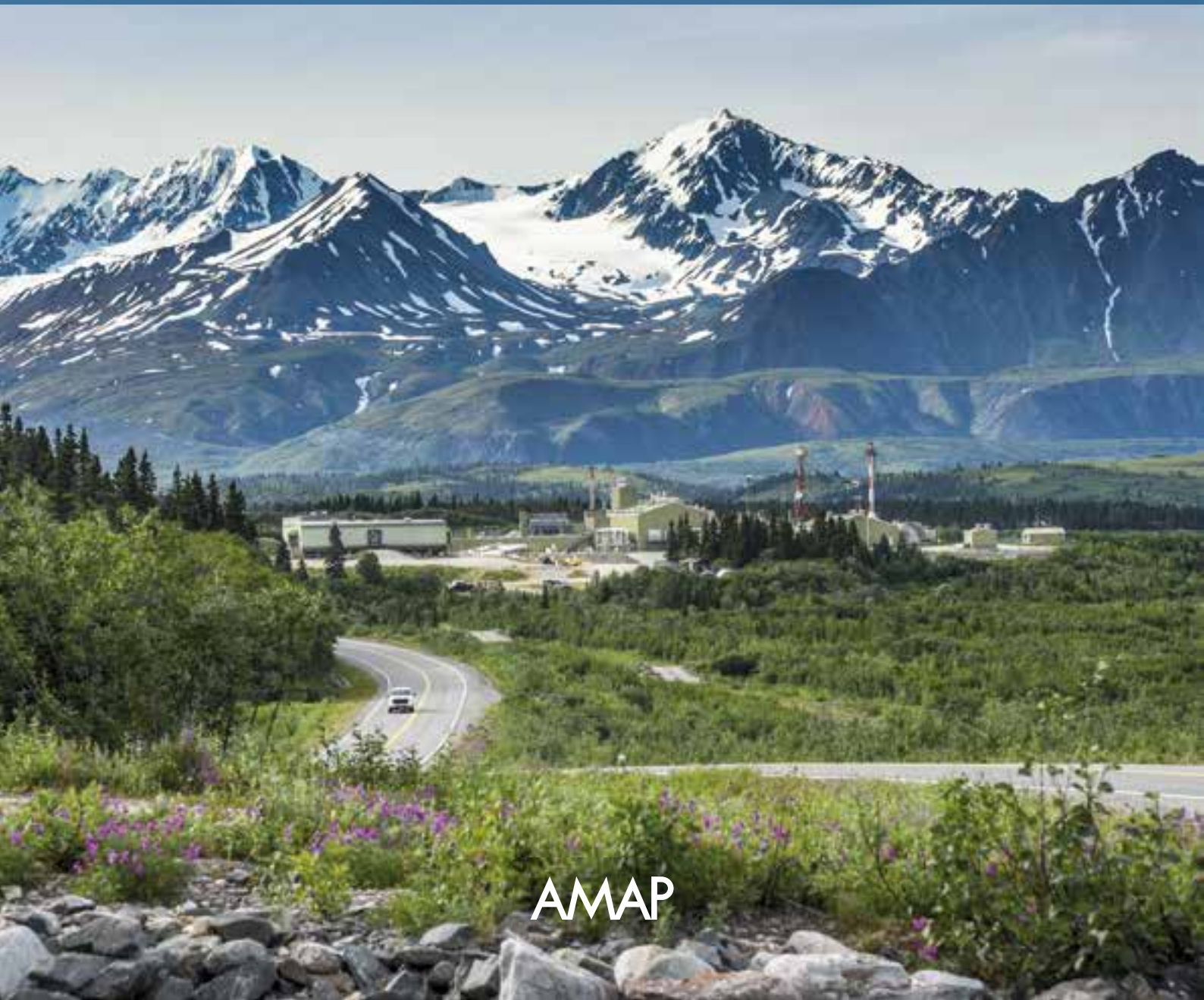




ADAPTATION ACTIONS  
FOR A CHANGING ARCTIC

# BERING · CHUKCHI BEAUFORT REGION

OVERVIEW REPORT



AMAP



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The following is a short description of what can be found in this overview report and the underlying AACA Science Report for the Bering-Chukchi-Beaufort (BCB) region.

