 30 November 2020. For updates, visit www.isaaffik.org.

College. Since 2007, JSEP has brought together high school, undergraduate, and graduate students from the U.S., Greenland, and Denmark for a three-week field course in Greenland. Scientists, as well as undergraduate and graduate students, share their research and mentor the high school students as they complete inquiry-driven research projects in Greenland's tundra and on the Greenland Ice Sheet. In addition to training in natural science research, both programmes intentionally create opportunities for cultural sharing and meaningful dialogue about the human dimensions of Arctic change. We suggest that this is one reason why recent evaluation data (unpublished) from both programmes indicate that students form long-lasting relationships that will very likely underlie future U.S. and Greenland research collaborations. Additionally, students in both programmes have been required to share their research with the public. IGERT students shared their research at a public event at Katuaq, the cultural centre in Nuuk, and JSEP students have presented their research at the Kangerlussuaq international airport where they reach hundreds of people travelling to, from, and within Greenland. Emphasis on communication helps students practice this skill and learn the integral role of communication in the processes of research and collaboration. After participating in JSEP and IGERT, several students have continued to work collaboratively on projects in Greenland and assessment of outcomes will continue as these students take the next steps in their education and careers.

Cooperative policy agreements

Joint committee

In 2004, Greenland, Denmark, and the U.S. signed an update to the 1951 defence agreement and two additional political declarations

that broadened and deepened cooperation between the U.S. and Greenland. Specifically, the *Igaliku Agreements* created the Joint Committee, which serves as an expanded forum to promote cooperation across a diverse range of policy areas, including environment, science, health, technology, trade, tourism, education, and culture (Igaliku Agreement, 2004). Both the IGERT and JSEP projects were considered flagship activities under the Joint Committee.

Agreement on enhancing international arctic scientific cooperation

More recently, in 2017, the eight Arctic Council member states signed an Agreement on Enhancing International Arctic Scientific Cooperation (Arctic Council, 2017). The legally binding agreement is aimed at facilitating access for scientists into the Arctic, but it also calls for the promotion of education, career development, and training opportunities as well as encouraging activities associated with Indigenous and local knowledge (USARC, n.d.).

A vision towards increasing bilateral collaboration – our process & findings

As the second largest body of ice in the world, more than 7 metres (~23 feet) of sea level rise are “locked up” in the Greenland ice sheet (IPCC, 2019), making Greenland the subject of important research contributing to advancing the understanding of how climate change around the planet will unfold. In light of this increasing interest in Greenland and its role on the world stage, the need for bilateral collaboration has been recognised as more important than ever.

