FINAL REPORT

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1. EXECUTIVE SUMMARY

Today's Arctic is not the Arctic of twenty years ago, and the quickening pace of Northern change – social, economic, and environmental – will continue to transform the Arctic over the years to come. Although the region is in many ways unique, the dynamics of fundamental change in the Arctic is the same as anyplace else on Earth. Change creates opportunity for some and challenges – even crises – for others. Change exposes vulnerability, fuels innovation, and fosters resilience in every community, state, and nation it touches. Arctic Horizons identifies the diverse needs and priorities of Arctic social interdisciplinary research, which will give policy-makers and researchers the information and strategies they require to respond to – and get ahead of – the profound changes occurring in the Arctic.

The U.S. has significant and growing economic, security, and cultural interests in the Arctic. The creation of the NSF Arctic Social Sciences Program (ASSP) and the International Polar Year (IPY) transformed how social science is done in the Arctic. The US must continue and expand its leading role in Northern social science research. The changes occurring in the Arctic are broad and multidimensional, and ASSP takes an equally wide and comprehensive approach. ASSP–funded projects provide local, national, and international officials with the interdisciplinary knowledge they need to make effective policy, integrating natural science data with social science research methods. ASSP also emphasizes the importance of Indigenous peoples in this research and the development of Arctic policy. Indigenous people have lived there for millennia, and Indigenous communities and cultures have preserved a wealth of information about the Arctic, past and present. Their knowledge and unique insights are invaluable resources for understanding the rapidly changing Arctic and the public policy choices before us in this new age.

As the volume and diversity of human activities in the Arctic continue to increase, so too will the demand for social scientific study. Arctic Horizons is another step forward in the substantial growth and innovation in Arctic social science research which began with the ASSP visioning workshop in 1999.

Recommendations

- Expand the number of agencies, foundations, and organizations with incentives to include funding for Arctic social science research in their mandates.
- Pursue international, interdisciplinary, and comparative research and funding.
- Expand efforts to mentor the next generation of northern scholars and to promote equity in northern research.
- Promote, support, and enact Indigenous scholarship, including improved support for community and community collaborations with scientists.
- Make ethics concerning the research and information sovereignty of Arctic Indigenous communities a standard element of research design in the region.

- Address rapid loss of cultural heritage, including the loss of Indigenous languages and the destruction of archaeological sites by climate change.
- Invest in language research and revitalization programs.
- Improve and support research communication with the public and indigenous communities.
- Invest in data management, maintenance, and services for sharing, discoverability, and access; and seek to balance issues of confidentiality and information sovereignty with the open data movement.
- Encourage researchers to share methodological innovations, findings, and data developed in Arctic research with scientists focusing on other regions.
- Provide a venue to foster nimble participatory discussion on the state of the discipline.

Research Priorities

- Convergent research on socio–ecological systems.
- Past and present drivers of change in the North, including climate change.
- Demographics of past and present migration.
- Community health and healing, social aspects of health.
- Food, water, and energy security.
- Youth and gender studies.
- Sustainability and sustainable development.
- Globalization and new colonialism.
- Innovations in data curation, management, sharing, discoverability, and access.

Workshop Findings

- Research on the effects of a wide range of interactive changes will be a crucial part of future work within Arctic social sciences.
- Arctic social science makes major, pioneering contributions to community–based research methodologies, Indigenous scholarship, sociology of disaster, language vitality studies, social and environmental impact assessment, co–management studies, socio–ecological systems research and modeling, and resilience theory.
- Arctic social science research is increasingly collaborative and community–driven.
- Political tensions among Arctic countries can stymie collaborative research and reduce access to new knowledge. Military investments in the region are on the rise.
- Climate change and other socio–environmental processes, coupled with development, result in the rapid loss of heritage resources, including Indigenous languages, marine and land resources critical for food security, and archaeological sites.
- The loss of Indigenous languages continues in various parts of the Arctic, although in some regions language vitality remains high.
- Major technological and methodological changes in remote sensing instrumentation, sampling techniques, and data sharing enable less invasive, collaborative, and multi–scalar investigations in the lab and in the field, from the elemental to the geospatial.
- Interdisciplinary social/natural science partnerships are extensive and expanding.

2. PROJECT OVERVIEW

Purpose

Arctic Horizons is a multi–institution collaboration that provides the Arctic social science research community with an opportunity to reassess goals, potentials, and needs within the diverse disciplinary and transdisciplinary currents of social science research across the circumpolar North. The Arctic social science research community is at a momentous point when (1) several key domains of social science link explicitly to U.S. national and international research interests in the Arctic (e.g., Arctic Council, 2016; CAFF, 2017; IARPC, 2016; NRC, 2014; USARC, 2017), (2) the products and publications of the International Polar Year (IPY) 2007–2009 offer myriad testimonies to the accomplishments and potentials of research in Indigenous knowledge systems, (3) new media technologies greatly enrich the possibilities for outreach and science engagement among Arctic residents as well as wider publics, (4) the U.S. public is gaining a better understanding of Northern issues through policy and media sources (Myers, 2015; Hamilton et al., 2012), and (5) collaborations between the social and natural sciences across Arctic research are transitioning toward truly convergent efforts (Krupnik et al., 2011). These and other developments provide a fruitful opportunity for reflection and reevaluation, while also highlighting the need for input from Arctic communities to identify innovative and transformative synergies that capitalize on the rich past and the contemporary diversity of social science disciplines and approaches.

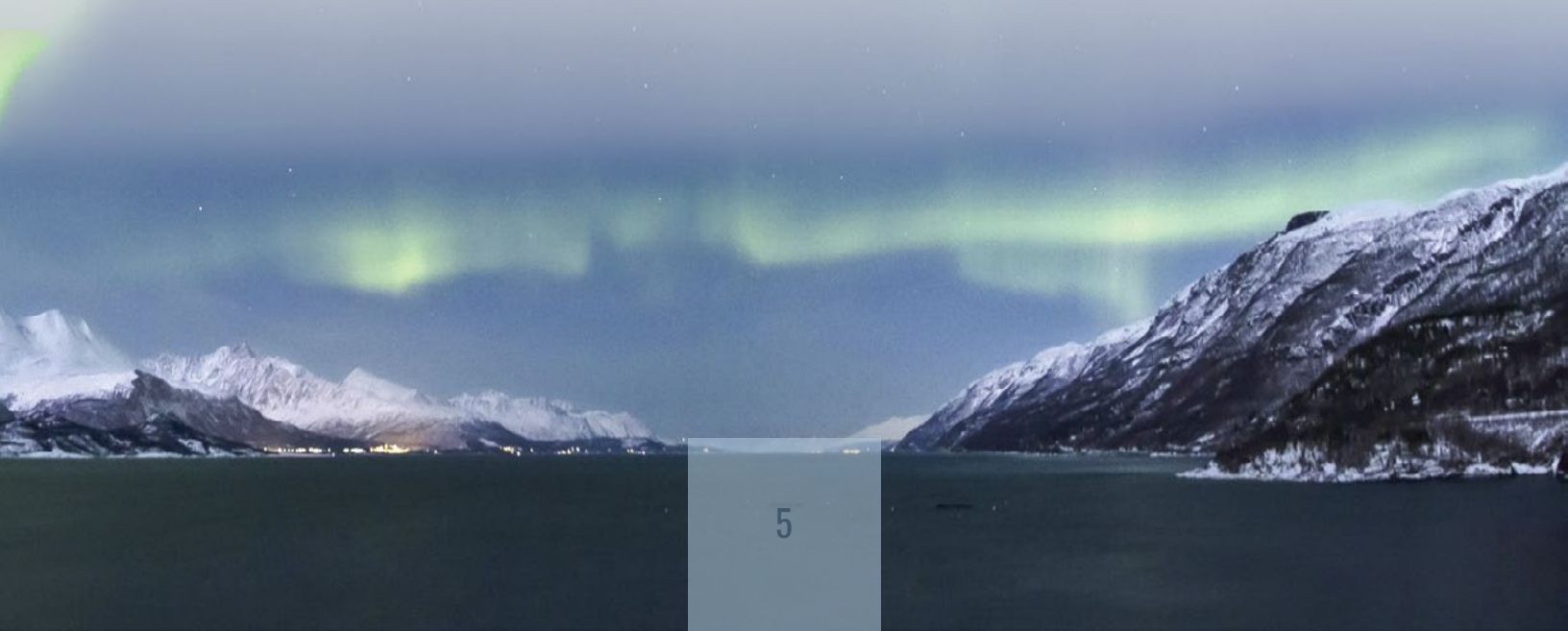
Prior to Arctic Horizons, the most recent effort at synthesizing United States Arctic social science research priorities, specifically by the National Science Foundation (NSF), is the now 18–year old ARCUS (Arctic Research Consortium of the United States, 1999) publication *Arctic Social Sciences: Opportunities in Arctic Research*. This document successfully guided research priorities and constructs for more than a decade and a half without constraining or restricting new types of research or collaborations in response to rapidly changing social, environmental, political, or intellectual trajectories. NSF's Arctic Social Sciences Program (NSF ASSP), in particular, has relied upon *Arctic Social Sciences* (ARCUS, 1999) to guide researchers toward globally relevant issues, while adjusting its vision and priorities in response to new or innovative constructs and changes in the social, environmental, and intellectual contexts within which, and on which, research is proposed. Many of the parameters governing work and life in the Arctic have changed dramatically since the release of this 1999 publication. It is time for the Arctic research community to review and articulate its priorities reflecting the new realities of work, life, environments, and policies in the North.

Goals and Objectives

The goal of the current Arctic Horizons project was to assemble community input and recommendations on re–envisioning the mission, scope, future priorities and resource needs of the Arctic social sciences research community. Our objectives were to:

1. Organize, develop, and conduct five regional, multidisciplinary and transdisciplinary workshops that integrated expertise from various fields, geographic locations, Indigenous communities, and stakeholder groups to develop a renewed vision of Arctic social sciences and identify key priorities and resource needs in the field for the future.
2. Design and support a broad, inclusive discussion of research priorities, scope, and mission in the Arctic social sciences.
3. Make recommendations to funders and policy makers who support/should support Arctic research.
4. Produce this final report for the Arctic research community or for Arctic research funders that synthesizes relevant findings on the vision, mission, scope, and priorities of the Arctic social sciences community based on a sixth "synthesis" workshop.

The first two objectives were achieved through a series of workshops, as well as several panels and town halls at relevant conferences (e.g. the Alaska Anthropological Association conference, the American Association of Geographers). Participation opportunities were increased through several online forums, including the project website (www.arctichorizons.org) and through social media, including Facebook and Twitter. Workshop participants were drawn from a broad range of social science disciplines as well as current and prospective contributors in the fields of Indigenous science, natural science, humanities, and engineering. This final report synthesizes the future research priorities that emerged over the course of the project.

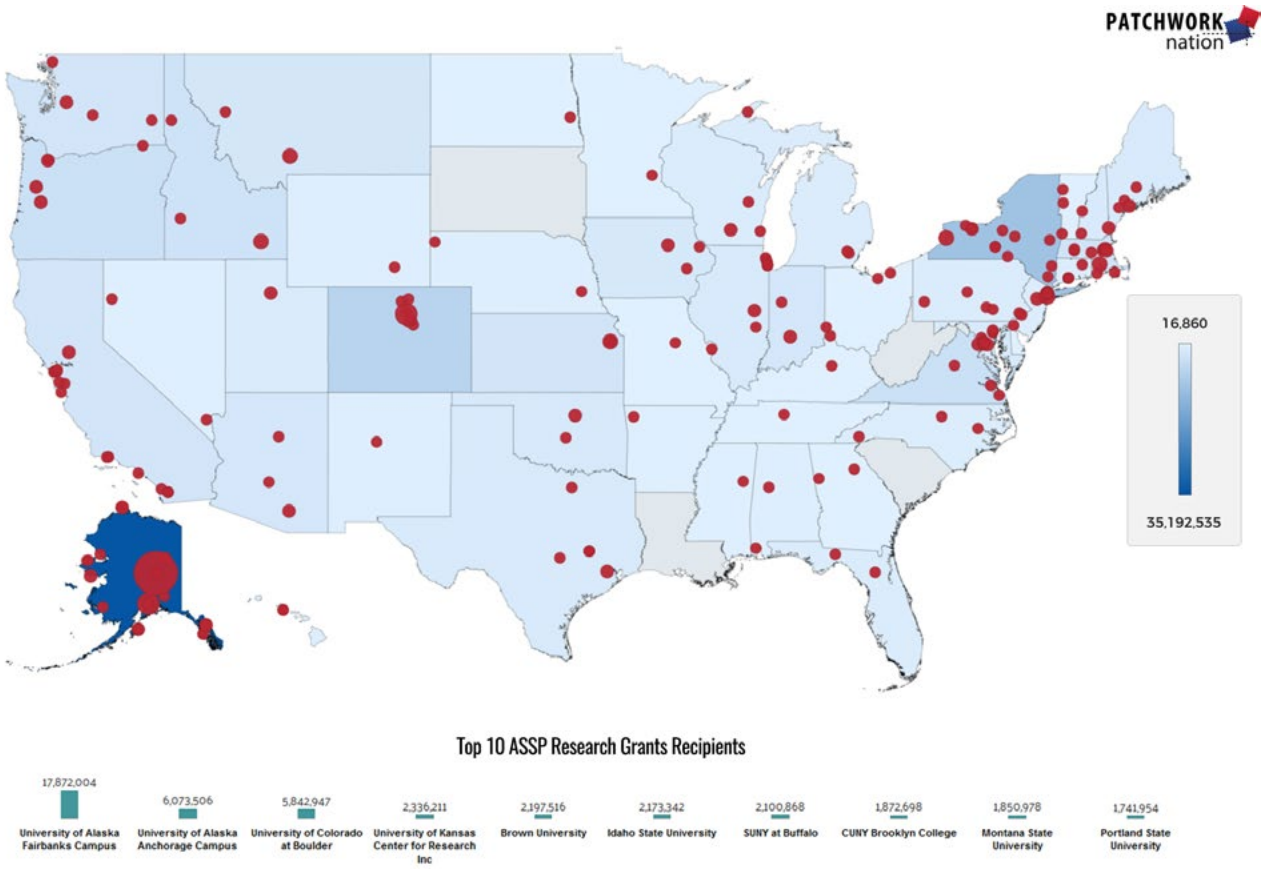


3. SOCIAL SCIENCE RESEARCH IN THE ARCTIC

The NSF Arctic Social Sciences Program as a Determinant of Rapid Progress in Arctic Social Sciences