## Describing the BCB region

This section describes the Bering-Chukchi-Beaufort study region which covers Russia's Far Eastern Chukotka region, the North Slope of Alaska and Yukon, to the Inuvialuit Settlement Region of the Northwest Territories and the Kitikmeot area of Nunavut in Canada. The section informs about the people living in the BCB region, the marine and terrestrial ecosystems and the industry in the region.

## Climate change in the BCB region

This section describes how the Arctic is warming faster than the global mean, how this temperature rise influence permafrost, the tundra ecosystems, the ocean and sea-ice and future changes in freshwater inputs to the marine environment.



## Socio-economic drivers of change in the BCB region

In addition to climate change also the socio-economic drivers influence the future of the BCB region. The section describes how the BCB region is also being driven by global and regional socio-economic factors, such as globalization of the economy, changing demand for resources, increasing tourism and potential changes in population, lifestyles, and political and governance structures.

## Laying the foundations for adaptation

The AACA reports contain a wealth of material that can help inform decision makers in government, civil society, business and academia as they prepare to adapt to anticipated change in the Arctic. The report presents key foundational elements that decision makers should consider in their work on adaptation; five elements are intended to be informational; four offer suggestions for action.

## Concluding remarks

This section of the overview report sums up the previous sections and underline that climate change is not the only important driver of change in the BCB region. The information reviewed in the BCB science report described the many interlinked chains of cause-and-effect that are irreversibly altering social systems, the physical environment, the ecosystems supported by this environment, and the impacts and responses of the human communities to those alterations.

# Introduction

In the 2011 Nuuk Declaration the Ministers “direct SAOs to review the need for an integrated assessment of multiple drivers of Arctic change”. This resulted in a three phase approach in which the Arctic Monitoring and Assessment Programme (AMAP) in 2013 was requested to: “produce information to assist local decision makers and stakeholders in three pilot regions in developing adaptation tools and strategies to better deal with climate change and other pertinent environmental stressors”.

Following significant interactions with both the Arctic science and decision-making communities, AMAP’s response to this request led to the establishment of a new initiative called *Adaptation Actions for a Changing Arctic (AACA)*. This initiative provides integrated stakeholder engagement and science-based information that can ultimately be synthesized and translated into knowledge that is useful and useable for making effective adaptation actions within a rapidly changing Arctic. Furthermore, the AACA is structured to promote stakeholder engagement, including participation from many different professional and public communities in the identification of the most relevant issues and challenges associated with a changing Arctic.

Three regions, Baffin Bay/Davis Strait, Barents and Bering-Chukchi-Beaufort, were chosen for an initial pilot phase. These three regions were chosen to provide a diverse range of socio-economic and ecological conditions, as well as to include as many Arctic Council nations as possible.

Each of the three regional reports provides a scientific assessment of the types and state of changes within



Figure 1: The three AACA pilot regions.

## DEFINING ADAPTATION

The Intergovernmental Panel on Climate Change defines adaptation as: “The process of adjustment to actual or expected climate and its effects. In human systems, adaptation seeks to moderate or avoid harm or exploit beneficial opportunities. In some natural systems, human intervention may facilitate adjustment to expected climate and its effects”<sup>1</sup>. For the purposes of this study, we also consider non-climate drivers of change.

the specific regions, along with a discussion of current levels of change, and the related impacts, effects and consequences of these changes, past, present and future. This information, which combines scientific and available traditional and local knowledge, forms a knowledge base that can be used to better inform adaptation actions being taken by decision-makers. Thus, AACA is truly an iterative process between the stakeholder, scientific, indigenous and local communities, focused on providing a sustained level of updated information for a diverse array of local, regional, national and international audiences.

1 IPCC, 2014: Annex II: Glossary [Mach, K.J., S. Planton and C. von Stechow (eds.)]. In: Climate Change 2014: Synthesis Report. Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change. IPCC, Geneva, Switzerland, pp. 117-130

This overview report is based upon the scientific report for the Bering-Chukchi-Beaufort (BCB) region, which comprises parts of Canada, the United States and Russia. The scientific report describes current regional environmental conditions, global and regional drivers of change, and the human and ecological impacts of this change. It also emphasises the diverse, inter-linked environmental, social and economic challenges that residents are already, or likely will be, experiencing from climate change and other regional and global-scale drivers. It considers the environmental and socio-economic changes to which inhabitants in the region are and will be adapting to. Finally, it provides a number of observations intended to help inform decision makers about how they might help their communities adapt to future changes.