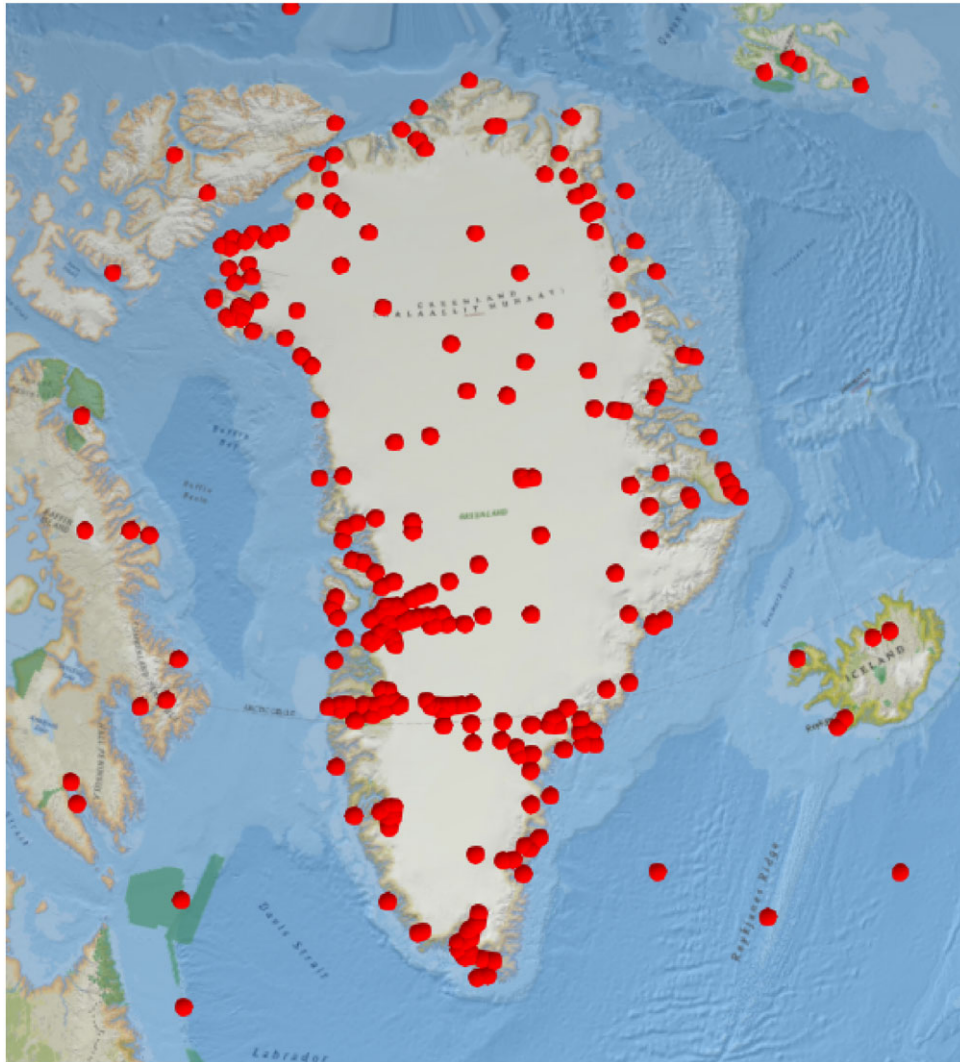


Fig. 2. U.S. research project sites in Greenland during 2019. Many of the sites are autonomous instruments only. Map generated on 30 November 2020. For updates, visit www.arnmap.org

Embassy science fellowship

As noted above, the Joint Committee had some notable successes in IGERT and JSEP. However, in order to further advance science diplomacy (the promotion and facilitation of scientific collaboration) and research dissemination, the Joint Committee’s working group on Environment, Science, Technology and Health (ESTH), chaired by the Regional ESTH Hub at the U.S. Embassy in Copenhagen, recognised a need for “boots on the ground” not just at research locations in Greenland, but in Nuuk, home of Naalakkersuisut and Ilisimatusarfik. Until this point, science diplomacy was being conducted with limited funding amongst counterparts spread across four time zones. One outcome of an ESTH working group meeting in 2014 was to better clarify the development of potential collaborations of research activities between the U.S. and Greenland. From there, the group held a series of meetings that led to the concept of a science fellowship programme in Nuuk. In a model collaboration, the Government of Greenland, and the ESTH Hub developed a strong and cost-efficient proposal for an Embassy Science Fellowship (ESF) and secured support from the U.S. State Department, Embassy leadership, NSF, and Greenland and Danish counterparts.

The inaugural Embassy Science Fellowship would be focused on three major objectives:

- Facilitating discussion among researchers, educators, and government representatives to further develop the concept and development of an international Arctic science research hub located in Greenland.
- Facilitating the joint development of new Science, Technology, Engineering, and Mathematics (STEM) educational initiatives and activities, in collaboration with relevant U.S. agencies, institutions, and other resources.
- Promoting and coordinating international research with the Greenland Research Council.

In 2017, Greenland welcomed its first-ever ESF to work not just *with* the Government of Greenland, but also to work *from within* the government. The Fellow was assigned to the Ministry of Education, Culture, Research and Church. During the Fellow’s weeks in Nuuk, over a dozen meetings were held with various national entities to allow the development of an in-depth understanding of the research structure, activities, capacity, and resources in Greenland. Three central themes began to emerge that

characterised the Greenlanders' perspectives on and desires for science in Greenland:

- To improve advances in science, it is crucial to increase participation of local communities in research and to share knowledge (between researchers and community members) of observations, results, and natural processes. There is a sense that scientific results often echo Indigenous and local knowledge.
- There is a strong desire within Greenland's local research community (Government, University, Institutes) to improve collaboration and coordination of research with international scientists working in Greenland. Discussion with the local Greenland researchers frequently included questions which echoed those often asked within the local communities, such as "What are the international researchers actually doing here?" and "What are the results of their work?"
- There is a desire to improve the student experience in STEM education and a need for research into how to improve student achievements. Greenland's educators would like to connect more real-world scientists with their students and facilitate hands-on learning, experiments, and experiences. This could also help to strengthen English learning at earlier ages and thus improve communication with international audiences, increasing future educational and professional opportunities.