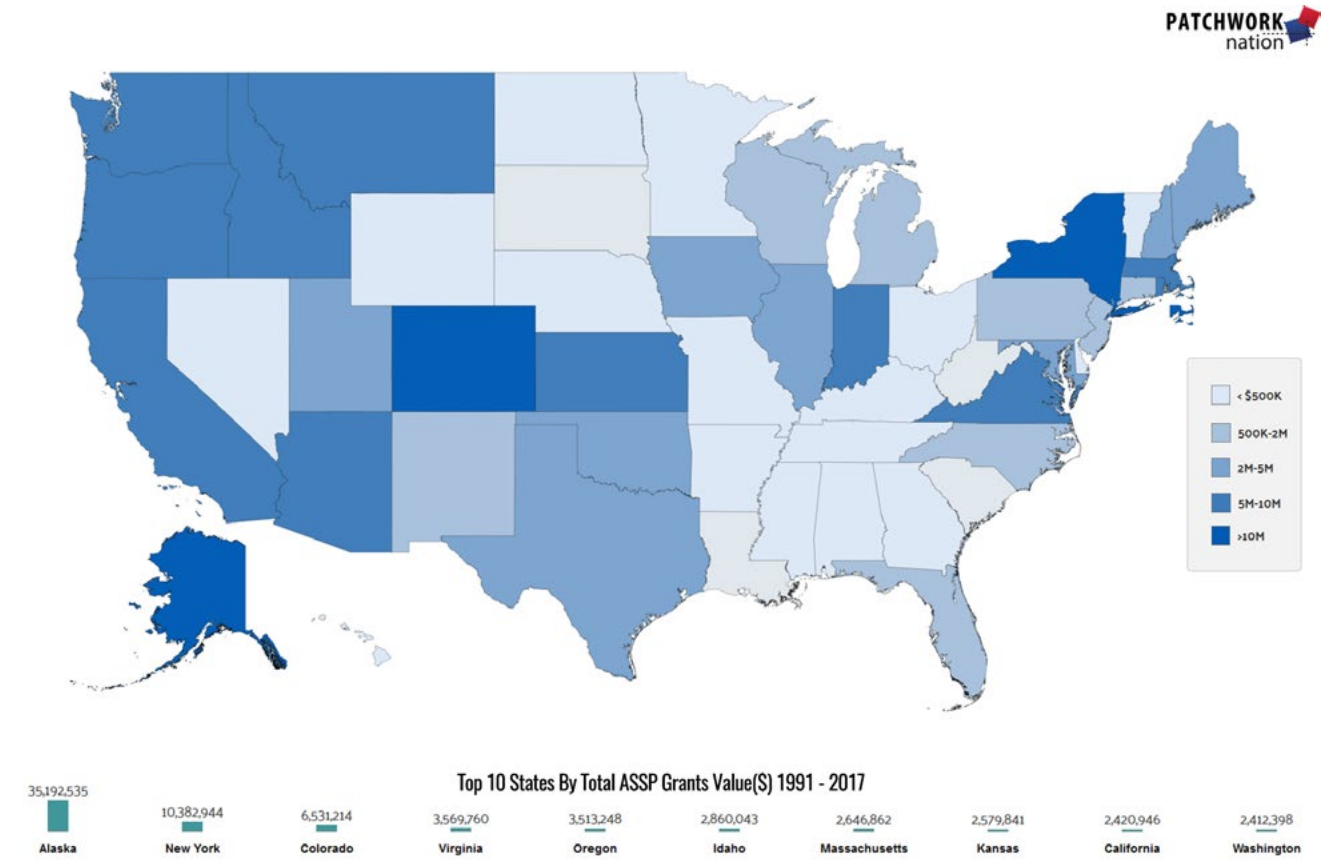
Over the past three decades, NSF's ASSP has funded 741 awards, investing more than $60 million in the advancement of Arctic science. The awards covered broad disciplinary areas from archaeology to economics, from linguistics to geography. Many projects were interdisciplinary in nature and involved international collaboration, with some projects aimed at providing opportunities for community and stakeholder engagement, enhancing education and workforce training, and the preservation and visualization of Indigenous Knowledge.

Figure 1. *ASSP Research Grants 1991–2017 ($)*

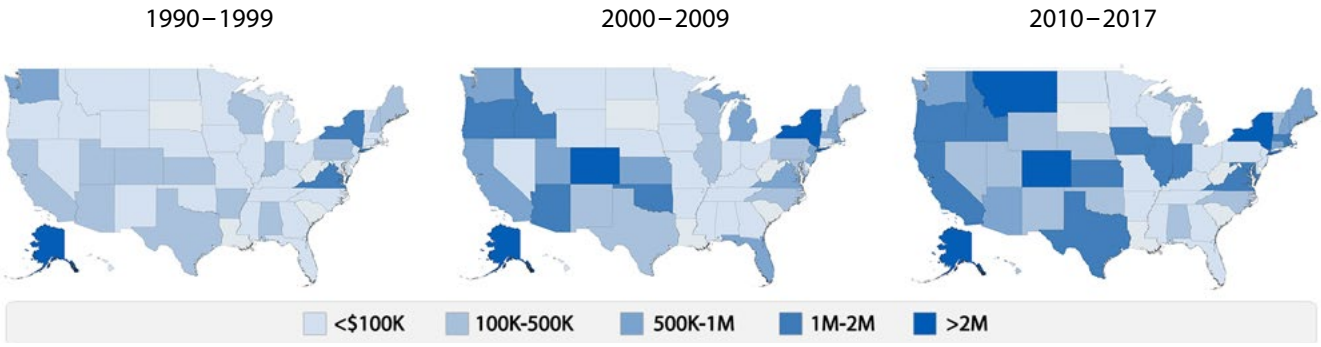


Source: *National Science Foundation*

Figure 2. *ASSP Research Grants By State 1991–2017 ($)*



Source: *National Science Foundation*

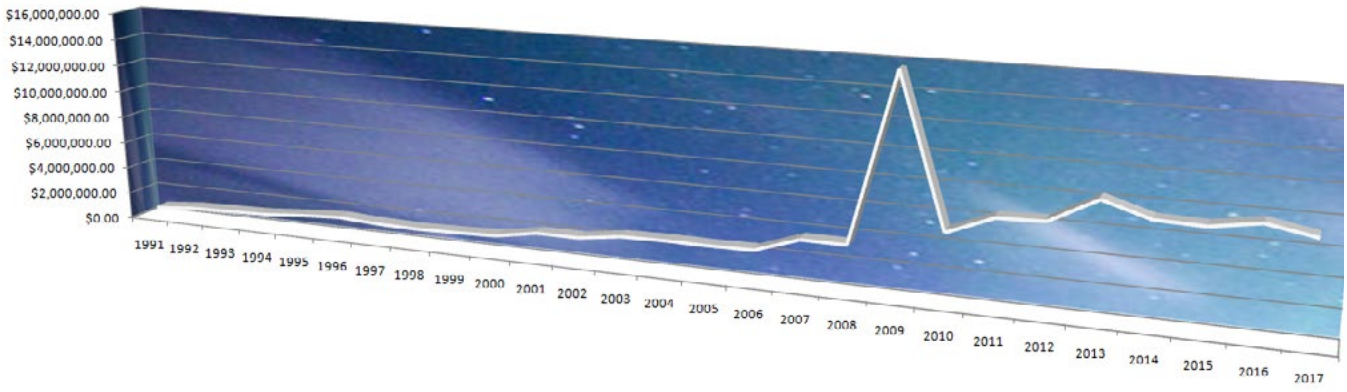


Source: *National Science Foundation*

At the program's inception in 1990, Arctic social sciences was an emerging discipline only beginning to gain momentum, and grants from ASSP provided unique capacity–building opportunities for researchers at U.S. institutions working across the Arctic. Active ASSP participation in the IPY marked the next step of growth in Arctic social sciences and laid a foundation for integrating ASSP as an equal partner among other agencies supporting Polar sciences (Krupnik et al., 2011). The impact of IPY and NSF investment in ASSP was transformational in respect to defining the field of social sciences in the Arctic and ensuring that the United States secured a leading role in social science disciplines along with Canada, the Nordic Countries, and Russia. ASSP and individual NSF researchers were also key in establishing and growing the International Arctic Social Sciences Association (IASSA), an international association of scholars in social sciences and humanities working across the Arctic.

Founded in 1992, IASSA now is a vibrant organization with more than 450 members (www.iassa.org), acting as an observer in the Arctic Council and partnering with the International Arctic Science Committee (IASC). IASC established the Social and Human Sciences Working Group to reflect the increasing importance of Arctic social sciences. Recent international Conferences on Arctic Research Planning (ICARP) in 2005 and 2015 highlighted the role of social sciences in proposed research priorities (ICARP II, 2005; ICARP III, 2015).

Figure 3. *ASSP Award Values 1991–2017 ($)*



Source: *National Science Foundation*

ASSP is instrumental in maintaining the research momentum for Arctic social sciences after the IPY. In recent years, ASSP has emphasized international projects which pursue interdisciplinary projects which engage multiple stakeholders. For example, ASSP supported the Arctic Human Development Report (Larsen and Fondahl, 2015), RCN–SEES Arctic–FROST (Research Coordination Network–Science, Engineering, and Education for Sustainability) (Petrov, 2014), RCN in Arctic Urban Sustainability (Orttung and Reiser, 2014), RCN–GHEA (Global Human Ecodynamics Alliance) (Nelson et al., 2015), MOVE–BOREAS (Huskey and Southcott, 2010), and many others. In addition, ASSP has consistently funded projects dealing with fundamental research questions and applied projects aimed at developing knowledge to address community needs in Alaska and around the Arctic. Projects funded by ASSP range from archaeological investigations of the earliest settlements in the Arctic to interdisciplinary studies of economic development trajectories and their potential environmental, social, cultural, and political impacts. The focus of that research and the relative importance of sharing its results beyond scientific communities has shifted over time (Figures 4, 5).

Figure 4.

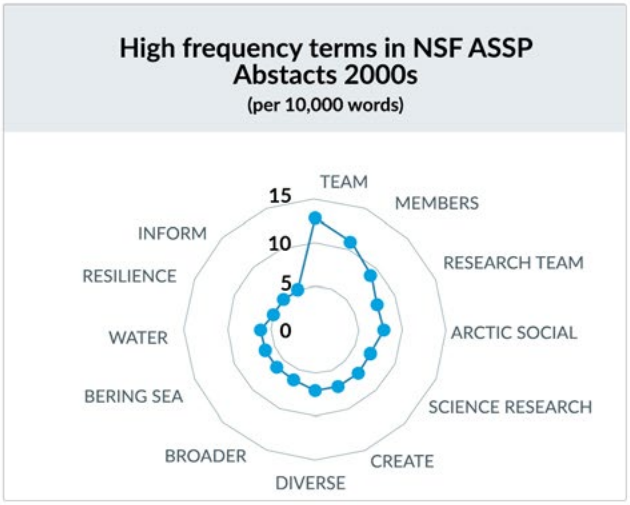
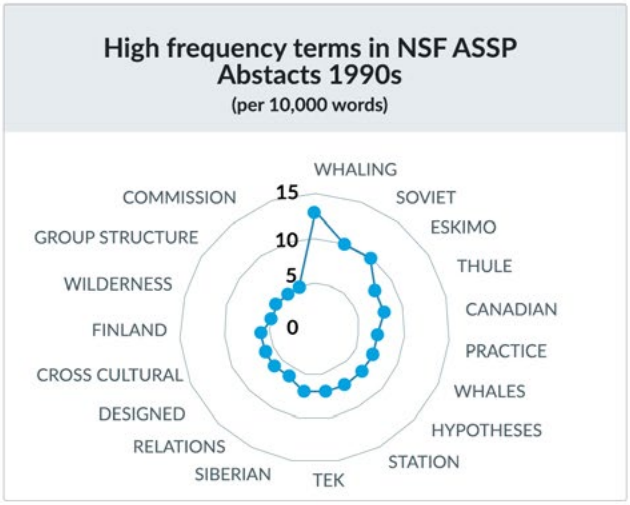


Figure 5.

