

Strategic Document Syntheses¹

Four strategic document syntheses were created to support the development of the next Arctic Research Plan 2022-2026, including the following: [Federal Document Synthesis](#), [International Document Synthesis](#), [Northern Communities Document Synthesis](#), and [State Document Synthesis](#).

The purpose of these syntheses is to provide an overview of research needs and priorities identified in recent, public facing strategic documents at the state, international, northern community, and federal levels. Each synthesis uses strategic documents to identify key research themes that exist in each of these sectors. Identified themes are linked to strategic documents which can provide additional detail on specific research priorities. Syntheses are all accompanied by a narrative which summarizes key themes under similar groupings to allow for easier identification of cross-sectoral themes.

The strategic document syntheses will be used to aid workshop participants as well as federal drafting teams in the development of the next Arctic Research Plan 2022-2026. All document syntheses should be used in consideration with other sources including the strategic documents themselves, synthesis of input in response to the Federal Register Notice, synthesis of listening sessions, workshops and online input, and people's own knowledge of the research landscape.

¹ This document was prepared by Sorina Stalla for the Plan Development Steering Group

Federal Strategic Document Synthesis Narrative

Introduction

The [Federal Strategic Document Synthesis](#) (Federal Synthesis) is a synthesis of research priorities identified in public facing federal strategic documents published between 2014 and 2020. Documents include strategic plans, action and implementation plans, priority documents, research program goals and objectives, and high-level reports including the USARC Goals Report. The purpose of the Federal Synthesis is to summarize Arctic research priorities and identify cross-cutting themes across agencies. The Federal Synthesis is complemented by three additional syntheses that highlight Arctic Research Priorities at the state, northern community, and international level. Individually, these syntheses provide insight into research priorities in each sector, collectively, they seek to highlight themes that exist across all four sectors. This synthesis of information from Federal documents complements direct input from the Federal agencies, summarized in a separate document.

How to Use the Synthesis

The Federal Synthesis is not a document created by federal agencies. It is a survey of recently released strategic documents and may not fully represent the full suite of current research priorities. Additionally, the documents in the synthesis were not intended specifically as input to the development of the Arctic Research Plan. The Federal Synthesis should be used as a resource to aid workshop participants and drafting teams in the development of the next Arctic Research Plan. It should not be used as the definitive guide on federal Arctic research priorities. The Federal Synthesis should be used in tandem with the synthesis of federal input specific to the Arctic Research Plan (“federal agency input synthesis”) which is a summary of input provided by IARPC departments and agencies and submitted in June 2020. The federal agency input is consolidated at the agency level whereas this Federal Document Synthesis contains documents and considers plans from the bureau level. The information in the federal agency input synthesis is more current than the information found in this Federal Synthesis

Federal Synthesis Thematic Overview

The Federal Synthesis identifies major cross-cutting themes that permeate across agencies as well as themes shared by multiple agencies. Major cross-cutting themes include environmental change, hazard mitigation, infrastructure, and energy development.

Environmental Change: Understanding the drivers and impacts of environmental change underlie many of the themes presented throughout the Federal Synthesis. At a global scale this includes an increased understanding of high latitude systems and their global impacts.

Emissions and Pollutants: There is a need for increased research and tracking of emissions and pollutants accelerating Arctic change impacts on human health. This includes the impact of black carbon and methane as well as a better understanding of the production and fluxes of carbon dioxide and methane from Arctic wetlands to improve climate projections.

Monitoring, Observing and Forecasting: Increased forecasting to better understand global influences, consequences and opportunities of Arctic change as well as increased observation of oceanic, terrestrial and

climatic processes and changes. Technological advances are needed for surveying and conducting Arctic research including unmanned aerial systems and technological advances in tagging approaches. Throughout all monitoring, observing, and forecasting there is the need for increased engagement with local residents to co-produce knowledge.

Erosion, Permafrost and Infrastructure: An increased understanding of the drivers and impacts of erosion (riparian and coastal) and permafrost thaw. The comprehensive mapping of shorelines and soil profiles as well as increased analysis on flood risk and impact. Increased monitoring and identification of practices to slow thaw and erosion as well as identification of community expansion areas that will minimize the potential for impacts of thaw and erosion on infrastructure. Increased research on the impact of permafrost thaw and erosion on infrastructure including identifying climate resilient infrastructure, research on how infrastructure across sectors (including building, energy, communication) can evolve with Arctic change, and identifying major infrastructure gaps that should be identified to promote safe and sustainable Arctic communities.