Once the initial phase of the fellowship was completed, both the Government of Greenland representatives and the U.S. Government representatives went back to their respective research communities to discuss the topics and themes that had emerged. The Government representatives continued to meet via video conference to compare input and feedback received from their respective research communities and to identify areas of synergy, opportunities for leveraging, and next steps in the process. Of note was the affirmation that both research communities (U.S. and Greenland) shared similar desires for increased interaction, coordination, and collaboration. Three opportunities for next steps were identified:

- Facilitate a workshop in Nuuk to bring U.S. and Greenland researchers together to discuss best practices and ways for researchers to improve engagement and collaboration.
- Identify opportunities, such as workshops, classroom visits and field projects, to bring U.S. teachers together with Greenland teachers and foster collaboration on STEM education.
- Develop a pilot programme to facilitate U.S. researcher visits to Nuuk and foster communication and collaboration with the local research institutions and increased interaction with the local communities to help improve societal understanding of their research and its significance.

The rest of this publication focuses on the first activity listed above (a joint workshop), its follow-on activities, outcomes, and recent developments that resulted from this effort. It should be noted that the other two activities (bringing teachers together and facilitating U.S. researcher visits to Nuuk) are both being pursued.

Bilateral workshop

The most tangible outcome of the first ESF in Nuuk was holding a workshop, involving U.S. and Greenland researchers, to identify opportunities to strengthen research collaborations between the two countries. In August 2018, nearly fifty researchers from Greenland and the U.S. assembled for two days in Nuuk at

Pinngortitaleriffik (Greenland Institute of Natural Resources, GINR) to explore a new model for research in Greenland and to identify and set priorities for future collaborative work and funding. Participants learned about research organisation and infrastructure in Greenland, participated in interactive panels, and discussed how to develop and facilitate successful collaborations. The culminating activity of the workshop was setting priorities for future work and funding related to Research & Co-Production of Research, Public Outreach, and Education & Student Training. The group was enthusiastic about working together and optimistic that future research co-led by scientists from Greenland and the U.S. would be mutually beneficial.

The key findings and recommendations from the workshop are captured in a report that is freely available online in English and Kalaallisut (Culler et al., 2019). Participants agreed that more can be done by individuals, institutions, and funding agencies to overcome barriers to implementing joint projects (Fig. 3, Table 2). Researchers appreciated the chance to meet in-person, which they cited as important for building relationships and trust. An overarching conclusion was that U.S.–Greenland collaborations will strengthen if researchers work together intentionally and continuously. Starting collaborations early to co-define project questions and objectives and allowing adequate time to develop trusted partnerships with defined roles were two of the key recommendations (Fig. 3, Table 2). The report contains many specific ideas, mechanisms, and contacts for U.S. and Greenland researchers as they consider future work in Greenland (Culler et al., 2019).

Public dialogues & conference sessions

Following the workshop, the Greenland Representation in Washington, D.C., spearheaded two events to further showcase and bring the findings and recommendations of the workshop report to a wider audience as well as to further cultivate bilateral networks and relationships. The events ensured that the findings would reach diverse audiences in the U.S. and internationally.