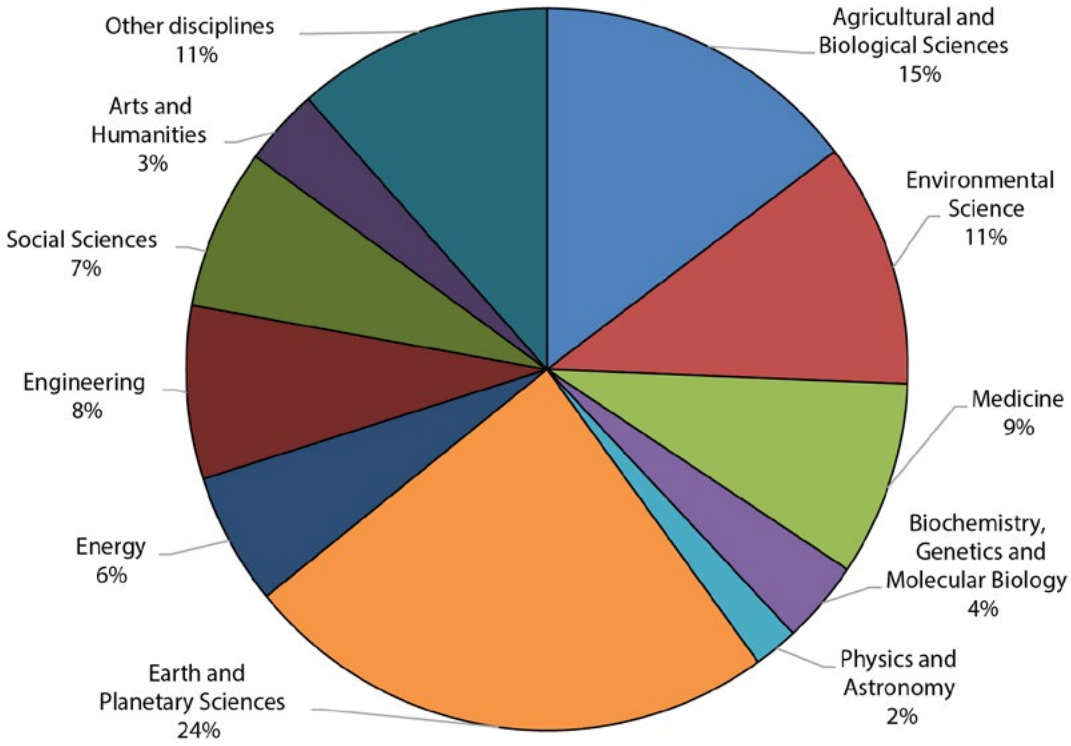


Source: *National Science Foundation*

ASSP studies document and provide the basis for safeguarding the cultural heritage of the North's Indigenous peoples and provide foundational, interdisciplinary data sets critical for the development of policy at many scales (from local to international). This information is required by the dynamic and fast–changing contexts of contemporary Arctic environmental, economic, political, social, and strategic challenges. For example, ASSP has supported studies that have led to the development of critical repositories of multi level data on weather and sea ice trends that have implications for global policy as environmental shifts affect human health and social, cultural and economic aspirations and potentials (Eicken et al., 2014; ELOKA, 2017). ASSP also supports knowledge co–production for the Arctic. As a result, ASSP projects contribute to effective policy by integrating natural sciences data, social sciences approaches, Indigenous Knowledge, and Community–Based Monitoring. The co–production of knowledge for the Arctic has allowed for ASSP

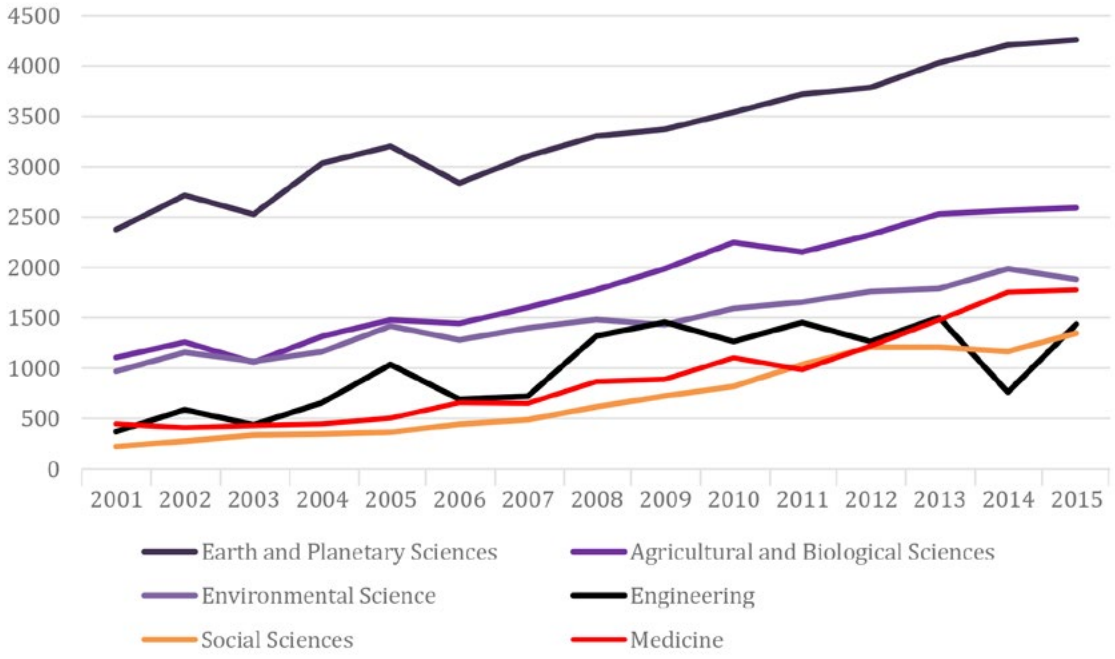
projects to contribute to effective policy (Johnson, 2014; Johnson et al., 2015). For example, currently funded research by Karen Hébert (Award 1219390) is exploring the roles of risk assessment in northern Alaskan coastal communities. Hébert's focus is on differential perceptions and risk assessment models that guide actors in different roles within their communities as they confront changes due to climate change and/or economic development. Additionally, ASSP supports studies that preserve, protect and maintain Indigenous languages and promote linguistic diversity (Kari et al., 2012; Krauss, 2012). These studies contributed, in part, to the recent passing of legislative bills in Alaska recognizing Alaska Native languages as official languages of the state and establishing the second Monday in October as Indigenous Peoples Day. Currently funded research by Karen Hébert (Award 1219390) also is exploring the roles of risk assessment in northern (Alaskan) coastal communities and the differential perceptions and risk assessment models guiding actors in different roles within their communities as they confront changes due to climate change and/or economic development. Comparable studies of present day integration of Indigenous Knowledge with interdisciplinary natural/social science models form a growing thread within ASSP funding.

Figure 6. *Distribution of Arctic scientific publications by field, 2011–2015*



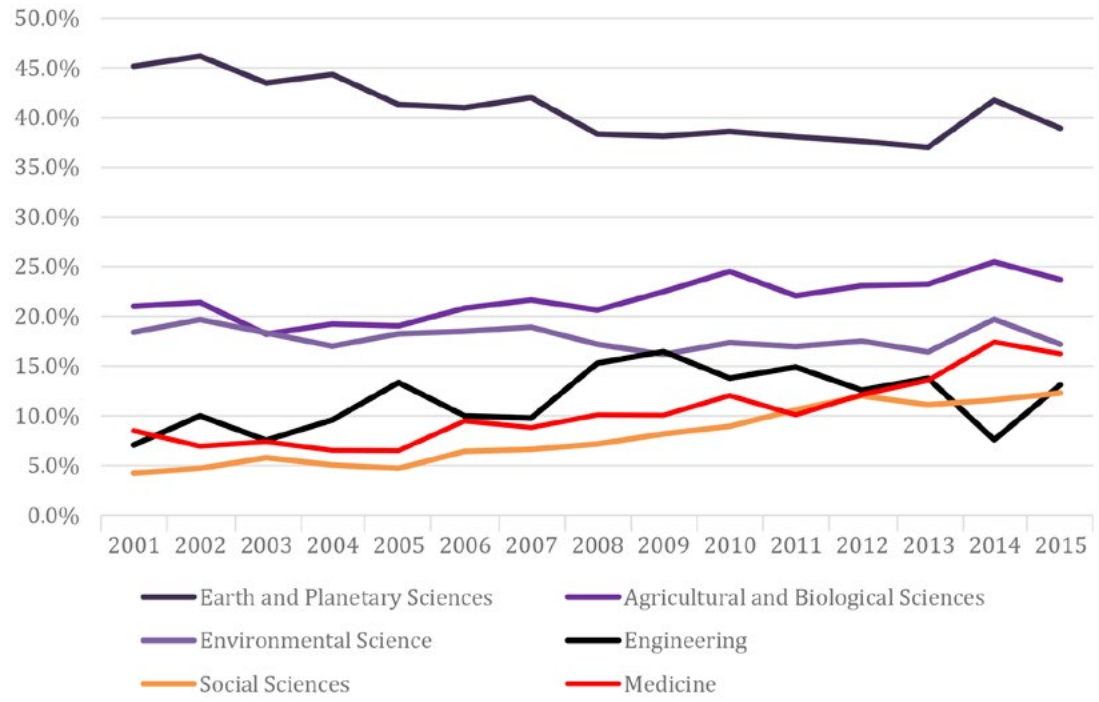
Source: *Arctic Research Publication Trends: A Pilot Study, 2016*

Figure 7. *Number of Arctic scientific publications by Scopus Subject Area, top–6, 2001–2015*



Source: *Arctic Research Publication Trends: A Pilot Study, 2016*

Figure 8. *Proportion of Arctic scientific publications by Scopus Subject Area, top–6, 2001–2015*



Source: *Arctic Research Publication Trends: A Pilot Study, 2016*

Current Status of Arctic Research

Since the 1997 ASSP visioning workshop, the Arctic social sciences have experienced substantial growth and transitioned from an emerging field of research to a well–established multidisciplinary research area. At the same time, due to rapid environmental and social changes, the Arctic itself has moved to the front of U.S. national interests and to a focus of scientific inquiry on "navigating the new Arctic" (White House, 2013; U.S. Arctic Research Commission, 2015; NSF, 2016), and the U.S. has taken a leadership role in Arctic policy development by chairing the Arctic Council from 2015–2017. In recent years various U.S. agencies and international organizations produced a number of reports and priority–setting documents for polar research, including the Arctic social sciences. Key conclusions and recommendations from these reports are important elements for defining new visions for Arctic social sciences in the near– to long–term future. Arctic Horizons steering committee members and participants consulted a variety of U.S. government documents (NSTC, 2013; IARPC, 2016; USARC, 2017), NAS and NSF commissioned reports (NRC, 2014; NSF, 2013; NSF, 2016), and international priority–setting documents (AHDR II, 2014; ICARP III, 2015; Petrov et al., 2016; RATIC, 2016; Vorosmarty et al., 2015).

4. ARCTIC HORIZONS ORGANIZATION AND PROCESS

Arctic Horizons contributes to this re–envisioning with a dedicated effort to assemble the needs and priorities of social sciences and its many subfields, including the involvement of a large group of participants across a diverse set of geographic and virtual platforms, the focused participation of Indigenous scholars, and an emphasis on the inclusion of early career scholars. The primary path for community input was through five regional workshops that took place between early February and early June 2016 (Table 1).

Workshops hosted researchers with expertise across a range of social science fields, as well as other fields engaged with human–environmental connections (e.g., ecology, geology), and members of Indigenous communities linked to Arctic regions; and the workshops were characterized by broad, inclusive discussion of ASSP priorities, scope, and mission. During and between the workshops, the larger Arctic research community and any interested individuals contributed ideas and suggestions to Arctic Horizons through an interactive project web platform (www.arctichorizons.org) and social media such as Facebook (www.facebook.com/ArcticHorizons/) and Twitter (@ArcticHz) that emphasized both engagement and transparency. Additional insights

from the community were also obtained from three town halls and panel discussions that took place at already scheduled conferences known to attract Arctic social science researchers. A final formal event, the Synthesis Workshop, was held September 21 to 23, 2016, to integrate key ideas that emerged from the workshops, town halls, and social media, and to draft a final report for Arctic Horizons. See Appendix IV for process details.

To lead and support these varied activities, the Arctic Horizons PIs created a flexible leadership and organizational structure that consisted of three main components: a Steering Committee, Local Organizing Committees, and an Advisory Board (Figure 9).

The National Steering Committee was comprised of the Arctic Horizons PIs, representing multiple disciplines and geographic regions of the Arctic, and included archaeologists, socio–cultural anthropologists, geographers, Indigenous scholars, and researchers in aesthetics and environmental engineering. The eight members were Shelby Anderson (Portland State University), Virginia Butler (Portland State University), Michael Etnier (Portland State University), Andrey Petrov (University of Northern Iowa), Aaron Presnall (Jefferson Institute), Stacy Rasmus (University of Alaska Fairbanks), Kevin Smith (Brown University), and Sveta Yamin–Pasternak (University of Alaska Fairbanks). The Steering Committee provided overall guidance, participant recruitment and engagement strategy, coordination, planning, and assessment. The Steering Committee held virtual meetings every month from November 2015 to May 2016, to ensure communication, transparency, and collegiality in decision–making and management processes. Members attended one or more regional workshops and participated in the Synthesis Workshop. The Steering Committee also authored the final report summarizing the 2015–2016 Arctic Horizons project. Additional personnel (Colleen Strawhacker, NSIDC) were included in the authoring of the final report based on expertise needs and foci identified during the workshops.

To support each of the five regional workshops, the PI(s) responsible for a given workshop created a Local Organizing Committee comprised of professionals and students that worked closely with the PIs to plan the logistics of workshop organization and execution.

An 11–member Advisory Board, consisting of senior academics and Arctic stakeholder representatives, was created to provide recommendations on the directions of the re–envisioning process, assist with linking past and current priority–setting efforts, and participate in the Arctic Horizons evaluation process (Appendix II). The Advisory Board provided oversight in several ways. Board members reviewed and edited the set of questions posed at workshops; members commented on the draft final report; and the board suggested key literature that workshop attendees should read before workshops in preparation for discussions.