Perturbations in the natural and human systems within BCB in recent decades have been dramatic, and community responses to these challenges demonstrate the resilience of its peoples. Families and communities are already taking, or planning to take, specific adaptive actions in response to these changes and impacts.

As part of the AACA initiative, an on-line and telephone survey was conducted among 60 residents and stakeholders across the study region, in English and Russian, to better understand how existing information about climate change informs action. The primary goals included to determine what actions people are taking to adapt to the rapid changes that have occurred in the Arctic, to discover how scientific information can help inform decisions, and to determine what other information is needed to better respond to these changes in the Arctic. This information was used by assessment authors to provide deeper insight into concerns of local people and to direct further enquiry.

This assessment describes how new approaches to adaptation planning, governance, and community engagement can improve the prospects for successful adaptation by individuals and communities to future changes. It is important to note, however, that adaptation clearly has its limits, both in the rate and the amplitude of change that can be accommodated. Significant global mitigation of greenhouse gas emissions to slow the pace of climate change must go hand-in-hand with local and regional adaptation efforts.





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# Describing the Bering-Chukchi-Beaufort Region

The Bering-Chukchi-Beaufort region stretches from Russia's Far Eastern Chukotka region, across the North Slope of the US state of Alaska and Canada's Yukon Territory, to the Inuvialuit Settlement Region of the Northwest Territories and the Kitikmeot area of Nunavut in Canada.

BCB is one of the least populated regions in the Arctic, with a total population of around 85,000, and no large population centers. It is characterized by small, geographically isolated rural communities. The major Indigenous groups of the BCB are the Inuvialuit, Inupiat, Yup'ik, Gwich'in, and Chukchi people. Indigenous people comprise around half of the population. The remaining population includes local Caucasian residents from a wide

variety of origins, including many from well-established families, as well as more recent immigrants. The latter group is especially significant in Chukotka where immigration from countries such as China is increasing.

Many BCB residents, especially Indigenous people, participate both in the cash and subsistence economies. In Chukotka, there has been a widespread return to subsistence activities

following the collapse of the Soviet Union. Across the region, subsistence hunting, fishing and gathering is an essential component of food security, and also help to maintain social cohesion involving family ties and kinship, community cooperation, the sharing of food, traditional knowledge, teaching of skills, and ceremonial practices.

The extractive industries, such as those related to oil/gas and hard rock mining, are the major sources of employment in the region, outside of the public sector. Within the cash economy, the mining industry is especially significant in Chukotka, where it accounts for almost one in five of the region's jobs. One-third of all jobs in Alaska are directly or indirectly related to the oil and gas industry, which accounts for about 2,000 jobs or roughly one-half of the total employment in BCB parts of Alaska.

The marine, terrestrial and freshwater ecosystems of the BCB are in transitional states in large part driven by warming temperatures. The primary terrestrial environment of this region is one of permafrost and tundra, with low-lying coasts that are vulnerable to erosion and storm surge inundation.

The tundra ecosystems have evolved in response to low temperatures, little precipitation, nutrient limitations, short



Figure 2: The BCB study area

growing and reproductive seasons, and widespread permafrost. The mammal part of the tundra food web comprises two main branches: large herbivores, including caribou and reindeer, Dall sheep, muskox and moose; and smaller herbivores such as voles, lemmings, Arctic ground squirrels and pika. These are preyed upon by low densities of carnivores, including brown bears, polar bears, wolves and raptors.

The marine environment is strongly influenced by the Pacific Ocean, which distinguishes this region from other Arctic seascapes, and by freshwater inflows from Arctic rivers. More than

70 species of marine birds, numbering in the millions, visit the BCB each year, and its seas are home to a number of species of marine mammals. Of these, beluga and bowhead whales, and bearded and ringed seals are of particular nutritional and cultural importance to BCB communities. Polar bears remain a species of great local and international concern.

In terms of marine fish, the BCB contains high biodiversity, with more than 120 species. There are commercial fisheries in the northern Bering and southern Chukchi seas, and large salmon runs in the region.