Wilson Center

The first event (September 2019) was hosted at the Woodrow Wilson Center in Washington, D.C. as part of the Polar Institute's Greenland Dialogues. Titled "Greenland - U.S. Research Cooperation: Exploring a New Model for Research in Greenland," the event featured opening remarks by the Greenland Minister of Foreign Affairs, followed by members of the Greenland research community sharing perspectives on opportunities and challenges of interdisciplinary and international collaborative research in Greenland (Wilson Center, 2019). In her opening remarks, the Greenland Minister of Foreign Affairs noted, "We welcome the international research, and are glad in [that] sense, that we can contribute, but we need to secure real involvement of the communities. Too often we, the inhabitants of the Arctic, experience scientists coming to our homelands, doing their research, and then leaving again without having involved [our] communities." Members of the U.S. research community discussed the importance of Greenland to the U.S. research community and how they are working to build national capacity for conducting ethical research in Greenland. The 2018 workshop report findings and recommendations were shared and discussed with a focus on setting the tone for future research in Greenland. The event was the first of its kind with several members of the Greenland research community present in the U.S. to engage directly with an American audience. The event in itself thus represented an

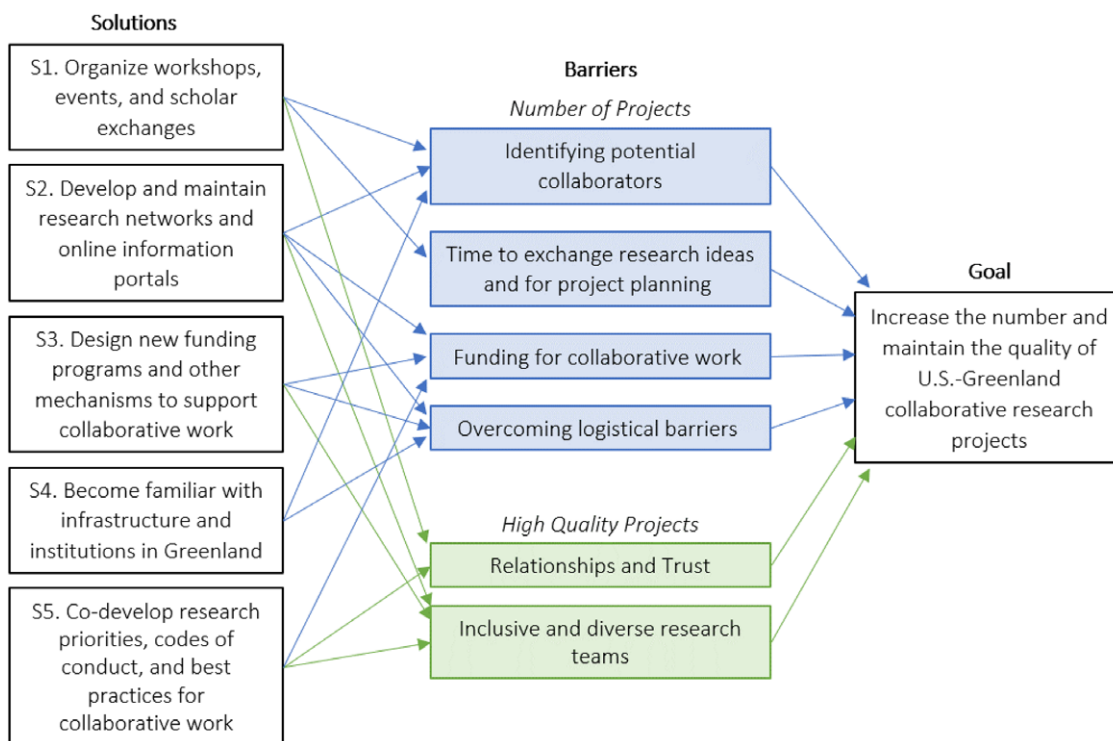


Fig. 3. This diagram lists the core barriers to successful collaborations and corresponding solutions (S1-S5) outlined during the 2018 Nuuk workshop. Used with permission from Culler et al., (2019).