Figure 9. *Project Diagram of Arctic Horizons, highlighting synthesis and reporting process*

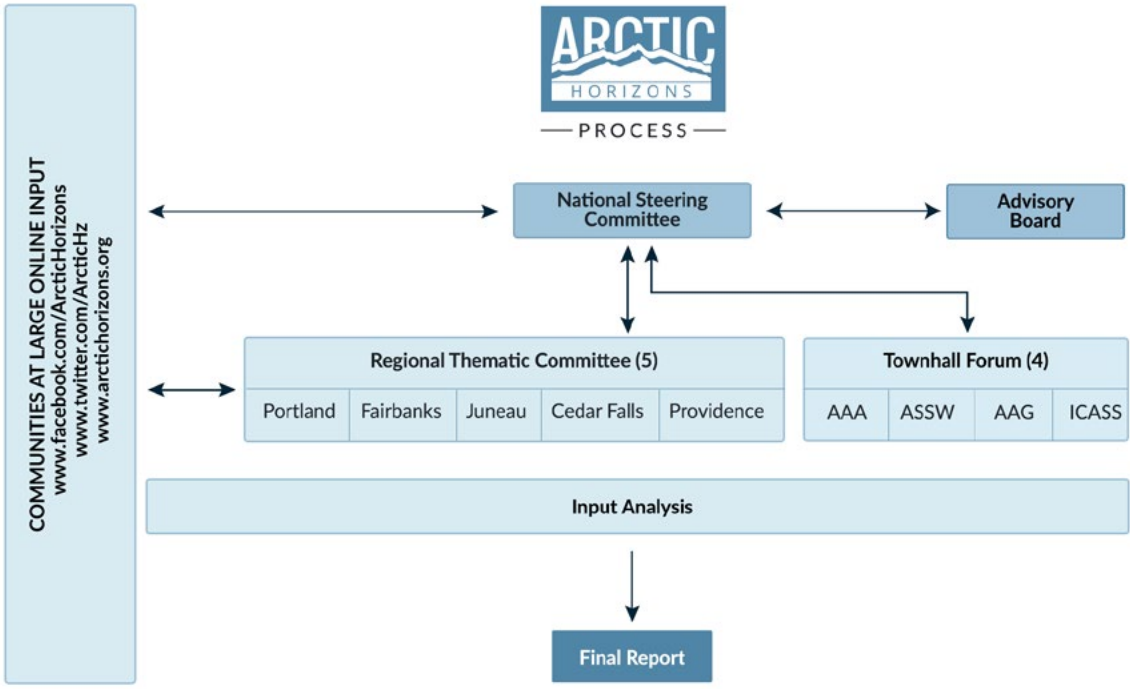


Table 1. *List of Arctic Horizons workshops hosted in drop period after 2016*

WORKSHOP		THEME	Number Of Participants
	Portland State Univ., Portland, OR Feb 7-9	Integrating Past, Present, and Future Human Ecodynamics in Arctic Social Science Research	35
	University of Alaska, Fairbanks, AK Mar 23-25	Arctic Social Sciences in the 21st Century: Indigenous Scholarship in the North: Decolonizing Methods, Models and Practices in Social Science Research	48
	University of Alaska, Juneau, AK Mar 31 – Apr 2	Arctic Social Science in the 21st Century: Uninhibited Synergies: Connecting Humanities, Engineering, and Social Sciences in Arctic Research and Public Engagement	36
	University of Northern Iowa, Cedar Falls, IA Apr 14-16	Arctic Social Sciences in the 21st Century: Integrating Theories, Data and Methods to Ascertain Local, National and International Relevance	36
	Brown University, Providence, RI May 31 – June 2	Arctic Social Sciences in the 21st Century: Integrating Interdisciplinary Natural/Social Scientific Research for Policy Development	35
	Jefferson Institute, Monticello, Charlottesville, VA Sept 21-23	Synthesis: Steering Committee + guests meet to integrate knowledge gained from Arctic Horizons activities, draft report	13

Web and Social Media

Workshop agendas, participant lists, audio recorded proceedings, and supporting documents such as papers and PowerPoint presentations, were posted on the project web platform to maximize transparency. Whenever possible, keynote addresses were video streamed as live casts through the platform and preserved for convenient review. Dynamic embeddable data visualizations presented the running results of project analytics, including text analysis of key associations in the transcripts of workshop discussions, participant survey results, citation surveys, and an analysis of all 737 NSF grants issued since 1991, to document and to learn from patterns in funding to date.

Town Halls and Panels Linked to Other Conferences

As noted above, besides the formal workshops, Steering Committee members organized special events at four conferences to further engage the research community in the Arctic Horizons process. Through these venues, we obtained ideas and perspectives from additional scholars not participating in the formal workshops (although in some cases, workshop attendees also were part of these smaller–scale events). These small–scaled events addressed two main questions: What are the domains of human experience in the North that warrant further attention on the part of the social science researchers over the next 10–15 years? What should be the funding priorities for NSF in respect to Arctic social sciences?

Shelby Anderson and Mike Etnier (Portland State University) hosted a two–hour town hall on March 18, 2016, at the Alaska Anthropological Association in Sitka, AK, and gathered input from 53 participants (mainly archaeologists, and cultural and biological anthropologists).

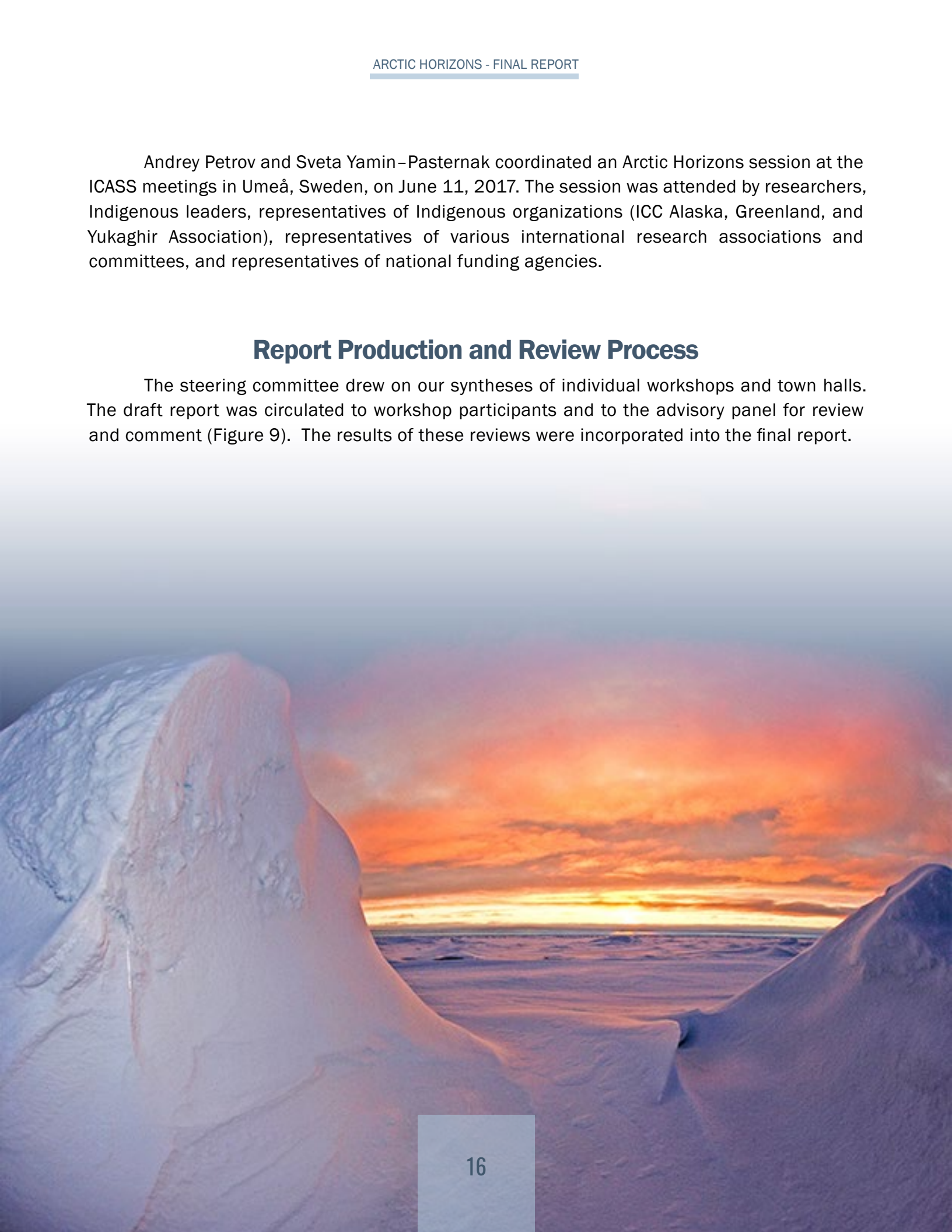
Andrey Petrov (University of Northern Iowa) hosted a one–day town hall during the Arctic Science Summit Week (ASSW) on March 14, 2016, in Fairbanks, AK. About 40 scholars from the U.S. and other nations participated, representing a variety of disciplines including anthropology, geography, economics, political science, archaeology, sociology, and the humanities. Early career scholars and researchers were also among the forum speakers.

On April 1, 2016, Petrov also organized a panel of 11 scholars at the American Association of Geographers meetings, entitled “Polar Issues VI: Arctic Horizons 2025: NSF forum on the Future of Arctic Social Research.” Input was gained from the 11 panelists and 22 audience members, who were primarily geographers.

Andrey Petrov and Sveta Yamin–Pasternak coordinated an Arctic Horizons session at the ICASS meetings in Umeå, Sweden, on June 11, 2017. The session was attended by researchers, Indigenous leaders, representatives of Indigenous organizations (ICC Alaska, Greenland, and Yukaghir Association), representatives of various international research associations and committees, and representatives of national funding agencies.

Report Production and Review Process

The steering committee drew on our syntheses of individual workshops and town halls. The draft report was circulated to workshop participants and to the advisory panel for review and comment (Figure 9). The results of these reviews were incorporated into the final report.



5. WORKSHOP FINDINGS, RESEARCH PRIORITIES AND RECOMMENDATIONS

Critical Changes in the Arctic that Affect Social Science Research

Workshop participants identified many changes in the diverse social, environmental, cultural, and political landscape of the Arctic – across many spatial and temporal scales – that will affect the direction of social science research. The degrees of predictability and the paces of change in a range of social, cultural, institutional, economic, political and environmental systems will be key considerations guiding both subjects of research and the practice of research in the North.

Climate change in the Arctic is characterized by abnormally fast paces and wide geographic scales that vary significantly in different parts of the Arctic and that produce uncertainty in formerly familiar conditions as well as newly emergent environmental structures with broadly predictable social implications. Rapid environmental change has brought about, and will bring about, more change for Arctic peoples in the future. While environmental change is not novel, the current pace and magnitude of environmental change is unprecedented (Gaffney and Steffen, 2017). These environmental changes have both positive and negative ramifications for Arctic peoples. Examples of ongoing impacts include changes in shipping and heating fuel costs; changes in the availability of subsistence foods; and increased immigration and emigration, which are not gender or demographically even. Many social processes related to climate change are not well understood (e.g. immigration/emigration). Emerging infrastructure changes and challenges due to rising sea levels, melting permafrost, and potential economic developments linked to shipping, tourism, resource extraction, and population movements all pose potential and currently evolving challenges to existing land–use and resource ownership systems. Given these various vectors of change, research on the effects of a wide range of interactive and intersecting transformations will be a crucial part of future work within Arctic social sciences.

Climate change and other natural processes, coupled with development, are resulting in a rapid loss of heritage resources. These losses have implications not only for Indigenous or local communities' cultural grounding and legal rights but also for loss of long–term datasets on human adaptability, broad themes in the global cultural narrative, and natural resource use and histories. The loss of Indigenous languages continues in various parts of the Arctic, although in some regions language vitality remains high.

Arctic youth conditions, roles, and desires are quickly changing. New generations of Arctic residents are characterized by evolving professional and personal aspirations, increased

mobility, higher educational attainment, diversification of employment and study pursuits, development of mixed identities and cultures, migration to urban centers, and amplified gender differences. Gender definitions, roles, and diversity are changing and becoming more complex as they are negotiated across other vectors of change. Significant shifts in human migration patterns will most likely increase, changing what "northern communities" are and establishing new dynamics – including migration into urban centers, non–northern groups moving into the North (refugees, economic migrants, and others), and gendered migration. On the other hand, there is a lack of meaningful change in wellbeing and health in small Arctic communities. For example, suicide continues to be a significant and intractable problem. Although community wellbeing has improved since the 1990s, many Arctic regions are still lagging behind their southern counterparts (Larsen, J. N., Schweitzer, P., & Petrov, A., 2015). This is especially pertinent to small, remote communities and Indigenous populations. Small communities are no longer in control of decisions and policies that affect them.

There is a disconnect between decision makers in urban centers and people living in villages. Many questions of local sovereignty and (non)local governance are emerging in the context of how best to adapt to rapidly changing climatic/geopolitical/economic environments.

Technologies that affect access, connectivity, data collection, management, and sharing have changed the ways people communicate and in which researchers could capture and understand human connections and relationships. An increased use of social media and evolving communication formats create new opportunities for building connectivities within the Arctic and with other regions, but also create challenges in respect to uncertain access, security and power associated with these information flows.

The Arctic has increasingly come into the public view and that of policy makers with implications for social science research. Policy makers (at the international and national levels) see the Arctic as a region of economic, military, and political significance with implications for new scales of governance intervention and funding for non–social science projects that need social science oversight/study to understand their impacts and potential. There are major changes in the international situation, geopolitical environment and (circum) polar politics due to elevated interests in Arctic resources and a consequent rapid pace of territorial claim–staking by local, provincial/state, national, and transnational political entities and corporate concerns. At the same time, the relative success of the Arctic Council (est. in 1996) signals a desire for increased international collaboration in the areas of environmental protection, search and rescue, and sustainable development.

There are also significant changes in northern governance and political frameworks, especially in the ways that governments, NGOs, the military, and foundations engage with Arctic communities. Put simply, there are more areas in which Indigenous communities exercise self–governance or have gained strong voices in governance. Transnational governance and interest groups have emerged whose future roles as elements of existing nations or as challengers to

current nation–states remain to be seen. Devolution and decentralization of decision making proliferated across Arctic regions through the advancement of self–governance and strengthening self–determination. However, these processes are uneven across the Arctic in space and in time. More universally, the remilitarization of the Arctic, following the demilitarization in the 1990s, is evident today, and military investments in the region will most likely increase.

Trends in Arctic Social Science Research over the Past 20 Years

Some research themes identified as important in the 1999 report remain viable and relevant, while others have changed radically. Over the past 20 years, social science research in the Arctic has expanded in scope and reach in response to these challenges and opportunities. Spurred in part by priorities outlined by the ASSP, as well as the efforts of Indigenous scholars in Arctic communities, Arctic social science research is increasingly collaborative and often community–driven. The emphasis in the ARCUS 1999 recommendations to the ASSP on education and outreach increasingly bring Arctic youth and other community members into research teams. As a result of these trends, the research capacity of Indigenous communities has increased over the past 20 years, leading to new collaborations and insights on the part of researchers.