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# Climate change in the BCB region

Climate change-induced warming of the Arctic over the past century has occurred at more than double the rate of the global mean, particularly in winter. This has led to delayed onset of snow and ice accumulation in Fall, earlier melt in Spring, declining sea ice, thawing permafrost and changes to the region's water cycle. However, despite these clear trends, there will continue to be years that are significantly warmer or even colder than average, which must be taken into account in adaptation planning.

Annual mean air **temperatures** in the BCB have increased by roughly 1.5°C over the last 50 years, and winter-time temperatures are projected to increase a further 3-7°C by the end of the century under a mid-range (RCP 4.5) greenhouse gas emission scenario (*see RCP definition on page 9*).

The vast majority of the **permafrost** in the BCB regions is quite cold (~-5 to -10°C), so while there is some near surface thermal degradation and wide-spread warming of the permafrost temperatures, the permafrost in this area has not yet began extensive thawing. There is some evidence of deeper thawing of the active layer, but substantially increased thaw depths have not been observed, probably due to subsidence of the surface following melt of near-surface ice.

Arctic **tundra ecosystems** are very sensitive to shifts in temperature. Vegetation productivity – 'Arctic greening' – has generally increased in recent decades, as a result of rising temperatures and climate feedback effects. These effects include reduced reflection of sunlight (albedo), compared with snow-covered ground. Conversely, reduced soil temperatures in localized areas can be expected as a result of shading from an increased shrub canopy. In recent years, a reversal of this trend, Arctic browning, has been observed. Even the short-term trajectory of Arctic vegetation dynamics is uncertain, making projections of climate dynamics quite challenging.

In the ocean, **sea-ice extent** has been declining, particularly in summer, over most of the Arctic Ocean. The BCB marine environment is primarily in the marginal ice zone, which is now free of significant ice in the summer. This leads to greater ocean wave heights and the amplification of coastal erosion, as well as having major impacts on ice-dependent species such as Arctic cod, ringed seals, and polar bears.

Rising global temperatures are leading to increased flows of freshwater into the Arctic Ocean, which affect **ocean circulation, salinity, stratification and nutrient transfers**. The absorption of CO<sub>2</sub> from the atmosphere by oceans is increasing the acidity of seawater, affecting growth, metabolism and life-cycles of many marine organisms. The continental shelves of the Beaufort and Chukchi Sea are especially vulnerable compared with the central Arctic Ocean Basin, because of the already relatively low pH of incoming Pacific seawater and dilution by the high freshwater inflows.

Although melting glaciers and ice sheets and ocean warming are leading to absolute global sea-level rise, **local relative sea level** is also affected by the variable rates of rise of coastal lands. In many areas of the Canadian Arctic, coastlines are slowly rising due to ongoing rebound following glacier retreat at the end of the last Ice Age. In addition, recent ice mass loss from the Greenland ice sheet contributes to relatively rapid rebound in the eastern part of the BCB region. As a result, the sea level relative to the coastline is dropping around the Arctic Archipelago islands in the eastern portion of BCB, but is rising along the Beaufort coast of Canada, the north coast of Alaska, and the Chukchi coast.





## DEFINING RCP

In the RCP-4.5 scenario (RCP= Representative Concentration Pathways), reductions in emissions lead to stabilization of greenhouse gas concentrations in the atmosphere by 2100 and a stabilized end-of-century global average temperature rise of 1.7–3.1°C above pre-industrial levels. RCP-8.5 is a high-emission business-as-usual scenario, leading to a global non-stabilized temperature rise of 3.8–6°C by 2100.

Tuktoyaktuk, situated on the shores of the Beaufort Sea with an Inuvialuit population of 950 people, faces two opposing realities with regard to impacts from climate change. On one hand the community is literally sinking into the sea. On the other, climate factors make adjacent natural resources more accessible for potential large-scale development. While most people and organizations recognize that the impacts of climate change need to be addressed, the promotion of an economically self-sufficient community and region is also very important.

Mike Harlow, Chief Land Administrator, Inuvialuit Regional Corporation, Inuvik, NWT, Canada



Nadia Takui takes 18 month old Rima Votgyrgina, to watch the reindeer during the Chukchi 'Festival of the Young Reindeer' out on the tundra, Iultinsky District, Chukotka, Russia.

# Socio-economic drivers of change

Change in the BCB region is also being driven by global and regional socio-economic factors, such as globalization of the economy, changing demand for resources, increasing tourism and potential changes in population, lifestyles, and political and governance structures.