Energy Development, Shipping, Hazard Response and Mitigation: Increased understanding of oil and gas potential on the North Slope as well as an increased regional and synthesized understanding of the cumulative effect of climate change on development activities. Research to support contingency planning, oil spill impacts and response, and hazard mitigation. Improved Arctic modeling and understanding of vessel activity as well as identification of low-impact shipping corridors.

Ecosystem Changes, Species Management, and Sea Ice: Need for increased sea ice forecasting as well as understanding of the impacts of sea ice changes. Increased monitoring and understanding of marine, coastal, and terrestrial ecosystems changes (including tundra processes) at a broad level as well as at the species level. Characterization of key habitats and food web dynamics, increased monitoring of species populations, invasive species, productivity and demographic changes, as well as impacts of development on wildlife and improved species management through co-production of knowledge. Investigations into the impact and causes of harmful algal blooms on species as well as across the food web including on human health and increasing early detection techniques. Expand coastal data collection and leverage innovation in mapping technology development.

Fisheries: Increased understanding of fisheries changes occurring with climate change, impacts of fishing, community vulnerability to fisheries changes as well as the impact of development on fisheries.

Community Health: Better understanding and supporting mental health challenges as well as an increased monitoring and understanding of emerging diseases. Increased understanding of health impacts from landfills, lack of adequate access to in-home water, and development impact on subsistence resources. There is a need for data collection on the status of Alaska Indigenous languages as well as research that assesses the effectiveness of programs that teach Indigenous languages.

International Cooperation: A need to strengthen partnerships in research through bilateral and multilateral research cooperation as well as through specific mechanisms such as the implementation of the Central Arctic Ocean Fisheries Agreements and the Arctic Science Cooperation Agreement.

Education: Research on the effectiveness of formal and informal education activities as well as on the methods and impact of dissemination of STEM research results.

Convergence: A need for the formation of collaborations for convergence research in the new Arctic as well as convergence research approaches to understand the complex relationship between Arctic residents and their natural and cultural landscape.

Technology: Increase use of new technologies to collect data and conduct research including cloud technology, unmanned systems, artificial intelligence, and 'omnics.

Northern Communities Strategic Document Synthesis Narrative

Introduction

The [Northern Communities Strategic Document Synthesis](#) (Communities Synthesis) is a synthesis of research priorities and needs identified in public facing, community generated strategic documents. Documents include strategic plans, action and implementation plans, priority documents, workshop reports, resolutions, and comment letters. The purpose of the Communities Synthesis is to summarize Arctic research priorities and identify cross-cutting themes across Arctic regions². The Communities Synthesis is complemented by three additional syntheses that highlight Arctic research priorities at the state, federal, and international level. Individually, these syntheses provide insight into research priorities in each sector, combined, they seek to highlight themes that exist across all four sectors.

How to Use the Synthesis

The Communities Synthesis is not a document created by northern communities. It is a survey of various recently released strategic documents³ that are a “snapshot” in time and may not fully represent the full suite of current research priorities. Additionally, the documents in the Synthesis were not intended specifically as input to the development of the Five Year Arctic Research Plan. The Communities Synthesis should be used as a resource to aid workshop participants and drafting teams in the development of the next Arctic Research Plan. It should not be used as the definitive guide on northern communities’ Arctic research priorities.

Communities Synthesis Thematic Overview

The Communities Synthesis identifies major regional research needs and priorities as well as research priorities that permeate across regions and throughout the Arctic. Many community themes are cross-cutting and tightly interwoven with other challenges. Major cross-cutting themes include monitoring and observations, community resilience, food security, the co-production of knowledge in research processes and climate change.

Co-Production: Relevant to all research priorities is the need for true co-production in research processes. Partner with Indigenous Peoples at the beginning of project development, using research questions driven by and created by and in partnership with communities. Include Indigenous Knowledge and co-production in the creation of research plans and throughout the entire research process, including specific research on how to bring together different knowledge and value systems.

Sovereignty: Highlight ethical approaches for research and ensuring data sovereignty of Indigenous Knowledge.

² Arctic, Alaska, Aleutian and Pribilof Islands, Bering Straits, Interior, Northwest, North Slope, Southwest, Southcentral, Yukon-Kuskokwim Delta

³ Such as business plans, community economic development plans, policy documents, etc.

Data Management: The need for a better definition of what data are collected, standardization of collection protocols and systems for connecting local data with research institutions. Need to ensure maintenance of security and integrity of data, particularly with Indigenous Knowledge and ensure that Indigenous Knowledge is interpreted by Indigenous Knowledge holders.