Table 2. Major findings of the 2018 Joint U.S.–Greenland Workshop. The Nuuk workshop resulted in the following six overarching recommendations for improved Research, Co-Production of Research, Public Outreach, and Education & Student Training

| Six Key Recommendations |
|---|
| 1. Host workshops, symposia, and scholar exchanges year-round that bring researchers together in-person |
| 2. U.S. universities with significant research presence in Greenland should pursue self-funding for workshops and student and scholar exchanges |
| 3. Use online networks and websites to describe research projects based in Greenland and seek collaborations |
| 4. Co-develop research priorities, codes of conduct, and best practices for collaboration and research co-production |
| 5. Engage potential research partners and Greenland communities early and often during research |
| 6. Make public outreach and training of U.S. and Greenland students an explicit goal of all research projects |

important step forward in the bilateral relationship between the U.S. and Greenland where Indigenous Kalaallit researchers could convey the wants and needs for collaborative research with Greenland research institutions, anchored in Greenland, and with and to the benefit of Greenland communities and Greenland society as a whole.

Arctic Circle Assembly

Shortly after the Wilson Center event, the discussion was brought to an international audience, as experts convened at the Arctic Circle Assembly in Reykjavík, Iceland (October 2019) for a session titled “Increasing Engagement Between the Greenland and U.S. Research Communities – Bridging The Gap” (Arctic Circle Assembly, 2019). Seven members of the research communities (four from Greenland and three from the U.S.) delivered remarks

about their experiences with collaborative research with emphasis on improving the conduct of research between the U.S. and Greenland and on the conduct of Arctic research, generally. By sharing key recommendations from the report and highlighting first-hand experiences of collaborative research in Greenland, barriers and ideas for improving the conduct of Arctic research were discussed.

Moving to everyday practice of bilateral collaboration – outcomes & new developments

The events in Washington, D.C., and Reykjavík in the fall of 2019 provided important platforms for in-person follow-up to the 2018 workshop, while engaging broader U.S. and international audiences to cultivate further the bilateral relationships between researchers interested in – or already conducting – research in Greenland. As one of the key findings of the 2018 workshop report (Culler et al., 2019) pointed to, in-person meetings are crucial to further build understanding, relationships and trust between local and international researchers. Continuously identifying opportunities to meet in-person and ensuring that Greenland researchers are represented at events discussing research *in* Greenland is imperative to de facto improve the conduct of Arctic research by ensuring the consideration of diverse and local perspectives and the articulation of the benefits of research to Greenland society.

New partnerships, collaborations, and engagement

Several new collaborations have been initiated since the workshop and follow-up events. The Greenland Research Council and the Arctic Hub report a much greater frequency of requests from both natural and social scientists to discuss collaborations that include human dimensions (J. Nymand, personal observation). At the

same time, there is an increasing acceptance of how the longevity of Indigenous and local knowledge and observations adds to the quality of research conducted. U.S. funding agencies are increasingly implementing programmes that encourage co-production of knowledge and international collaborations, such as NSF's "Navigating the New Arctic" (NNA) (National Science Foundation, 2020). One NNA project is supporting U.S. researchers who have partnered with Greenland researchers and local community members to develop and implement renewable energy solutions in Qaanaaq, Greenland (National Science Foundation, 2019). Another NNA project, called "Greenland Rising," is a partnership between U.S. and Greenland researchers studying anticipated land and sea level changes around Greenland. Importantly, NNA also solicits proposals for planning grants that support "activities leading to convergence research team formation and capacity-building within the research community," which addresses the need for time to develop trusted partnerships.

Greenland science week

In December 2019, the inaugural Greenland Science Week (GSW) was hosted in Nuuk. International researchers were welcomed by the municipality and all of Greenland's research communities. More than 200 researchers, students, educators, and administrators from Greenland, Denmark, Europe, and the U.S. participated in the five day event. The concept for initiating a GSW emerged in relation to the ending of the Polar Research Day that had been held in Denmark annually for approximately 20 years. The Polar Research Day started from the need for collaboration and sharing of research platforms to realise both cost and logistics efficiencies during fieldwork in remote areas of Greenland. The meeting also included the sharing of experiences, scientific results, and the discussion of new research questions and projects. This need for sharing of platforms, logistics, experiences, results, and new ideas still holds. Thus, it was decided to implement a new meeting held annually in Greenland. During the early planning of the inaugural GSW, it became clear that when people would eventually make it to Greenland for attending a "Polar Research Day," there should be more to it than a one-day event. Therefore, the format was expanded and researchers were invited to conduct seminars, stakeholder meetings, workshops, and student courses, thus forming "a week of science" that ended with one day of outreach and student projects. The original plan was to organise GSW annually, however, due to the pandemic and limited resources, the larger event will probably take place biannually, with a smaller more local event in the alternating years.