At least in part as a result of this, there is a growing emphasis on repatriation of knowledge, artifacts, and data to communities in the north: the decolonization of science is happening rapidly in the Arctic. Related to this, applied social science research has advanced in the Arctic, largely due to continued, sustained funding support for social science research. The same can be said of inter–, multi–, and transdisciplinary research in Arctic, which has been actively promoted by the ASSP. Ongoing funding support facilitates long–term programs of observation and other longitudinal forms of social science research that cross traditional disciplinary boundaries in addressing questions of interest to Arctic communities and researchers. Arctic social science is, in many respects, advancing social science methodologies and theory more broadly.

Major Contributions of Arctic Social Science

Over the past decade, Arctic social scientists have made major, pioneering contributions to community–based research methodologies, sociology of disaster, language vitality studies, social and environmental impact assessment, human ecodynamics, co–management studies, migration research, socio–ecological systems research, and resilience theory (e.g. Chapin et al., 2009; Fondahl and Wilson, 2016; Arctic Resilience Report, 2016; Petrov et al., 2016;

Pearce et al., 2009; Kouril et al., 2015; Hamilton & Rasmussen, 2010; Hamilton et al., 2016). Arctic social sciences occupy the leading edge of multi–, inter– and transdisciplinary research focused on complex coupled systems dynamics and multifaceted special transitions (ARA, 2016). Scholars devoted considerable efforts to understanding gender and sexuality diversities in the Arctic and their intersections with issues ranging from equity and wellness, to family, migration, and community dynamics, among others. ASSP also spearheaded the investment in comparative research among Arctic regions, whether cross–latitude, cross–disciplinary, or through methodological cross–pollination. Comparative work in the Arctic is challenging due to institutional, political, and geographical differences. However, it brings critically important results and lessons that define our understanding of socio–economic, cultural and natural processes over space and time and guide our actions in Arctic communities. Social scientist–facilitated community–to–community collaborations among Arctic countries have risen over the past few years (e.g., Petrov, 2016). We also have established long–term programs of observation and longitudinal forms of social science research to build systems of trust between communities and researchers.

The Arctic is emerging as a region of research interest on par with other parts of the world, and possibly a critical region of inquiry. However, the contributions of Arctic social scientists to "non–Arctic" conversations, journals, and debates often remain less visible than those from social scientists working in other regions. An increasing willingness by Arctic scholars to tie their research to larger conversations about global processes unfolding over both longer and shorter scales (colonization, urbanization, globalization, migration studies, indigeneity, etc.) is reducing existing views of Arctic social science as "regional", out–of–date, or marginal. At this point in history, social scientists have or seek greater awareness of the political implications of their work. This awareness and interest are necessary to position social sciences research as a vehicle of transformation, but could also become a constraining element of action research.

Key Methodological Transformations

Using the notion of methodological transitions in Arctic social science research (Petrov et al., 2016) we identify a number of trends, which constitute three epistemological shifts in Arctic social sciences research and reflect the directions in which methodologies are progressing. First of all, the move to inter– and transdisciplinary and mixed methods research is rooted in methods from multiple (sub)disciplines. Second, the transition to understanding knowledge co–production as a central epistemological paradigm refers to a joint process between academics and other knowledge holders in planning, carrying out, and disseminating research. Third, the breakthrough in indicators research refers to a shift from an initial concern with individual social indicators toward integrated systems of indicators (e.g., Larsen et al., 2010, 2015; Kruse

et al., 2011; Hamilton & Lammers, 2011). More social science research is now community–driven and place–based with growing emphasis on the repatriation of knowledge. There are significant changes in how social scientists interact with diverse Northern communities at many different levels, from dissemination of results to their integration as collaborators, partners, and co–creators of knowledge. Social scientists now deal explicitly with issues of intellectual and data sovereignty, knowledge appropriation and ownership (see Data section). We witness an epistemological evolution toward knowledge co–production, with a focus placed on participatory action and community–based research. Most crucially, the research capacity of Indigenous communities has increased, leading to new opportunities and collaborations. Another crucial change has been in the improved access to fieldwork through better logistics, technology, and international collaboration. Since political tensions between Arctic countries can reduce these gains, IASSA, IASC, and other international science organizations, and the assured participation of U.S. researchers in their activities, play an instrumental, ever–increasing role in providing access to new knowledge and data. The use of media and social media has resulted in new ways to integrate research agendas and disseminate results in real time.

Major technological changes in instrumentation, such as portable X–ray fluorescence (pXRF), geospatial technology, ground penetrating radar, and expanded monitoring methods, allow multiscalar investigations, almost simultaneously from the elemental to the geospatial while in the field, allowing researchers to answer questions or to reframe research questions in real time. These instrumentation changes are especially transformative in archaeology, planning, and human geography, but also in other fields (e.g. community health, land use, infrastructure development, etc.). Improvements in sampling techniques and analytical methods (e.g., ancient DNA, trace element and isotope analyses) tend to be far less invasive than previous methods, thus addressing community concerns about destructive analyses.

Finally, over the past two decades we have observed significant transformations in the relationships between social and natural science research in the Arctic: interdisciplinary social/natural science partnerships are now extensive and expanding in archaeological research, sustainability science, indicators development, socio–ecological systems analysis, community–based monitoring and other fields (SIKU; ELOKA; Hovelsrud and Smit, 2010).

Important Institutional Changes

An important institutional change has been the emergence and strengthening of new professional organizations for Arctic social scientists, such as IASSA and IASC SHWG, and resultant improved recognition given to Arctic social sciences within and outside polar research. IASSA continued its tradition of triannual meetings with ICASS VIII (2014) bringing more than 450 participants and the most recent ICASS IX in 2017 growing to over 700 attendees. Other professional organizations created study, specialty, affinity groups or sections with the focus

on Arctic research, e.g., the Polar Geography Specialty Group of the American Association of Geographers (2013).

In conjunction with these developments, the International Polar Year (2007–2009) was instrumental in propelling social science in the Arctic to a new level of recognition and relevance (Krupnik et al., 2011). By acting forcefully and early, IASSA developed an engagement plan that ensured a broad participation of social and human scientists in IPY: 20% of all endorsed proposals were in social sciences (Krupnik, 2008).

In the U.S., the most significant institutional factor in advancing Arctic social sciences has been the emergence of the ASSP at NSF as a vibrant forum for diverse perspectives and integrative projects. ASSP has provided a model within NSF and beyond as to the power of framing a research domain geographically rather than thematically or disciplinarily. Such a focus opens up transformative opportunities for transnational and interdisciplinary research across many temporal and spatial scales. ASSP and the Office (now Division) of Polar Programs have demonstrated the power of international/multinational collaborations to bring unexpected focus and outcomes on shared issues and to open potentials for bringing "science diplomacy" into the playbooks of policy makers and governments, as they look at the Arctic in a new, multidisciplinary light. Arctic trans–border and multidisciplinary approaches are seen in other parts of the world (e.g. Australia) as models for adoption. In recent years, significant investment in early career scholars and considerable support to building capacity in ASSP has occurred through various U.S.–based and international initiatives, including NSF research coordination networks (Arctic–FROST, Urban Arctic, Arctic–COAST), Northern Research Forum, APECS and others. This investment reflects an increasing recognition of the need to train more students from underserved and local communities, to help ensure that rising generations have every opportunity to reach their full potential. ASSP has been actively and purposefully funding doctoral dissertation improvement grants to assist early career researchers with access to study sites and necessary resources.

Data, Information, and Knowledge: Data Curation and Sovereignty

The now–defunct Polar Cyberinfrastructure program generated a report on the future of data, information, and knowledge produced from projects funded by the Office of Polar Programs at the National Science Foundation (Pundsack et al., 2013). While covering a wide range of topics from cyberinfrastructure to oceanography, from remote sensing to mapping, there is no mention of the special nuances of social science data nor any plans or strategies in place to ensure those data are available and usable in the future. The Office of Polar Programs also operates its own repository for data produced by the scientific research it funds, and the newly

created Arctic Data Center (Budden et al., 2016, www.arcticdata.io) has two dedicated social science representatives on its Advisory Board, although the capacity for managing data from the social sciences is still being negotiated. The future of data and information for the Arctic social sciences program will need to be carefully considered to ensure appropriate and ethical access and reuse in the future.

Specific challenges and concerns around the curation of social science data and Indigenous Knowledge involve the diversity and variety of data created, the protection and anonymity of research subjects, the difference between social science data and Indigenous Knowledge, and information sovereignty of Indigenous Arctic communities. Projects funded by the ASSP create a variety of data, information, and knowledge, from spreadsheets of demographic information, to local observations of environmental conditions; from complex spatial data in a Geographic Information System, to Indigenous Knowledge accumulated over millennia on the state of the Arctic. This diversity in data and information types, formats, and needs makes it difficult to curate, discover, and access these data and information on a technical and social level. Existing metadata standards that can deal with this diversity in data types are often not detailed enough to be helpful. More research is needed to develop best practices in this arena that would allow for improved capacity to research linked databases for more robust syntheses.

Data and information collected by researchers funded by ASSP must protect the privacy and confidentiality of their research subjects. Often times, researchers interview subjects on very sensitive topics, from sexual health to political stances. Some researchers have feared for the lives of their research subjects in difficult political climates. Further complicating the anonymity of research subjects in the Arctic is the prevalence of small rural villages of a few hundred people; establishing anonymity for individuals with unique demographics is especially hard. As such, great care must be taken – in close consultation with the research subjects, researchers, and Institutional Research Board (IRB) protocols – to ensure that an acceptable data curation plan and system is in place to protect the identity of those being studied for Arctic social science research. Besides research subject anonymity, information sovereignty of any research around issues of Indigenous Knowledge must be considered in scholarship. Local and Indigenous Knowledge, which has been created over the course of millennia, brings up issues of ownership, access, and control. Decisions regarding what to share need to be made by Indigenous communities. In short, issues of anonymity, protection of research subjects, and information sovereignty all must be carefully considered under the current "open data" and "open science" movement in close collaboration among researchers, Indigenous communities, and data professionals. The International Arctic Science Committee (IASC) thoughtfully included a section on "ethically open access" to address some of these issues (http://iasc.info/images/data/IASC_data_statement.pdf).

Despite its challenges, preserving data collected by the Arctic social sciences program as well as Indigenous Knowledge from the communities directly engaged by the program is

essential for future reuse by appropriate parties. Fortunately, many efforts are ongoing to ensure that data are effectively stored and curated and can provide important use cases in lessons on how to preserve these information sources effectively. The Exchange for Local Observations and Knowledge in the Arctic (ELOKA, www.eloka–arctic.org) has built partnerships with Indigenous communities since the mid–2000s to create digital tools to support the curation and sharing of Indigenous knowledge, including atlases of place names and databases to enable uploading and sharing of local observations. Additionally, dataARC (www.data–arc.org) is building infrastructure and online tools to connect archaeological research with paleoclimate data and insight from the humanities to address climate change in the past, and Patchwork Barents (patchworkbarents.org) is a pilot project focused on making social science data more widely available to data journalists who cover pressing Arctic issues. Many ongoing local efforts to curate institutional and museum data could be enhanced by building support links across these entities.

A comprehensive plan and system needs to be in place to manage and curate ASSP data for the future. Many ongoing efforts outside of the Arctic can be leveraged and used (with support from OPP to insure Arctic–specific issues are considered) including the US Indigenous Data Sovereignty Network and Interuniversity Consortium for Political and Social Research (ICPSR), informed by Arctic use cases and data specifics. It is clear from many Arctic data initiatives (see the forthcoming "Conclusions" from the Arctic Data Committee's Polar Interoperability workshop, www.arcticdc.org/news/40–polar–connections–interoperability–workshop–and–process), that progress needs to be made socially, as well as technically. While appropriate metadata standards and discovery systems are important, a culture of data sharing and management among individual researchers needs to be fostered and nurtured, to ensure the data are shared and curated, and ultimately of the greatest use to future research.

Social Science Research Priorities in the Arctic

Workshop participants identified enduring questions and several new areas where research is needed, particularly with respect to the needs and interests of Arctic communities and the rapid pace of change in the Arctic. These are key research themes for the next 10+ years that were mentioned multiple times by multiple scientists at multiple workshops. They transcend disciplinary boundaries. It will not be possible to pursue all of these research priorities without expanded support and increased funding and other programmatic support for Arctic social sciences.

Support and Expand Research Across the Social Sciences on Contemporary Community Issues

We need more research on the reality of being rural, rather than studying rural in opposition to "urban." More study is also needed of urban areas, non–resource economies, and underground or "gray" economies (e.g., economies of drugs and alcohol).

The topics of demographics of migration, community health (physical, mental, spiritual, etc.) and healing, food security, social aspects of health all require focused research. Research needs to be done on historic traumas – including ethnohistoric research and oral history studies, working within communities to explore past and contemporary vectors of trauma – in order to understand the bases of trauma in contemporary communities. We need to explore not only different histories of trauma but also commonalities (residential schools, loss of language, colonialism, etc.). Research is also needed on community resilience in both the short and long term. We need to study under–represented age and gender groups; understanding the problems and prospects of the next generation in the Arctic is important and often disregarded in our hurry to capture the knowledge of elders.

Research in political science and economics should be encouraged in the Arctic to allow us to address broad–based questions about security, globalization, development, trade, and governance in the North. Research is needed on the historical institutional structure of policies in relation to change in the Arctic and to community ability to adapt to change; as well as on sustainability and on sustainable development of Arctic communities. Research is needed on institutions, governance, equity, and fate control by Indigenous communities. Studies of globalization and new colonialism will contribute to understanding the dynamic socio–political landscape of the Arctic. Northern research should further engage with predictive modeling, multivariate integrated analysis and computational social science.