Food Security and Subsistence: The cross-cutting challenges of food security intersect with many northern communities' research themes. There is a need for increased research on food security and the impacts of climate change, development, and contaminants on the food web, species, habitats, and subsistence activities. More specifically, the need for baseline data, support studies, and impact assessments on subsistence species and long-term monitoring of species.

Energy Development, Shipping, Hazard Response and Mitigation: Increased research on sustainable energy as well as methods to improve and enlarge renewable the energy base. Broad sustainability is a research priority including research to promote sustainable tourism and the potential impacts of tourism as well as research on the impacts of shipping including potential risks (invasive species, pollution and others). Research on climate mitigation and adaptation measures are also needed as well as data analysis related to coastal hazards and hazard mitigation planning.

Environmental Changes: An increased understanding and information on climate change, its drivers and impacts. This includes baseline data on climate change as well as impacts on water and food security, regional and local impacts, cultural impacts and increased understanding on future changes.

Ecosystem Changes, Species Management, and Sea Ice: Increased understanding, monitoring and forecasting of ice changes including in thickness and coverage. Understanding the impacts of climate change and marine litter on marine, coastal and watershed ecosystems broadly and on specific species. Research on ocean acidification, its impacts on marine species, invasive species and possibilities for adaptation. Increased research on harmful algal blooms and paralytic shellfish poisoning monitoring to provide early detection on emerging food security concerns.

Fisheries: Increased understanding and monitoring of fisheries changes. Identification of important fisheries habitats. Research on mariculture as well as applied research to support seafood and other food producers in developing new products, improving processes, and reducing waste.

Community Health: Need to better understand the environmental causes of health programs including research that addresses community health through food security and impacts on community infrastructure. The development and implementation of suicide prevention strategies is needed as well as increased research on community health and healing. An increased monitoring of lake conditions and changes as habitat and a drinking source as well as increased testing for contaminants and emerging illness from water sources.

Emissions and Pollutants: Increased monitoring and research on airborne and water pollutants as well as impacts of pollutants.

Erosion, Permafrost and Infrastructure: Increased monitoring and understanding of permafrost changes as well as distribution of permafrost. Research on erosion of coasts and rivers as well as the interplay of factors contributing to erosion. Research that guides mitigation and adaptation responses. Research on the main threats to infrastructure including community infrastructure focusing on areas with the greatest need for this research.

Education: Development of new pedagogies that reflect Indigenous values as well as focus on youth, gender and language studies. The development of education and research materials that increase awareness on the deleterious effects of colonization, establish a research and knowledge base, and form alliances to promote Indigenization. Research on high teacher turnover rate.

Convergence and Socio-Ecological Systems: Convergent research on socio-ecological systems as well as inclusion of social science research in research mandates.

International and Cross-Disciplinary Cooperation: Increased international and interdisciplinary research including research on transboundary toxins, fish stocks, and on health and social research programs.

State of Alaska Strategic Document Synthesis Narrative

Introduction

The [State Strategic Document Synthesis](#) (State Synthesis) is a compilation and synthesis of research priorities identified in public facing state strategic documents. Documents include State of Alaska generated strategic and development plans, mitigation plans, and assessments. Key documents from state recommender bodies are also included. The purpose of the State Synthesis is to summarize Arctic research priorities and identify cross-cutting themes across departments. The State Synthesis is complemented by three additional syntheses that highlight Arctic research priorities at the federal, northern community, and international level. Individually, these syntheses provide insight into research priorities in each sector, combined, they seek to highlight themes that exist across all four sectors.

How to Use the Synthesis

The State Synthesis is not a document created by state agencies. It is a survey of recently released strategic documents and may not fully represent the full suite of current research priorities. Additionally, the documents in the synthesis were not intended specifically as input to the development of the Arctic Research Plan. The State Synthesis should be used as a resource to aid workshop participants and drafting teams in the development of the next Arctic Research Plan. It should not be used as the definitive guide on state Arctic research priorities.

State Synthesis Thematic Overview

The State Synthesis identifies major cross-cutting themes that permeate across state agencies as well as themes shared by multiple agencies. Major cross-cutting themes include community resilience and monitoring.

State of Alaska

Energy Development, Shipping, Hazard Response and Mitigation: The understanding, monitoring of, and response development to the main natural hazard threats in Alaska: cryosphere, earthquakes, ground failure, floods, tsunami, volcano, weather, and wildlife. The establishment of a baseline of local knowledge and understanding of risk management concepts. The development of safe, reliable, and efficient energy systems.