Researcher network

One significant outcome of the 2018 Nuuk workshop is an initial U.S.–Greenland research network that is expected to expand in the coming years. Participants in the workshop have developed joint proposals, revised project plans related to education and outreach, and are planning future activities and proposals based on the growth and potential of U.S.–Greenland collaborations on Arctic research. Future networking activities are aimed at maintaining and expanding the initial network, co-planning projects that directly address priority research themes identified by the Greenland Research Council and creating new opportunities for research exchanges and student training in Greenland. These ongoing interactions, whether in-person or virtual, will ensure that researchers can do better research by working together, consider more diverse perspectives as they conduct their research, articulate

the benefits of research to Greenland society, and train the next generation in a collaborative framework.

OES small grants

In partnership with the Bureau of Oceans and International Environmental and Scientific Affairs (OES – a functional bureau within the U.S. Department of State), the Regional ESTH Hub at U.S. Embassy Copenhagen launched a small grants programme in Greenland in 2020 (three initial projects). In the spirit of past collaboration, strong consideration was given to projects aiming for true co-creation of knowledge, securing cost-efficiency through building on existing research networks and resources from the JSEP programme and the Fulbright Arctic Initiative (Bureau of Educational and Cultural Affairs, 2017). Building on the successful science fellowship in 2017, in 2021 the U.S. Embassy to the Kingdom of Denmark plans to deploy two more science fellows to Nuuk, one from Centers for Disease Control and Prevention (CDC – Alaska offices) and another from the National Science Foundation Office of Polar Programs (NSF/OPP).

Research during the pandemic

Interestingly, but not surprisingly, these efforts and initiatives had a substantial and positive effect on research efforts in Greenland during the pandemic in 2020. While the world came to a near standstill, some of the partnerships allowed for fieldwork to continue. Researchers were forced to learn new ways of working together in a virtual environment. Some projects indeed became more collaborative when U.S. researchers had to rely on local communities and researchers in Greenland to collect data to avoid lengthy project and research interruptions.

JSEP

In 2020, The JSEP programme, relying on the strength of existing partnerships, transitioned into a hybrid remote and field programme in just a matter of months. Participants from the U.S. were unable to travel and instead connected daily via video technology with the Kangerlussuaq-based Greenland and Danish students. One benefit was that more students from the U.S. could participate – 35 high school students instead of the usual five. Students shared their cultures through games and presentations and, using equipment that was shipped to participants ahead of the programme, collaborated on hands-on research activities. At the end of the programme, students shared their collaborative research projects using Zoom with audiences in Greenland, the U.S., and Denmark.

Greenland rising

Travel restrictions prevented U.S. researchers from travelling to Greenland for fieldwork during the pandemic in 2020. The outcome of the collaboration between scientists from Columbia University and GINR, on the NSF-funded project "Greenland Rising" depended on fieldwork taking place in 2020. Because the project was truly a collaboration between the two institutions, and there was already an agreement in place, it was possible for researchers in Greenland to conduct most of the fieldwork that had been planned for 2020 on their own with added support from local graduate students. Researchers from GINR travelled to North Greenland for interview studies and carried through conducting fieldwork from GINR's vessel "Sanna." The result was native Greenlandic speakers connecting with two communities . . . and the installation of the tide gauges became a school project and

was noted as “the first tide gauges installed by Greenlanders” (Robin Bell, personal communication, December 10, 2020).

In addition to these collaborations, Greenland’s research institutions were able to provide assistance to U.S. researchers who could not make it to Greenland during 2020. The Greenland Survey, Asiaq, helped NASA-funded researchers by deploying Greenland-based technicians to Inglefield Land in North Greenland to repair a meteorological station that had gone offline. GINR also did some maintenance and data collection on moorings in Melville Bay to support a U.S. researcher funded by the Office of Naval Research (ONR).

