2018 Annual Report on the Implementation of the Arctic Research Plan 2017-2021

Report to the Interagency Arctic Research Policy Committee[1]

The 2018 annual report highlights activities of the IARPC Collaboration Teams (see below) that address the policy drivers outlined in the Arctic Research Plan 2017-2021 (hereafter the Plan). Consistent with U.S. Arctic Region Policy[2] and the National Strategy for the Arctic Region[3], the policy drivers for the Plan are:

(1) Enhance the well-being of Arctic residents;
(2) Advance stewardship of the Arctic environment;
(3) Strengthen national and regional security; and
(4) Improve understanding of the Arctic as a component of planet Earth.

The research conducted to implement the Plan in support of these policy drivers is coordinated by nine collaboration teams each supporting one of nine research goals. The Plan does not attempt to cover all Arctic research supported by the Federal Government. Rather, it addresses key topics for which an interagency approach is most likely to accelerate progress. The nine goals and their corresponding collaboration teams are:

(1) Enhance understanding of health determinants and improve the well-being of Arctic residents (Health & Well-being Collaboration Team – HWCT)
(2) Advance process and system understanding of the changing Arctic atmospheric composition and dynamics and the resulting changes to surface energy budgets (Atmosphere Collaboration Team – ACT)
(3) Enhance understanding and improve predictions of the changing Arctic sea ice cover (Sea Ice Collaboration Team – SICT)
(4) Increase understanding of the structure and function of Arctic marine ecosystems and their role in the climate system and advance predictive capabilities (Marine Ecosystems Collaboration Team – MECT)
(5) Understand and project the mass balance of glaciers, ice caps, and the Greenland Ice Sheet, and their consequences for sea level rise (Glaciers & Sea Level Collaboration Team – GSLCT)

[1] IARPC is a National Science and Technology Council sub-committee of the Committee on Environment. The Federal agencies comprising IARPC are: Department of Commerce (DOC), Department of Defense (DOD), Department of Energy (DOE), Department of Health and Human Services (HHS), Department of Homeland Security (DHS), Department of the Interior (DOI), Department of State (DOS), Department of Transportation (DOT), Environmental Protection Agency (EPA), Marine Mammal Commission (MMC), National Aeronautics and Space Administration (NASA), National Science Foundation (NSF, Chair), Office of Management and Budget (OMB), Office of Science and Technology Policy (OSTP), Smithsonian Institution (SI), and United States Department of Agriculture (USDA). Other agencies also contribute to implementation of the Arctic Research Plan.
[2] National Security Presidential Directive/NSPD 66, Homeland Security Presidential Directive/HSPD 25: Arctic Region Policy, The White House, Washington DC, 2009
[3] National Strategy for the Arctic Region, The White House, Washington DC, 2013

(6) Advance understanding of processes controlling permafrost dynamics and the impacts on ecosystems, infrastructure, and climate feedbacks (Permafrost Collaboration Team – PCT)
(7) Advance an integrated, landscape-scale understanding of Arctic terrestrial and freshwater ecosystems and the potential for future change (Terrestrial Ecosystems Collaboration Team – TECT)
(8) Strengthen coastal community resilience and advance stewardship of coastal natural and cultural resources by engaging in research related to the interconnections of people, natural and built environments (Coastal Resilience Collaboration Team – CRCT)
(9) Enhance frameworks for environmental intelligence gathering, interpretation, and application toward decision support (Environmental Intelligence Collaboration Team – EICT). EICT has three sub-teams:
    - Arctic Observing Systems Sub-team (AOSST);
    - Arctic Data Sub-team (ADST); and
    - Modeling Sub-team (MST)

The Plan is implemented using the collaborative framework of IARPC Collaborations[4], which brings together Federal government researchers and program managers to address Arctic research challenges in collaboration with academic researchers and others outside the Federal government, and where each collaboration team has a leadership group comprising at least one "Fed" and one "non-Fed".

For each team, a 2018 annual report and a summary of progress on performance elements was prepared by the Federal government collaboration team leaders and is available on the IARPC Collaborations website. What follows are highlights from those annual reports that address how the teams have responded to the Plan's four policy drivers.

(1) Enhance the Well-being of Arctic Residents

Several teams (TECT, HWCT, ACT, and AOSST) have worked together to better articulate the exposure, vulnerability, and adaptive capacity of remote Arctic communities to wildfire smoke and its health effects. Their efforts focused on observing system applications and gaps for wildfire smoke detection and forecasting. They examined the benefits of using the Local Environmental Observer (LEO) Network to help improve smoke preparedness efforts in potentially affected communities, and ways to better identify at-risk populations in the Arctic and improve on-ground fire forecasting and observation tools. The collaboration teams believe that significant effort to improve forecasting is underway, but relatively little work on the impacts and vulnerability of communities exists. A strategy and mechanisms for catalyzing research will continue to be explored.