Figure 10. *ASSP Awards Abstracts 1991–2016 – number of mentions*

Source: *National Science Foundation*

Support and Expand Socio–Ecological and Inter–Disciplinary Research

More research is needed on coupled socio–ecological systems (SES). Social scientists need to become better integrated into natural science projects and bring natural scientists on board with socially focused research. We can assist in identifying ways of understanding "impacts" of environmental factors on communities in more nuanced ways and over long term, centennial and millennial scales, through archaeological research (d'Alpoim Guedes, 2016). Social scientists can also frame predictions about human–environment interactions in ways that policy makers and the public could understand and use for short–term, mid–range, and long–term planning. This integration of social scientists with natural scientists in research projects, however, has to take place at the beginning and with equal participation in project planning and execution rather than bringing in social scientists to act as translators or p.r. managers for natural science research done in isolation from its social implications. Natural sciences polar programs should fund social science projects when appropriate; re–centralizing ASSP in polar programs would facilitate this. The Arctic Observing Network should incorporate social sciences.

Interdisciplinary, multidisciplinary, and collaborative research is needed to articulate and test models for research and understanding of processes associated with climate change and other drivers of change in the North, across a wide range: from local to regional and circumpolar geographical scales, and temporal scales from immediate to decades or centuries. These models could have broad applicability in other parts of the world as well. Research is needed to aid communities in making decisions around climate change–related relocations.

Support and Expand Archaeological Research

Understanding "the changing Arctic" requires putting present–day questions into deep time perspectives. Research on contemporary issues cannot be done meaningfully without simultaneously looking at the past. Despite the rapid pace of change that is happening, it is not the first time northern peoples have experienced dramatic climatic change. Indeed, exploring the past dynamics of human response to climate change may provide clues for future responses. Archaeological research is critical for providing the long–term context for socio–ecological trajectories leading to present conditions, including the relationship between short–term actions and long–term effects. Archaeologists can also help in studies of past landscape use, contributing to research on how and why people were tied to many different lands, at different times. In providing a dynamic view of human–environmental relationships, archaeology helps undermine simple stereotypic views of the so–called "ethnographic present" that constrain contemporary Indigenous communities' abilities to adapt, change, or set their own agendas. In doing so, archaeologists can also contribute to heritage preservation efforts supporting local sovereignty and economic opportunities for contemporary communities. The possibility of an open Arctic basin suggests the potential of another period of economic and population boom in the Arctic. Studies of the past can inform the present to help us understand processes of stability, instability, and migration in northern communities in more nuanced ways.

Northern archaeologists should expand current efforts to take advantage of new methodological advances in archaeology to 1) carry out fieldwork in remote places through the use of drones, remote imaging, spatial modeling, etc., and 2) to reconstruct the past (aDNA, isotopes, lipids, etc.). Excellent preservation conditions unique to Arctic environments mean that certain archaeological analyses, and the development of innovative methods (the first full prehistoric human genome, for example, was produced from the hair of a 4,200 year–old Saqqaq culture individual from Greenland) are particularly well suited to application in northern climates. There is the potential to advance these methodologies and their applications in archaeology more broadly through our work in the Arctic, although we are racing against the effects of climate warming. Northern archaeologists are also at the forefront of community archaeology, collaborating closely with Indigenous communities across the Arctic. We can contribute to the

discipline of archaeology more broadly, and the development of collaborative archaeological approaches, by sharing our collaborative research successes with archaeologists outside of the Arctic community.

Several specific archaeological topics of enduring interest were identified through the Arctic Horizons process. The peopling of the Americas and the Arctic remains a basic but important issue that not only remains crucial for understanding the Arctic but also the global human narrative. Research is needed on past demography and migration to further understanding of how past people moved across the Arctic landscape and interacted with one another. We need to study the long–term history of past population expansions, migrations, and population contractions or extinctions to better understand the challenges that may be inherent in economic expansion, development, and population migration into the Arctic in the near future. Archaeology can contribute long–term baseline data on past human–interactions that can inform contemporary research on climate change, climate change impacts, and human response to climate change. Investment in Indigenous archaeology in the Arctic should be continued and expanded. We can contribute to research on gender, socio–economic systems, international interaction, colonialism, food security, health, and wellness; our work can provide a longer term perspective on these priority issues, complementing comparable research with contemporary northern peoples.

Address Rapid Loss of Heritage Resources

A combination of factors such as permafrost melting, rising sea levels, and increasing storminess are destroying heritage resources; these climate change related processes are expected to increase in pace in the coming years. Infrastructure development, economic expansion, and population expansion associated with a changing northern climate will further impact cultural heritage. At present, some of the most critical areas of loss are coastal zones, where rising seas and enhanced storminess are eroding coastal sites, and zones that still contain sufficient permafrost to retain sites with exceptional organic preservation. Anticipated areas of heritage resource loss in the future include the peripheries of current northern towns and cities and any areas that will become sites of infrastructure development, settlement, and economic change. Many of these areas will also be located along the coasts, exacerbating the current loss of northern heritage resources (archaeological and culturally significant archaeological sites and locations); however, other zones that will be impacted may be considerably far from the coasts, as mines, roads, gas lines, and other infrastructure, or new settlements change the configuration of human impacts on the land.

Understanding their distribution and cultural significance may have implications for Indigenous communities' legal claims to the ownership of terrestrial and maritime resources and sovereignty within their "traditional" territories, if past processes of land division and settlement claims, such as implementation of the Alaska Native Land Claims Settlement Act of 1971 (ANLCSA), provide precedents for future efforts to develop and alienate the resources of the North. Warming trends across the Arctic are leading, already, to the wholesale destruction of archaeological sites through increased coastal erosion and the melting of once–permanently frozen deposits. Archaeological assessment programs from Greenland to Alaska have documented that organic objects, faunal remains, and human remains once preserved in frozen "time capsules" spanning more than 4,000 years are disappearing as these sites melt or are washed away. Across the circumpolar zone, economic and development models anticipate increased shipping and resource exploitation and strategic investments over the coming decades, along with attendant increases in coastal and interior infrastructure systems and population centers to support them. These developments pose additional challenges to the North's archaeological record, especially given that the coastal and maritime adaptations of most of the circumpolar region's Indigenous cultures position the sites representing their most important heritage resources in areas most likely to see future infrastructure development.

Archaeological resources across the North, therefore, contain uniquely preserved records of past climates and ecosystems of value to trans–disciplinary research at a global scale. However, archaeological sites are also integral parts of the intellectual property and heritage resources belonging to contemporary, Indigenous Northern communities. These sites and their contents document those communities' deep ancestral ownership and use of places and landscapes that may be increasingly endangered through development, migration, and environmental changes.

Archaeological research therefore needs to be supported and expanded not only to encourage thematic and trans–disciplinary research addressing enduring and emerging research problems crucial to understanding the North and its role in global cultural trajectories but also to allow archaeologists, Indigenous communities, and policy makers opportunities to co–produce priority structures and policies for salvaging, preserving, or conducting research on archaeological and heritage resources in the face of the interacting environmental, developmental, and institutional changes that are anticipated to affect Northern landscapes and their cultural resources over the next decades. Achieving the balances implied – between salvage and documentation, development and preservation – will require developing a critical mass of Indigenous and non–Native archaeologists and heritage resource managers, trained in Northern archaeology and in collaborative research, sufficient to tackle the work ahead of us, to influence policy development, and to advance new methods and theories sufficient to realize the contributions that northern archaeology can make at global and local levels in the face of transformative change.

The issue of cultural heritage at risk due to northern climate change is an emergent one; we need prioritization and mitigation models to address rapid heritage loss in a thoughtful and coordinated way. Funding needs to be allocated for archaeological research to prioritize those sites that must be saved or protected, to identify those that are at risk now or may be later under different development scenarios, to identify those which should be excavated, and to support the excavation of those that need to be salvaged before their records of the past are destroyed or for the information they can provide on large–scale or local research questions of interest is lost.

Recommendations for the Support of Social Science Research in the Arctic:

Pursue Convergent, Interdisciplinary, and Comparative Research and Funding

The Arctic is a testbed for interdisciplinary research, a "critical region of inquiry." Addressing many complex issues raised by multiple, intersecting vectors of rapid change in the North will require research efforts that are multi–scalar, multi–method and potentially multi–vocal in formulation and execution. This research takes place at multiple scales (e.g., local and global, on both short and long time spans, etc.) and requires that we work across disciplines and regions; the local and the global both need to be supported, and the places of their intersection located. We need to promote and find support for convergent (not just interdisciplinary) research methods and designs for understanding complex problems in the North, as well as collaborative and interdisciplinary social sciences and social–natural–humanities synergies. There is a pressing need for long–term observations, continuity in research, and comparative analyses of the histories, oral histories, archaeological records, and impacts of colonialism in the North. This research should be undertaken across various domains, integrating archaeology, anthropology, history, oral history, economic history, and more. Arctic knowledge is transferable to different regions and contexts, and more comparative studies will facilitate this knowledge transfer and further inform the course of Arctic research. Scientists often find themselves beyond their capacity to grasp and capture the intensity of the situation they are facing and need to look to arts and humanities for ideas and approaches that inform science.

Northern researchers should work to broaden the tent that is Arctic Social Science. Currently the literature is heavy on anthropology and archaeology, and while these remain core

disciplines, Arctic social science needs to incorporate all of the social sciences and seek their integration around problem–oriented approaches. To achieve this we must work to break down walls between disciplines and integrate multiple ways of knowing, beginning with those that exist in undergraduate and graduate training. For example, we should work toward transforming the structure of natural science and engineering degree programs in higher education to incorporate social sciences perspectives. Conversely, social scientists and students with Arctic interests in particular need familiarity with natural–science methods and data.

Funding should support research that takes place at various scales – from the lone researcher working with one community member in co–production efforts for locally significant outcomes requiring minimal equipment or funding to international, large interdisciplinary teams exploring issues on circumpolar scales that require major instrumentation and seven–figure budgets.

Arctic social scientists need to seek sources of funding beyond ASSP. We should mobilize funding resources nationally and internationally, and explore public–private partnerships. Funders and other international science organizations (including IASSA, IASC, SAON, etc.) should support international collaborative efforts and the participation of U.S. researchers. Social science in service to natural science has been the norm at NSF. Even when social science collaborates with natural science, the agenda is generally natural science. Funding should be sought from natural science sources at NSF and beyond, particularly for interdisciplinary research. At the same time, continued and increased financial support for ASSP at NSF is essential.

Engage in International Collaboration

International collaboration is essential for a complete view into the ongoing social and environmental processes in the Arctic. Defined by the Arctic Circle, the Arctic includes eight countries: Canada, Denmark, Finland, Iceland, Norway, Russia, Sweden, and the U.S. Species, culture, and languages are not bound by modern international boundaries. Scholars working across the Arctic share common questions and goals. To promote the best science and scholarship, researchers should work in an internationally open and supportive environment to support sharing of findings, data, theories, and methodologies. Moreover, international collaboration will ensure that diverse viewpoints and findings in Arctic social science research are considered, resulting in stronger scientific endeavors and practices. ASSP has supported large–scale international collaborations (e.g., Iceland, Canada, Greenland or Denmark) and should continue such practices. We note, too that collaboration between Russian and US scientists is difficult, given the current political situation. However, we recommend scholars continue to pursue such partnerships, drawing on NSF and international funding.

Expand Efforts to Mentor the Next Generation of Northern Scholars and Promote Equity in Northern Research

Currently, most scientific research done in the Arctic is performed by those working at universities trained in a Western science approach. Given the strong Indigenous presence in the Arctic, Indigenous points of view, methodologies, and theories on how the Arctic operates need to be supported and grown in partnership with Arctic scientists. To do so, we need to mentor more Indigenous scholars and transform educational structures to support the inclusion of Indigenous peoples in the pursuit of advanced graduate degrees. Additionally, the scientific community must recognize that not all research and science is done within academic institutions and that Indigenous Knowledge is a valid, strong, and complementary way of knowing and observing the world in addition to the scientific method.

Movement toward equality in Arctic research can be achieved in part by moving our discourse around Indigenous scholarship from the broader impacts of projects into intellectual merit, and continued thoughtful inclusion of underrepresented communities in meetings, conferences, panels, and research projects. Continued investment in doctoral dissertation improvement grants and similar opportunities for early career scholars from diverse backgrounds will also help to encourage this process at earlier career stages. Our work should promote Indigenous intellectual equity and equity in presence among gender and career stages in science. Support should also continue to be directed at greater inclusion of women in northern scholarship, and directed at research on northern women and topics related to gender more broadly. Researchers working in communities should work in teams that allow culturally appropriate access into gendered worlds.

Promote, Support, and Enact Indigenous Scholarship

The northern social science community should continue to lead in the realm of Indigenous scholarship and epistemologies, supporting existing efforts and expanding research by, for, and with Indigenous communities. In moving forward, the research community needs to focus on enactment through practical and practiced methods of scholarship, rather than simply talking about what needs to be done toward the achievement of intellectual equality and self–determination. In simple terms, non–Indigenous researchers should “stop asking and start listening” to communities and community members. We need to create opportunities for Indigenous self–determination and knowledge sovereignty, and promote collaboration and exchange, including Indigenous–to–Indigenous and community–to–community collaborations.

Research should push beyond Traditional Ecological Knowledge (TEK) and engagement models, and support transforming research as well as self–development and self–determined models. It is critical that we recognize diverse forms of knowledge production, methodologies, and products of research beyond written texts, journal based publications, and traditionally recognized bases for academic achievement and review criteria in promoting Indigenous scholarship. The Arctic can be decolonized through Indigenous Self–Development. Funding should be directed to agenda–identifying projects, with a focus on community–driven agendas. Considerable scholarship is needed on Indigenous and local knowledge, and Indigenous knowledge transmission, with Indigenous production of knowledge and Tribal self–determination ultimate research goals. The idea of scholarship or benchmarks of Indigenous knowledge must expand and should include intergenerational research teams, with Elders or Tribal leaders as PIs/Co–Is. NSF should empower local communities to have their own local and regional research programs and provide them with researcher contact lists so that the communities contact and engage researchers with fitting expertise and shared interests.