Conclusions & next steps

Successes and challenges

While the National Science Foundation and the U.S. Embassy to the Kingdom of Denmark have had long-standing strong relationships with the Government of Greenland, the Science Fellowship helped to provide another angle and level of understanding – one that led to true science diplomacy – where we were able to build on the foundation of those relationships to further initiatives for both the U.S. and Greenland and their respective research communities. With the fellowship, U.S. government representatives achieved a deeper understanding of the concerns and desires of Greenland and its research community which mirrored the concerns and desires of the U.S. research community. This allowed the two governments to jointly develop ideas for resolving these concerns. The fellowship and subsequent workshop, public dialogues, and new collaborations, coupled with the successes of the earlier Joint Committee projects and Greenland’s political objectives to promote and strengthen Greenland research that is anchored in Greenland and for the benefit of Greenland’s society, are all considered positive steps forward.

Even with the high level of success achieved by the ESF and other recent efforts, challenges and questions remain. One of the biggest challenges may actually lie within the successes themselves – shining a spotlight on bilateral collaboration and creating the networks to facilitate it has led to an increase in interest among U.S. researchers to collaborate with Greenland researchers. In addition, increased scientific interest in Greenland and more focus on Arctic and global scientific problems in general means that more and more international researchers are interested in working in Greenland. This presents a challenge in how to encourage co-production models without overwhelming Greenland researchers and infrastructure. Once completed, the national strategy for research in Greenland will likely help to identify priority areas of collaboration or themes on which to focus. Other questions have arisen, such as:

How do we facilitate meaningful engagement with local communities and incorporation of Indigenous and local knowledge? And, how do we ensure United States and other international researchers adhere to ethical and collaborative practices when working with different communities (both the research community and the local communities) in Greenland? Mechanisms and additional funding are needed to ensure follow-through of planned collaborations and inclusion of Indigenous knowledge in meaningful ways, as well as a way to assess and respond to the experiences of different Greenland communities (e.g. the public, researchers, and other stakeholders) as they work with U.S. researchers.

How do we incentivise collaborative and interdisciplinary efforts? This kind of work often requires more time than traditional

research projects and may result in products that have different impacts than standard peer-reviewed journal articles. Yet, metrics of collaboration, interdisciplinarity, and outreach are not fully integrated into academic evaluation systems. Especially as education programmes such as IGERT continue to train scientists for collaborative and interdisciplinary research, academic hiring, and promotion systems must give equal or greater value to this type of work versus traditional disciplinary work and rapid publication of scientific research.

As we exit the pandemic, how can we make use of new practices we’ve learned? U.S. and Greenland researchers have consistently cited the importance of in-person meetings for building relationships that underlie successful collaborative work (Culler et al., 2019). While this remains true, the pandemic forced researchers to learn new ways of working together in a virtual environment. Moving forward, researchers will be more comfortable using online meetings to stay connected throughout the research process while also allocating project funds for in-person meetings and fieldwork.

Next steps

Mitigating these challenges presents an increased need for a mechanism, or mechanisms, to coordinate and prioritise efforts. Importantly, continuity and progress in mitigating any of the challenges encountered may be exacerbated by the high turnover rate of funded scientists, diplomats, and government officials on both sides.

While most of the next steps focus on continuing the diplomacy efforts described, one new development will be key to leveraging and expanding upon the successes already realised. In 2020, long-discussed plans of an International Arctic Research Hub in Greenland progressed with the establishment of the International Arctic Hub’s (IAH) board of directors and a secretariat, tasked with managing implementation of the hub (Naalakkersuisut 2019a). The purpose of the IAH is to establish a unifying platform in Greenland for local, national, and international researchers as well as Arctic stakeholders (Naalakkersuisut 2019b). The IAH will assist with coordinating activities in research, education, international collaboration, dissemination to society, collaboration between researchers and business, and administrative collaboration. Integrating current and future U.S.–Greenland bilateral efforts with the IAH will be important in the development of a new model for conducting interdisciplinary international research with co-production of knowledge in Greenland. Conversely, lessons learned, successes, and challenges identified through the 2018 workshop, report, and subsequently continued collaboration between Greenland and U.S. researchers provide guidance and insights relevant to the further development and full implementation of IAH in the coming years.

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