Erosion, Permafrost and Infrastructure: Understanding of and planning for community risks from erosion, flooding, storm surge, and thawing permafrost as well as increased forecasting for safety and travel. Assessments of community infrastructure threatened by erosion, permafrost thaw, and flooding as well as understanding of how trails and transportation corridors will be impacted. Increase baseline data related to coastal flooding and erosion.

Fisheries: An understanding of the impact of ocean acidification on mariculture. Increased research and stock assessments on Chinook salmon, genetics research on and monitoring of commercially important fish and shellfish. Research and development of mariculture systems, including economic and environmental information relevant for Alaska Mariculture. Research on marine invertebrates and on emerging threats including on disease, ocean acidification, harmful algal blooms, and climate change.

Ecosystem Changes, Species Management, and Sea Ice: Understanding of species shifts (marine, avian, and terrestrial), threatened and endangered species, and wildlife diseases.

Food Security and Subsistence: Increase data and studies on the role of subsistence in the lives of Alaskans. There is a need to evaluate impacts of state and federal regulations on subsistence hunting and fishing as well as conduct subsistence harvest assessments.

Community Health: Assess health impacts of climate change and increase availability of health data.

State of Alaska Recommender Bodies:

Environmental Change: The strengthening of science and research on climate change including impacts to environment, ecosystems and human health. Monitoring and data gathering to understand impacts of climate change in community risk monitoring, assessment, and planning. Research that includes engaging local and regional entities and municipal and tribal governments in community risk monitoring, assessment, and planning.

Community Resilience: An understanding of how communities can respond to social changes for example, major climate-driven landscape changes, changes in resource availability and emerging natural hazards such as forest fires.

Energy Development, Shipping, Hazard Response and Mitigation: Development of advanced exploration and production technology. Improved data to refine oil permitting to be more efficient and scientifically sound as well as improvement of oil spill responses. Research on natural gas potential. Research and promotion of technologies and processes related to carbon emissions reduction and sequestration as well as analysis of sectors that will be impacted by a transition to a low-carbon future. Identification of research gaps related to valuation of land, forest, wetlands, and water carbon sequestration. Identification of resources and optimal sites for power generation as well as improved technology on efficient home heating. Studies on expanding shipping and port development as well as studies to improve port design. Research on global supply chain logistics to decrease the amount of perishables spoiled or damaged on route to Alaskan communities.

Technology: Research and development of mapping, aerial and unmanned aerial systems. Research on ways to improve land transportation and feasibility of next generation airships for cargo transport in Alaska. Research on improving laying fiber-optic cables in Alaskan environments.

Indigenous Languages: Survey research on Indigenous language speakers and promotion of the survival of Indigenous languages.

Community Health: Monitoring of and research on climate and environmental health impacts. Research on epidemiology in rural populations as well as research on rural-urban health disparities. Increased understanding of behavioral and mental health challenges.

Fisheries: A need to understand trends in Chinook salmon populations as well as conduct species assessments on salmon, sablefish, pollock, and halibut. Research on coastal and marine food webs including impact of ocean acidification on fisheries as well as long-term monitoring on fish and fish habitat. Increased research on mariculture potential.

Ecosystem Changes, Species Management, and Sea Ice: Research on marine ecosystem structure and processes, endangered and stressed species, and contaminants. Understanding of the effects of water system changes on aquatic communities and marine mammal management. The need to identify information needs, data gaps, and emerging threats and increase monitoring and forecasting capabilities on harmful algal blooms.

Food Security and Subsistence: Research on bolstering local food production and improving food security as well as continued study of the nexus of food, energy and water.

International Strategic Document Synthesis Narrative

Introduction

The [International Strategic Document Synthesis](#) (International Synthesis) is a synthesis of research priorities and needs identified in public facing strategic and research priority documents generated through international collaboration. Documents include strategic plans, work and action plans, assessments and priority documents, workshop reports, and agreements.

The purpose of the International Synthesis is to summarize Arctic research priorities and identify cross-cutting themes across the Arctic. The International Synthesis is complemented by three additional syntheses that highlight Arctic research priorities at the state, federal, and northern community level. Individually, these syntheses provide insight into research priorities in each sector, combined, they seek to highlight themes that exist across all four sectors.