Work to Improve Support for Community and Indigenous Community Collaborative Efforts

Research fatigue in Indigenous Arctic communities is an existing problem that is likely to expand as research and other interests in the North increase in the coming decades. Strategies to prevent research fatigue are essential. Researchers should be trained in how to work with communities. Researchers need to improve transparency and communications with Indigenous communities, while also maintaining or improving practices that support privacy rights, intellectual property rights and sovereignty. Communities should have the opportunity to engage and integrate at all levels of research to the extent desired by the community. Universities and outside researchers should provide evidence of compliance with local community guidelines and practices for Indigenous knowledge–sharing and use as a condition of funding. Research sharing and outreach should be required by communities and funders, and effort should be directed toward improving databases and data access for communities. We should invest in local capacity building as well as community–driven, community–designed research conducted in communities, for communities, by communities. NSF needs to expand its role in educating scientists on what it means to have genuine co–production with Indigenous communities, self–production by communities themselves, and genuine partnership and collaboration.

Support and Expand Linguistic Research and Language Revitalization Programs

The United Nations' 2004 Human Development Report (Fukuda–Parr 2004: 33) states that "Language is often a key element of an individual's cultural identity. Limitations on people's ability to use their mother tongue – and limited facility in speaking the dominant or official national language – can exclude people from education, political life and access to justice." However, in recent decades the rate of language loss across the globe has increased dramatically; these effects have been particularly pronounced in the Arctic. Nearly one–quarter of the 92 Indigenous languages spoken in the Circumpolar North are considered to be "sleeping," with no remaining speakers, and half of these have fallen silent since 1990 (Barry et al., 2013).

The loss of Indigenous languages not only impoverishes the global community but also threatens the stability and rights of communities across the North through irreversible losses of knowledge transmitted inter–generationally in Indigenous languages about land rights, the environment, and community heritage. We therefore need more research on the speed of language loss in communities across the Circumpolar North; the social contexts that promote stability, loss, or revitalization; and on–going work on the gendered and inter–generational impacts of language loss on communities and cultural stability. Such work needs to be coupled with projects to record languages in danger of disappearance, to guide language revitalization programs for maximum effectiveness, and to disseminate the results of this research to communities and researchers.

In addition, we need research with community members in their own languages to retain and integrate the knowledge they keep and convey best within their own linguistic frameworks about the North with the work of non–Native researchers in the natural and social sciences. Language provides a window into the way a culture experiences its environment and hence can provide information about changes in that environment. However, as a result of recent and rapid changes in human–environment interactions in the North, traditional knowledge is particularly susceptible to loss, even in relatively vibrant linguistic communities. Indigenous Science is often the most "vulnerable part of a community's cultural and linguistic heritage" (Si 2011: 185). There is thus a great need to expand documentation efforts to include greater coverage of specialized knowledge domains such as botany, astronomy, and toponymy, building on recently successful projects such Fienup–Riordan's (2007) collaborative work on Yup'ik science and Gearheard, Holm, Huntington, Leavitt, Mahoney, Opie, Oshima, and Sanguya's masterfully co–produced work on the meaning of sea ice to Arctic communities (Gearheard et al., 2013).

Invest in Data, Information, and Knowledge: Data Curation and Sovereignty for ASSP

ASSP should invest in data management, maintenance, and services, with a comprehensive plan and culture of data sharing to manage and curate ASSP data for the future, leveraging the many ongoing efforts outside of the Arctic. Investing in these services will be critical to future research and collaborations, allowing for more powerful analyses at larger spatial and deeper temporal scales, by providing increases to quantity, quality, and scales of data collection and use. Data sources that could be accessed, discovered, and shared are not just quantitative data, but also data in museum collections, archives, photos, and interviews.

Improve and Support Research Communication with the Public and Indigenous Communities

We must strive to make "broader impacts" a central part of the research process and goals, and to find ways to evaluate and assess the intended and unanticipated impacts of social science research carried out in the North. Innovation in the communication of scientific knowledge to the public and to policymakers should be supported by funders and recognized professionally as a scholarly contribution. Methods of assessing the impact of educational and broader effects could be enhanced through more collaboration with education science. Developing ways to engage youth in Arctic research would be particularly worthwhile. Improving communication among the research community and collaborators, including Indigenous partners, can be done through a variety of already–existing venues, including the Interagency Arctic Research and Policy Committee (IARPC), which holds periodic webinars with a diverse set of communities and research interests. Arctic social science is little represented in these venues, so an effort should be made by ASSP researchers to further engage in these avenues to highlight ongoing social science research. Researchers should be encouraged to share methodological innovations, findings, and data developed in Arctic studies with scientists focusing on other regions. Last, we must work to improve databases and data access for communities (see below) and require sharing and outreach in all northern research.

Continue the Arctic Horizons Effort

While the ultimate goal of Arctic Horizons was to create a document (this report), that would help with re–envisioning Arctic social science research for the next decade or more, the process itself had many other values. Workshop participants forged new social, personal, and professional links, which have created opportunities for new research partnerships; new research directions emerged from workshop discussions that crossed traditional disciplinary boundaries and brought together scholars from diverse career stages and areas of expertise. The Indigenous scholars workshop in Fairbanks was described as transformative by numerous participants. This was a rare opportunity for Indigenous scholars to come together and focus specifically on future directions for Indigenous scholarship in the Arctic, and to develop recommendations for scholarship by and for Indigenous peoples.

Based on feedback from participants, we strongly recommend that the Arctic Horizons process continue in the future. Some recommendations for workshops that would build on the work completed to date include holding additional workshops for Indigenous scholars (perhaps some in northern communities to ease participation), conducting workshop(s) for early career scholars, and bringing in additional international participation either through more funding for U.S. based workshops or by holding workshops at various international locations.

6. SUMMARY

The Arctic Horizons project brought together a diverse group of Indigenous and non–Indigenous scholars from across the social sciences and other disciplines. Our goal was to work together to re–envision research priorities for Arctic social sciences over the next 10 years and to make programmatic recommendations for funding agencies.

From this work it is apparent that the Arctic social science community is uniquely positioned to

1. Make crucial contributions to guide and understand change in the North through study of the shifting intersections between people, communities, environments, heritage, policy, infrastructure, and development.
2. Contribute to policy production around issues of sustainability, climate change response, globalization, militarization, and development.
3. Inform engineering, natural sciences, and other interdisciplinary collaborations through our research on past and present human experience and knowledge of the built and natural environments of the Arctic.
4. Empower Indigenous communities in the North through collaborative research and the elevation of Indigenous knowledge and experience in policy discourse.
5. Contribute to the present and future needs of peoples in the North with our work on issues of sustainability, heritage, climate change impacts and response, urban and rural socio–economic systems and development, community resilience, health and well–being, food security, gender and youth studies.

The 21st century Arctic has moved to the forefront of national interest and public perception. At the same time, Arctic communities face rapid socio–economic, environmental, and geopolitical change. Arctic social science research will continue to be a critical source of knowledge in “navigating the new Arctic” (NSF Big Ideas, 2016).

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8. APPENDICES

I. List of Steering Committee

II. List of Advisory Board

III. List of workshop participants

IV. Arctic Horizons Workshops

V. Lists of workshop discussion questions

Appendix I. Steering Committee

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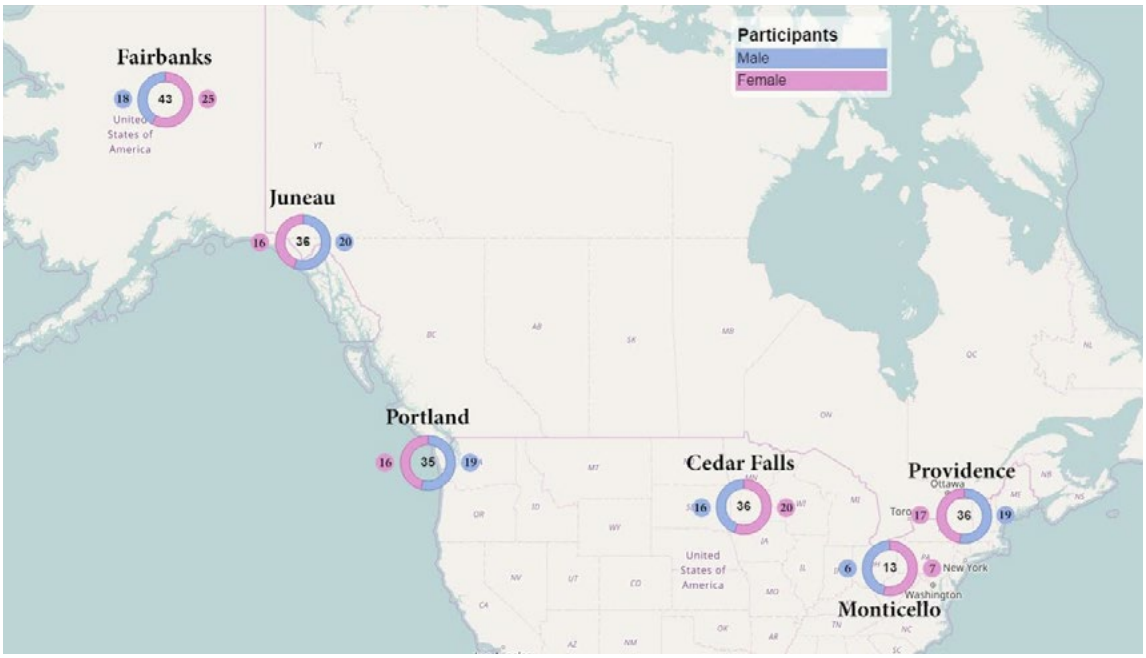
Appendix II. Advisory Board

Barbara Bodenhorn, University of Cambridge/Iliqsavik Tribal College
Nikoosh Carlo, U.S. State Department
F. Stuart Chapin, III (Terry), University of Alaska Fairbanks
Elizabeth (Moore) Cravalho, NANA Regional Corporation
Gail Fondhal, University of Northern British Columbia
Larry Hamilton, University of New Hampshire
Henry Huntington, Pew Environment Group
Susan Kaplan, Bowdoin College
Tim Kohler, Washington State University
Thomas H McGovern, Hunter College (CUNY)
Peter P. Schweitzer, University of Alaska Fairbanks

Appendix III. Workshop Participants



Workshops participation

Appendix IV. Arctic Horizons Workshops

Participant Selection. Each of the five regional workshops hosted between 35 and 48 individuals, selected by the Steering Committee to represent a diverse range of disciplines and scholarly backgrounds, including early career scientists and students as well as mid– and late–career researchers. To make their selections, the Steering Committee developed a list of participants to invite, drawing on these main sources: 1) lists of all PIs and CO–PIs on ASSP current and recently ended grants; 2) professional connections through regional, national, and international associations and contacts; 3) key international researchers; 4) representatives of the main research centers and institutions engaged in Arctic Social Science research (e.g., University of Alaska Fairbanks, University of Alaska Anchorage), Byrd Polar Research Center (Ohio State University), National Snow and Ice Data Center (University of Colorado, Boulder), and Institute of Arctic Studies (Dartmouth College); 5) representatives of topically focused centers engaged in ASSP studies (University of New Hampshire, Brown University, University

of Chicago, Portland State University, University of Oregon, University of Idaho, University of Kansas, University of Colorado, Boulder, University of California, Santa Barbara, UCLA, University of Northern Iowa, University of Minnesota, Twin Cities, the Smithsonian Institution, Rutgers University, Pennsylvania State University, University of Connecticut, George Washington University, University of Washington, George Mason University, Indiana University; and others).

Recruiting scholars and members from Indigenous and Arctic residents was a key component of Arctic Horizons programming. While a small number of Indigenous scholars were present at each of the five workshops, the Fairbanks Workshop was focused on Indigenous perspectives. The Local Organizing committee included a member of the Steering Committee who is an Indigenous researcher and community representative, and this group developed and reviewed a plan for engaging other key Indigenous researchers and community perspectives within each stage of the collaborative process.

Workshop Process. The main goal of the workshops was to elicit ideas and perspectives from participants about current and future directions for Arctic social science research. To organize discussion and to provide some continuity across workshops, the Steering Committee formulated several questions in advance, through discussions with the Arctic Horizons Advisory Panel and the Local Organizing Committees:

1. The Changing Arctic: What are the most important changes affecting the Arctic now and in the coming decades?
2. Changes in Arctic Social Science: How has Arctic social science changed over the last 20 years? Why do these changes matter to the social sciences, the broader scientific community, and society at large?
3. Broader Impacts and the Future of Arctic Social Science: In what ways has Arctic social science influenced the field of social science more broadly? What contributions can and should we continue to make, and what new contributions have we made, or do we have the potential to make, in the future? What key questions remain unanswered in the Arctic that require concerted research effort in the next 10–15 years?

The Fairbanks workshop shared the following Key topics & questions:

Exploring Indigenous Experiences and Understandings of the 'new Arctic'

- What are the primary drivers of change in the Arctic from an Indigenous perspective?
- How are Indigenous communities responding and adapting to change in the Arctic?
- How are Indigenous communities involved in identifying the most important changes affecting the Arctic now and in the coming decades?

Exploring Indigenous Experiences with Research

- What has been the Indigenous experience of social science research in the Arctic and beyond?
- How has Western–based research and science been impacted by Indigenous knowledge and practices?
- How have Indigenous experiences and perspectives of research changed over the past two decades?
- What factors have been most critical in changing Indigenous experiences and perspectives of research?
- What are key research priorities for Indigenous peoples in the Arctic?

Exploring Indigenous Knowledge and Indigenous Research Methodologies

- What is Indigenous knowledge and how does it interact/intersect with Western science?
- How does Indigenous knowledge inform domains of human experience in the Arctic (social, economic, political, ecological, educational, health/wellbeing, etc)?
- How is knowledge shaped by language?
- What are best practices for engaging Indigenous communities and community members in research?
- How can we engage in "de–colonizing methodologies" in social science research?