## Energy and mining

Possibly the most significant external drivers of change in the region are global energy markets, especially for oil. The Arctic accounts for around 10% of global oil production and a quarter of natural gas extraction. However, low prices are currently stifling exploration and development activities, and reducing tax revenues with implications for publicly funded programs. This is especially true for northern Alaska where the tax base in the North Slope Borough consists mainly of high-value property owned or leased by the oil industry in Prudhoe Bay.

The Beaufort Sea has extensive oil and gas potential, but development of the oil and gas sector in BCB over the near-term (within 10 years) is highly uncertain because of its dependence on global prices, the relatively high costs of exploration and production, as well as shifting regulatory regimes, especially offshore. Exploitation of reserves in the region may be attractive for energy security reasons. However, growing concerns about the risks of environmental damage from oil spills in Arctic waters, competition from other sources, and questions over future hydrocarbon demand raise doubts about the near-term economic feasibility of exploration, development, and production of new fields.

Similarly to hydrocarbon development, mining activities are highly dependent on world prices for metals and minerals. Alaska is the site of the world's second largest zinc mine, the Red Dog mine. In addition, there are some prospective, undeveloped deposits within the BCB. Soviet-era mining in Chukotka was undertaken for strategic rather than economic reasons, and the industry has suffered a severe collapse since 1991.

## Transportation and tourism

As summer sea-ice conditions change, there is the potential for increases in marine cargo shipping through the Arctic between Europe and Asia, as well as more cruise ship tourism. Routes through the Northwest Passage between Asia and Europe and the US East Coast are around 40% shorter than those via the Suez and Panama canals. However, significant investment in infrastructure, hydrographic research, and safety (search and rescue) would be required. The Northwest Passage is likely to continue to be a summer-time only route throughout the 21st century. For non ice-strengthened ships without ice-breaking escorts, the season will be limited to one or two months, largely because of the short open water season in the Parry Channel.

The effect of warming on land transportation can be significant, and likely deleterious. Thawing permafrost degrades permanent roads, while the later freezing of the ground reduces the period during which ice roads are viable. Thus, as climate warming continues, the costs of building new roads and maintaining existing networks are expected to increase substantially.

Tourism in the Arctic is expected to continue growing, due to increased accessibility and demand, as witnessed by the summer 2016 transit of a cruise ship through the Northwest Passage. Sustainable tourism, implemented in collaboration with coastal communities, may deliver economic benefits that could support adaptive actions by people in the region. Much coastal Arctic tourism, however, may be based on board cruise ships that are largely self-sufficient, potentially limiting economic benefit to Arctic communities.

## Education

Increased access to education is seen by many in the region to be an important preferred driver of regional change. However, access to education and skills training is a challenge in many remote areas, limiting the ability of local residents to take full advantage of economic development opportunities that may arise. Many of the higher-paying job opportunities, for example in the oil and gas industry, require specialized training or trade certifications.

## The mixed cash-subsistence economy

Rural Indigenous communities rely on a mixed cash-subsistence economy in which traditional ways of life and food harvesting interact with the need for cash income and employment. Changes in subsistence food harvest

practices are directly linked to changes in economic opportunities for residents as well as climate-driven alterations in the distribution and abundance of important subsistence species.

Surveys of the Indigenous Peoples in Canada and Alaska found that their sense of well-being is strongly influenced by job opportunities, locally available fish and game, and local control of those resources. Family ties, social support of each other, and traditional activities are major factors in dictating whether Indigenous people choose to remain in Arctic communities. Ties to the land, and high values placed on traditional food harvest activities, may conflict with the demands of full-time employment, posing additional challenges for maintaining the mixed cash-subsistence economy.

## Population changes

Global and local politico-economic shifts, population birth/death rates, migration associated with resource industry cycles, and the viability of traditional lifestyles can have important impacts on population trends. From 1970 to 2014, the population of northern Alaska approximately doubled, from about 13,000 to 27,000 people. It is projected to grow at close to its present rate, reaching 33,000 by 2042 – 20% above its 2014 level, according to estimates from the Alaska Department of Labor and Workforce Development.