How to Use the Synthesis

The International Synthesis is not a document created by international bodies or representatives. It is a survey of recently released strategic documents published over the past five years and may not fully represent the full suite of current research priorities. Additionally, the documents in the synthesis were not intended specifically as input to the development of the Arctic Research Plan. The International Synthesis should be used as a resource to aid workshop participants and drafting teams in the development of the next Arctic Research Plan. It should not be used as the definitive guide on international Arctic research priorities.

International Synthesis Thematic Overview

The International Synthesis identifies major regional research needs and priorities as well as research priorities that permeate across regions and throughout the Arctic. Major cross-cutting themes include monitoring, data sharing, and global linkages.

Monitoring, Observing and Forecasting: The need to strengthen and sustain long-term Arctic observations and identify gaps and integration with global observing systems. Increased observations of Arctic species, marine, coastal ecosystems, terrestrial, and freshwater ecosystems. Strengthening of data collection and integrated modeling of ecosystem changes where baselines have been established.

International Cooperation: Increased access to data and shared research including joint monitoring and coordination of existing data. Enhanced cooperation and data sharing on relevant data to Central Arctic Ocean ecosystems and potential future fisheries impacts in the Central Arctic Ocean. Circumpolar networks to harness innovative technologies to build knowledge and develop skills needed to maintain vibrant communities in a changing region.

Global Linkages: More accurate understanding of coupled Polar climate systems and the role of the Arctic in the global climate system.

Environmental Change: Improve knowledge of terrestrial, freshwater and marine ecosystems in the context of rapid change. Improve understanding of structure and functioning of polar ecosystems and projected changes as well as identify ecological indicators to evaluate risks to polar ecosystems and the services they provide to lower ecosystems. Increased predictive capacity of emerging threats, impacts of the changing hydrological cycle, and the consequences of variability in heat and momentum exchanges between ocean, land, ice, atmosphere and space in a changing climate.

Ecosystem Changes, Species Management, and Sea Ice: Improve the understanding of the cumulative impacts on marine ecosystems from multiple human activity-induced stressors including climate change. Research on areas particularly vulnerable to ocean acidification, biological productivity under changing regimes, and changes to coastal and marine species. Research on how changes are impacting areas of ecological and cultural significance.

Cryosphere: Improve understanding of snow-related processes including atmosphere-glacier-ocean interaction and implications for Arctic glacier mass budget, formation, development, frequency/intensity, and impacts of extreme cryospheric events. Increased understanding of the effect of diminishing ice cover on the carbon cycle in the Arctic.

Erosion, Permafrost and Infrastructure: Improve understanding of the impact of permafrost thaw on infrastructure. Information on how to adapt infrastructure to changes, develop sustainable transportation infrastructure, and support long-term investments in all forms of Arctic infrastructure. A need for information to support improved connectivity infrastructure throughout the Arctic.

Adaptation: A need to evaluate adaptation actions over time and implement research and monitoring focused on adaptation. Research on the cumulative impacts of climate change, industrial development, and societal change, including the complex dynamics of cross-scale and cross-sector comparisons. Need for social science approaches to adaptation including behavioral sciences, institutional analysis, and policy analysis.

Emissions and Pollutants: Better understanding of air pollution as well as the sources, trends, and impact of pollutants and contaminants on ecosystems and people. Research on persistent organic pollutants and short-lived climate pollutants. Increased information on improved waste management including as it relates to the need to reduce plastic marine litter and the release of microplastics into the Arctic environment.

Community Health: Research on ecosystem change impacts to human health and wellbeing. An increased understanding of the connection between community and environmental health. Increased information exchange to support public health system with an emphasis on projects that reduce death and disability from environmental risk factors, suicide and high-burden infectious and chronic diseases. Deepen global understanding of the region's peoples, cultures, traditional ways of life, languages and values and promote Indigenous Knowledge. Support the identification and promotion of heritage sites and areas of cultural significance in the Arctic. Strengthen the participation of local communities in improving sustainable water, sanitation, and waste disposal management.

Economic Trends: Strengthen analysis and joint monitoring of economic trends and activities in the Arctic. Explore and evaluate potential benefits of economic development including in new and emerging sectors.

Energy: Research on the sustainable development of energy and resources as well as innovative approaches encouraging renewable energy across remote Arctic communities.

Biodiversity: Address monitoring and research gaps in scientific knowledge of biodiversity, advance the Arctic Biodiversity Data Service, and develop and apply standards of the Arctic Spatial Data Infrastructure (SDI) and further develop use of remote sensing.

Risk Management and Response: Increased guidance and risk assessment methodologies.