The SICT used its meeting and web space to bring information to Arctic communities about the National Oceanic and Atmospheric Administration's (NOAA) Earth System Research Laboratory Arctic sea ice forecasts which use a fully-coupled, ice-ocean-atmosphere model. These forecasts are important for planning subsistence activities and supporting community wellbeing. The SICT also strengthened linkages between Arctic residents and sea ice scientists through presentations on the Alaska Arctic Observatory and Knowledge Hub, the Sea Ice for Walrus Outlook, and synthesized knowledge through the Study of the Environmental Arctic Change.

[4] IARPC Collaborations: www.iarpccollaborations.org

The CRCT organized a series of meetings intended to develop a discussion around co-producing knowledge. The first meeting was an Indigenous-only meeting, coordinated through the Inuit Circumpolar Council-Alaska network focused on co-production of knowledge and why it is critical to the well-being of Indigenous Peoples. The next meeting aimed at advancing an understanding of the co-production process. The discussion focused on the nature and source of distrust among Indigenous Peoples and researchers and identified ways to restructure systems to facilitate co-production processes. CRCT leadership is discussing a potential workshop on knowledge co-production.

The HWCT, PCT and TECT co-organized a meeting to address issues related to mercury storage in permafrost and potential and existing mercury monitoring resources. These resources can be used to better identify human exposure to mercury and whether other natural resources, such as fish, are being impacted.

The MECT held discussions and presentations addressing the functioning of the food web in the Chukchi and Beaufort Seas that supports the subsistence of Arctic residents. The team focused on drivers of change, functioning of the food web, and potential impacts of environmental change on subsistence activities. Their discussions illustrated that changes in environmental drivers that affect primary productivity, fish populations, and top predators are relevant to Arctic residents who are dependent upon subsistence activities that include taking fish, marine mammals, and birds.

(2) Advance Stewardship of the Arctic Environment

As a result of warming sea surface temperatures, the prevalence and frequency of harmful algal blooms (HABs) are increasing in the Alaskan Arctic, posing a threat to marine ecosystems and subsistence communities. The gap in current scientific understanding of Arctic HABs, lack of toxicity monitoring of subsistence food and safety protocols in place and preparedness to respond to wide-spread HABs, pose a considerable threat to coastal communities in the Arctic. In pursuing responsible stewardship of the Arctic environment (as well as enhancing the well-being of Arctic residents), the EICT aimed to increase the awareness of this issue, improve scientific coordination by leveraging funded FY18 research activities, and enhance communication both within the science community and between researchers and residents. This coordination has resulted in a multi-faceted partnership between the IARPC, NOAA Research and Ocean Service, the National Science Foundation (NSF), the North Pacific Research Board and the University of Alaska Fairbanks that has formed the foundation of Arctic HABs response team.

The EICT research coordination has brought together researchers from nearly 20 research cruises operating in the 2018 field season and leveraged a total of seven Bering Strait region research cruises that collected intensive HABs samples at an estimated 344 collection sites. This research coordination contributed significantly to the baseline understanding of HABs in the region while enhancing data sharing between researchers and residents. A HABs 2018 Coordinated Collection Map and data sharing and archiving site hosted by Alaska Ocean Observing System (AOOS) has been created specifically for this effort. Outreach lectures given prior to and following research cruises elevated the awareness of research efforts within communities and handouts summarizing research results quickly disseminated initial findings from the 2018 field season. An end-of-season synthesis following the return of the final coordination research cruise in November 2018 will be compiled and shared via relevant Federal, academic and communication channels (e.g. NOAA Easting Bering Sea Climate status report) and the IARPC Collaborations website.

The MECT organized and agencies supported the development of a new pan-Arctic conceptual model of the marine ecosystem by an international team. The comprehensive nature of the model includes the role played by humans in the system. An interactive version of the model is being made so that scientists, managers and decision-makers will be able to create different scenarios depending on different conditions set by the user. Several relevant considerations were incorporated into the model during its development to enhance its usefulness to natural resource management. These added elements allow users to set up environmental conditions and interventions and then observe if cascading (or domino) effects develop and what new conditions and interactions emerge. At a June 2018 meeting in Svalbard, Norway, the model was proposed as a tool-kit for guiding pan-Arctic integration efforts in science, management, and governance.

The MECT led discussions on the functioning of the marine food web (see the Well-being of Arctic Residents policy driver for more information). These discussions explained how changes in structure and functioning of local ecosystems need to be better understood in order to make responsible decisions on environmental stewardship including consistency across international borders. The MECT is currently organizing joint activities with the International Arctic Science Committee (IASC) to advance on this front.

The CRCT in several meetings addressed issues of the changing Arctic ecosystem and its connections to those living on the coast. Topics range from invasive species, interactions between walruses and vessels, and how to protect vulnerable archeological sites. These topics were identified for their relevance to communities, and many of the presentations spoke to an audience of Arctic community members.