These questions were circulated to participants at least three weeks prior to each workshop. Participants were also asked to review several recent publications related to Arctic social science research, providing common context and facilitating discussion (e.g., Arctic Social Sciences: Opportunities in Arctic Research, 1999; AHDR–II, 2014; The Arctic in the Anthropocene, 2014; Megatrends, 2011). In addition to the core questions, each workshop

emphasized particular themes within Arctic social science to allow more in–depth consideration of those issues. Both the Fairbanks and Juneau workshops took slightly different approaches with a stronger emphasis on participant driven questions and interests. While meeting formats varied somewhat, most workshops followed a common pattern. Workshops began with an icebreaker and general introductions, followed by a keynote address. For 1.5 to 2 days, the participants engaged with the core set of questions, often in break–out groups of 5–8 people, with one designated scribe. After each question was discussed in the small break–out groups, the participants as a whole would reconvene, with a spokesperson from each break–out group summarizing key ideas that emerged from a given discussion. Formal panels were sometimes set up to highlight specific themes (e.g., at the Portland Workshop, a 5–member panel discussed ways interdisciplinary research informed their work). Most workshops included two or more plenary presentations where speakers were asked ahead of the conference to prepare formal remarks relevant to a given theme. At most workshops, notes taken during all the proceedings were closely reviewed by the Steering and Local Organizing Committees, to extract the primary themes that emerged from the various activities (e.g., small group and plenary discussions, panels, keynote addresses). At the end of most workshops, participants were asked to fill out a simple review form to learn what the participants found valuable, what could have been improved regarding the workshop process, and overall organization.

After each workshop, the Steering Committee members who organized that workshop would share key outcomes informally with the rest of the Steering Committee during monthly teleconferences, which often facilitated the organization for upcoming workshops. Each workshop, then, had the opportunity to build on the knowledge gained from previous workshops, thus improving the process in an iterative fashion. To prepare for the Synthesis workshop, the Steering Committee member(s) linked to a given workshop wrote a ~2 page summary of the main themes to emerge from their specific workshop.

Portland State Univ. Workshop:

Arctic Social Sciences in the 21st Century: Integrating Past, Present, and Future Human Ecodynamics in Arctic Social Science Research [February 7–9].

The Portland workshop brought together a diverse group of Arctic scholars currently engaged in Arctic social sciences research. Our aim was to generate discussion on a range of related topics including social sciences research and northern climate change; the challenges, promise, and future of interdisciplinary research in Arctic contexts; social science research and heritage issues; and applied social sciences research. While the majority of attendees were social scientists, researchers from the natural sciences were included to broaden the range of perspectives, especially regarding human–environment relationships. Dr. Thomas McGovern (City University of New York) gave a keynote address titled "The Anthropocene in the North: Prospects, Potentials, and Threats," and Jon Waterhouse and Mary Marshall (Oregon Health Sciences University) gave a keynote address titled "Indigenous Voices from the Arctic to the Amazon."

Univ. of Alaska Fairbanks Workshop:

Arctic Social Sciences in the 21st Century: Indigenous Scholarship in the North: Decolonizing Methods, Models and Practices in Social Science Research [March 23–25].

The Fairbanks workshop aimed to explore recent advances and innovations in Indigenous science, and scholarship in the circumpolar north and its neighbors. The workshop brought together Indigenous experts and researchers from diverse academic and cultural backgrounds to explore the role and contributions of Indigenous frameworks and knowledge systems in

advancing fields of science and informing global solutions. The workshop explored Indigenous science as relational, holistic, and multidimensional, taking into account impacts of the social and cultural environment on physical, material, and human processes. The workshop strove to move the academic discourse beyond exploring intersections of Indigenous knowledge and science to exploring Indigenous knowledge and practice as a framework of science. Additionally, participants discussed how knowledge produced within Indigenous systems contributes to community adaptation and resilience within multiple global contexts and settings. The workshop highlighted innovative, community–driven, and decolonizing methodologies that demonstrated how Indigenous frameworks can shape both knowledge and practice within social science research.

Univ. of Alaska–Juneau Workshop:

Arctic Social Science in the 21st Century: Uninhibited Synergies: Connecting Humanities, Engineering, and Social Sciences in Arctic Research and Public Engagement [March 31–April 2].

Broadly, the workshop aimed to identify the domains of human experience in the northern circumpolar regions that warrant prioritization in research, public outreach, and education; and to contemplate the known and novel synergies for working within these agendas. The vision of a specialized contribution to the Arctic Horizons process was vested in the workshop's focus on interactions of diverse epistemologies, aesthetic experiences, material words, human wellbeing, and social justice. In part, the disciplinary representation chosen for the workshop was driven by the fact that the types of cross–disciplinary collaborations in Arctic research over the past two decades have been predominantly between social and natural scientists. The Juneau workshop sought to explore a broader scope of collaborative experiences and discuss multimodal and multidisciplinary approaches in research, outreach, and education. Among the represented fields were anthropology, Indigenous scholarship, sociology, education, fine arts, architecture, rural development, marine ecology, and environmental engineering.

Univ. of Northern Iowa Workshop:

Arctic Social Sciences in the 21st Century: Integrating Theories, Data and Methods to Ascertain Local, National and International Relevance. [April 14–16].

This workshop gathered a diverse group of scholars to discuss state–of–the art methods and theories in Arctic social sciences and develop visioning scenarios for the future of social science research in the Arctic. The core topics paralleled discussions held at other regional workshops which included social sciences research and climate change; interdisciplinary research in the Arctic; social sciences and humanities in the Arctic; and applied social sciences research. Although the majority of attendees were social scientists, researchers from the natural sciences, archaeology, and the humanities were included to broaden the range of perspectives in workshop discussions. Particular emphasis was placed on applied research through integrating social science theories, methods, and data to serve the needs of Arctic communities, to meet national U.S. priorities, and to address global challenges of the 21st century. A special theme was the relevance of Arctic social science scholarship for sustainable development at different scales and in different regions (including all Arctic nations and the continental U.S.).

Brown University Workshop:

Arctic Social Sciences in the 21st Century: Integrating Interdisciplinary Natural/Social Scientific Research for Policy Development [May 31–June 2].

This workshop brought together a diverse international (U.S, Canada, Greenland, Iceland, Norway, Denmark, and Finland) group of researchers working on multidisciplinary natural/social science projects addressing issues of contemporary and past changes in the

North, social scientists focused on policy development at a global scale, and policy makers. In addition to discussion of Arctic Horizons core questions, this workshop specifically focused on connections linked to the integration of broad–based social and natural scientific research in policy development and implementation, as well as considering the degrees to which policy development and forecasting should lead to the prioritization of research funding or be independent from it. As Arctic Horizons only U.S. East Coast venue, our participants were mainly from eastern North America, with international participants from the North Atlantic region and Canada. Mark Brzezinski (Executive Director, U.S. Arctic Executive Steering Committee) gave a keynote address titled "The Arctic as a National Imperative," and Lene Kielsen Holm (Research Scientist and Project Leader, Greenland Climate Research Centre) gave a keynote address titled "Ilisimatusarneq, issittumi nunat inoqqaavisa ilisimasaat ilanngullugit / Building New Knowledge from the Arctic by the Methods of Knowledge Co–production."

Synthesis Workshop, Jefferson Institute:

Arctic Social Sciences in the 21st Century: Synthesis Meeting [September 21–23].

Members of the Steering Committee and a small selection of additional guests gathered with the aim of enhancing diversity, totaling 13 people. The goal of the Synthesis Workshop was to identify and synthesize the core threads of the previous workshops and public contributions proffered between workshops.

Appendix V. Workshop Discussion Questions

Portland State University (February 7–9, 2016)

1. The Changing Arctic

a) What do you see as the most important changes affecting the Arctic now and in the coming decades? What evidence is this change based on?

b) Are further changes discussed locally? If so, how might they be investigated?

c) What are possible drivers for Arctic change and what are some possible complications in identifying and assessing drivers of change?

d) What existing strategies for coping with or addressing change have been developed locally? Regionally? What are the challenges in understanding their consequences?

e) Are there particular nodes where drivers and strategies reflect contradictory factors (e.g. socio–political; ecological; developmental; scale; time; conflicts of interest)?

f) Are there potentially new and innovative strategies being considered in the settings where we work that invite further attention? Are there ways to assess potential consequences of these strategies?

g) What will we miss if we ignore the changes/drivers you identify?

h) What will we be able to do or do better if we improve our understanding of those changes/drivers and their societal effects?"

2. Changes in Arctic Social Science

a) What are we able to do now in Arctic social sciences that we could not do 20 years ago?

b) What results, discoveries, theories, methodological innovations, trends, and (inter) disciplinary approaches have changed the scope, nature, and place of Arctic social sciences across knowledge systems?

c) Why do these changes matter to social sciences, the broader scientific community, and to society at large?

3. Broader Impacts of Arctic Social Science

a) In what ways (e.g. theoretical, methodological, topical, etc.) has Arctic social science influenced the field of social science more broadly?

b) What contributions can and should we continue to make, and what new contributions or do we have the potential to make, in the future?

c) If Arctic conditions act as a global driver, do you see the potential for Arctic social science to play a critical role outside of the Arctic as well? If so, in what ways?

4. The Future of Arctic Social Sciences

a) What key questions remain unanswered regarding integrated social and social–ecological systems in the Arctic that require concerted research effort in the next 10–15 years?

b) What are we unable to do as a result of our knowledge gaps? Why does this matter?

c) What do we risk if we are not open to new and emerging issues?

5. Panel–Led Discussion: Integrating Past, Present, and Future Human Ecodynamics in Arctic Social Science Research.

Scientists are working across traditional disciplinary boundaries and with a wide range of "others" (e.g. artists; educators, traditional resource users, etc.) in increasingly productive ways. Much, although certainly not all, of this interdisciplinary and transdisciplinary research is focused on the interaction of humans and the Arctic environment. This research, which requires working across variable time–scales, with different data sets, and with people outside of one's own discipline holds much promise for furthering our understanding of past and present human ecodynamics. There are also many challenges. We have organized a panel to discuss: a) the promise and challenge of conducting inter– and transdisciplinary research on human ecodynamics and in other research areas, b) a consideration of the future of this type of research, and c) specific recommendations for research and funding priorities for inter– and transdisciplinary research.

The panelists will speak briefly (5 minutes or so) on the points below, drawing specific examples from their own experience. Then, they will then engage with each other and the larger group in a discussion of the same points.

a) Based on your experiences, what do you think is a good model for engaging in inter– or transdisciplinary research?

b) What worked and what were were the challenges in carrying out inter– or transdisciplinary research (e.g. scholarly training, logistics, funding)?

c) Has your own understanding shifted as a result of such interactions? Has transdisciplinary work altered the questions you ask? As you try to see the world through other lenses have you become engaged in altogether new areas of scholarship or approached "old" problems in new ways?) .

d) Do you see the impact of your own work or discipline on the ways your collaborators understand their own work?

e) What is the future of inter– and transdisciplinary research in the Arctic (Specifically for research on human ecodynamics and/or more broadly)? Do you think the current support for inter– and transdisciplinary work (funding, scholarly accolades, institutional organizations) is sufficient, or do we need more? What, if any, funding priorities do you think there should be for this type of work?

Brown University (May 31 – June 2, 2016)

Discussion Questions

Below are five key themes and related open–ended questions that we will explore as a group over the course of our workshop. Also included are four required readings. Additional recommended readings can be found on the project website: http://arctichorizons.org/literature. Please spend some time with the required readings and questions ahead of the workshop to help facilitate a productive discussion.

As you consider these questions, please give some additional thought to the themes of this workshop – interdisciplinarity and policy – and consider:

- ways in which interdisciplinary or transdisciplinary approaches have advanced or hindered progress in your own work or in related research domains,

- the dimensions of interdisciplinarity that seem to you most capable of advancing or hindering research, career development, public understanding of complex issues, and responsible policy guidance
- ways in which interdisciplinary research in the North (your own or in general) integrates with, responds to, is developed as an outcome of, guides or could guide policy developments in the countries from which you receive funding and in the communities, regions, and nations where we do our work.

Question 1. The Changing Arctic

a) What do you see as the most important changes affecting the Arctic now and in the coming decades? What evidence documents these changes?

b) What are the most important drivers of change in Arctic social and natural systems and what are some possible complications in identifying and assessing these drivers of change and their interactions?

c) How do issues related to the scales at which these changes occur, manifest, or require responses complicate social sciences research, interdisciplinary research, public perceptions, and policy development looking forward?

d) What should we be able to do or to do better if we improve our understanding of those changes/drivers and their societal effects?

Question 2. Changes in Arctic Social Science

a) What are we able to do now in Arctic social sciences that we could not, or did not, do 20 years ago?

b) What results, discoveries, theories, methodological innovations, trends, and (inter) disciplinary approaches have transformed the scope, nature, and place of Arctic social sciences across knowledge systems?

c) Why do these changes matter to social sciences, the broader scientific community, and to society at large?

Question 3. Broader Impacts of Arctic Social Science

a) In what ways (e.g. theoretical, methodological, topical, etc.) has Arctic social science influenced the field of social science more broadly?

b) What contributions can we continue to make that affect domains beyond the social sciences, and what are the most important new contributions that we have the potential to make, in the next 20 years?

c) If Arctic conditions act as a global driver, do you see the potential for Arctic social science to play a critical role outside of the Arctic as well? If so, in what ways?

Question 4. Arctic Social Science and Arctic Policy

a) What responsibilities should Arctic social scientists have, looking forward, to policy makers and the public?

b) Should our work be guided by efforts to promote better policy development at local, national, and international levels to help confront and direct social, environmental, political, and strategic goals?

c) Should Arctic research priorities be guided by national policy goals or be independent of them?

d) How should we balance potentially competing or divergent policy goals of the countries that provide our funding and those of communities or countries in which we work?

Question 5. The Future of Arctic Social Sciences

a) What key questions remain unanswered regarding integrated social and social–ecological systems in the Arctic that require concerted research effort in the next 10–15 years?

b) What are we unable to do as a result of our knowledge gaps? Why does this matter?

c) What do we risk if we are not open to new and emerging issues?