(3) Strengthen National and Regional Security

A sustained Arctic observing network is critical to providing the information needed to improve short-term environmental prediction capability, longer-term projections of the state of the Arctic region, and skillful forecasts of operational environments for emergency response. Accurate sea ice maps, for example, enable safe navigation of Arctic waters for commercial, research, and search and rescue vessels. The AOSST has focused efforts in 2018 on coordinating U.S. contributions to the sustained observing strategy and implementation plan and promoting the implementation of the Arctic observations' assessment framework, which directly maps Arctic Societal Benefit Areas to the set of Arctic observations that contribute to delivering those benefits through a value tree approach. The AOSST applied the assessment framework in two areas: (1) application to wildfire forecasting; and (2) application to sea ice forecasting, both of which are directly relevant to national and regional security. This activity can promote collaboration by providing a clear framework by which the research community can articulate their observational priorities to meet research goals and identify gaps in current observational networks and data availability.

SICT meetings informed the community of the Stratified Ocean Dynamics of the Arctic (SODA) project of the Office of Naval Research (ONR). SODA is an investigation of water circulation and stratification, sea ice behavior and the acoustic environment in the western Beaufort Sea and the Canada Basin. With the encouragement of the Office of Science and Technology Policy, additional contributions from the Bureau of Ocean Energy Management, NSF, NOAA, and the National Aeronautics and Space Administration, were added to SODA. The year-long SODA+ field campaign, which began in September 2018, is a research project that aims to improve understanding of the air-ice-ocean system and tests observing

technologies. It is part of broader interagency efforts to develop an integrated Arctic observing network that supports numerical forecasting, prediction, and projection.

(4) Improve Understanding of the Arctic as a Component of Planet Earth

IARPC research provides information about the important role of the Arctic in the global system. This can take many forms but is most strongly enforced through observations and modeling. Several projects were presented to the SICT, often in collaboration with other teams such as the ACT, demonstrating the increased collaboration between the observing and modeling research communities via the use of in situ observations to evaluate model performance and the assimilation of observations derived from satellite and aircraft (e.g., Multidisciplinary drifting Observatory for the Study of Arctic Climate (MOSAiC) project). Strategies for better integrating observations into regional and global-scale models were discussed in the context of the Year of Polar Prediction (YOPP – for more information, see below), the Sea Ice Prediction Network's Sea Ice Outlook, NOAA's sea ice forecasts, and Earth system climate simulations.

In 2018, the PCT engaged the TECT and MST in an informal but sustained relationship to address ongoing issues related to systems-based models for the Arctic. A series of webinars dedicated to enhancing Arctic modeling efforts, for which permafrost is a key component, and addressing cross-linked performance elements among the three teams, were held.

The GSLCT highlighted the NSF-funded Arctic System Change workshop hosted at the National Center for Atmospheric Research in Boulder, Colorado in April 2018 as a significant contribution to this policy driver. The workshop brought together observers and modelers from several disciplines in Earth Science and addressed the need for long-term and detailed observations of ice-sheet and glacier mass balance and dynamics. It was noted that mountain glaciers are presently not captured in Earth system models, highlighting the need for further process development in models. The meeting brought together both US and international researchers focused not only on glaciers and sea level but also on the profound changes underway in the Arctic. Communication and collaboration between agency scientists and academics were bolstered substantially by the workshop.

The ACT has participated in planning for, conducting, and analyzing data from several scheduled field measurement-related activities, including the International Arctic Systems for Observing the Atmosphere (IASOA), YOPP, MOSAiC, and NASA's Atmospheric Tomography Mission. IASOA aims to advance and coordinate research objectives from independent pan-Arctic atmospheric observatories by strategically developing comprehensive observational capacity, facilitating data access and usability, and mobilizing contributions to science and socially-relevant services. YOPP aims to promote cooperative international research enabling development of improved weather and environmental prediction services for the polar regions on time scales from hours to several months. These efforts are leading to collaboration between the scientists making observations and the modelers evaluating the data to better determine the long- and short-term variability of traces gases in the Arctic and improve our understanding of the physics of Arctic ozone depletion events.

Conclusion

Over the past year, the IARPC Staff Group and collaboration teams have promoted communication, coordination, and collaboration on research activities among agencies and with external partners in an

effort to better understand the Arctic. The work of the collaboration teams has focused on implementing the Plan and taking actions to address performance elements under their purview. At the same time, they are identifying new, emerging, and critical issues meriting the attention of the research community. One example of this is the addition of a performance element to better understand the impacts of anthropogenic and environmental sound on Arctic ecosystems. IARPC Collaborations serves as a powerful venue for discussions about how to address emerging research questions, whether they arise from the U.S. research community or internationally.

The IARPC Staff Group is working across boundaries to ensure that IARPC is relevant to Federal agencies operating in the State of Alaska. Because all IARPC Principals are based in the Washington DC region, it is beneficial to actively acknowledge the important work of and decisions being made in Alaska by Federal representatives there and to align activities to address urgent and immediate research concerns arising in Alaska.

The IARPC Staff Group and the collaboration teams are also very sensitive to the fact that research conducted in Alaska, and elsewhere in the Arctic, takes place in a region that is home to Indigenous and non-Indigenous peoples. The IARPC Staff Group has, over the past year, undertaken a revision to the Principles for Conducting Research in the Arctic. The original IARPC 'Principles' were released in 1990. Scheduled for release in late 2018, the updated 'Principles' will describe responsible and ethical research practices and encourage respect for all individuals, cultures, and the environment.