The population of Chukotka rose steeply to about 160,000 with in-migration during the late Soviet period, and then declined rapidly after 1990, falling 70% to around 45,000 by 2015 as generous state support for the region was eliminated. This very large, rapid and unforeseen change emphasizes the potential scale of impacts from distant political or socioeconomic events on relatively small Arctic populations. The population is projected to decline further, at a rate of 0.5-1% per year after 2030, reaching around 34,000 by 2050.

The population of the Canadian part of the BCB region is smaller than the Alaskan and Chukotkan sectors, totaling nearly 13,000 people across 11 villages and towns in 2011. Historical trend data, and future projections of population were not available, but the high proportion (21%) of youth under 15 years age in the Inuvialuit Settlement Region in 2011 suggests the potential for relatively rapid population growth in coming decades.



© Bryan & Cherry Alexander Photography / ArcticPhoto.  
Shishmaref Native Store, Alaska, USA

The linkage between environmental health and my cultural identity is inseparable. I can see the value of safeguarding the environment, and how conservation efforts can provide for the perseverance of my values. At the same time, I don't see people as separate from the environment; in the Arctic people are a central part of the land and seascape. This is why conservation efforts need to account for and directly link with values important to people.

Raychelle Daniel, Yup'ik, Alaska



# Laying the foundations for adaptation

The AACA reports contain a wealth of material that can help inform decision makers in government, civil society, business and academia as they prepare to adapt to anticipated change in the Arctic. The following presents key foundational elements that decision makers should consider in their work on adaptation: the initial five elements are intended to be informational; the last five offer suggestions for action.

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## ADAPTATION TO A CHANGING CLIMATE MUST BE UNDERSTOOD IN THE CONTEXT OF OTHER CHANGES WITHIN THE BCB REGION

While climate change and other environmental factors are important, change in the BCB region is also driven by global and regional socioeconomic factors such as globalization of the economy, changing demand for mineral resources, increasing tourism, and potential increases in marine transportation through the Arctic. Regional changes in population, lifestyle, political and governance structures are also driving change.

Each of these drivers are linked, with feedbacks among them. Thus, the drivers of change are not isolated, but interact to impact human well-being and thus also influence adaptation or response to change. For example, the changing climate impacts the habitat, abundance and

migratory patterns of subsistence food species as well as safe access to harvest locations. Similarly, while declining summer sea ice extent provides potential opportunities for shipping and resource extraction, global markets largely influence the realization of these economic activities.

Local-scale responses to climate change need to be framed in terms of the challenges communities see on a daily basis. Scientists and policy makers must pay closer attention to the values, perspectives, and priorities of communities in the BCB region and to help the communities address adaptation in terms of multiple stressors or cumulative impacts. Climate change-associated problems add to existing, sometimes long-standing issues affecting daily life, for example, food security and fuel costs, local political differences, youth disengagement, and the lack of employment opportunities.

The inter-relationships and cumulative effects of environmental, social and economic changes pose particular challenges in understanding and responding to them. These multiple stressors and cumulative impacts are widely acknowledged, but we lack structured frameworks to evaluate, assess and compare the complex dynamics at work across different economic sectors and governance systems. This lack makes it difficult to anticipate, much less quantify, the potential cumulative impacts of climate change and socio-economic changes.

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## **ADAPTATION IS UNDERWAY, BUT CAN BE BETTER SUPPORTED BY APPLYING SOME GENERAL PRINCIPLES**

In many respects, people in the region have displayed remarkable resilience and adaptation as valuable characteristics of their culture. Adaptation is underway both informally and as a result of proactive planning. Some actions may have an explicit focus on climate change. But in the majority of cases, people appear to be pursuing goals related to improving community health, housing, self-reliance and sustainability, while incorporating responses to climate change within these other, specific ongoing initiatives.

Some adaptations are immediate, such as changes to where, when and what people hunt, fish and gather food, or involve the use of better technologies to help them hunt. People are also increasingly reliant on store-bought food to supplement or replace country foods. Some communities are engaging in formal and informal monitoring, to better detect changes and understand their trends in order to project future conditions. Other adaptations are longer-term and more radical: communities immediately threatened

by coastal and river erosion are considering complete relocation as a response to climate-related impacts on their local landscapes.

It is important to realize that there is no “one-size-fits-all” solution for adaptation within the BCB region. Adaptation will require case-specific consideration of each community’s context within its landscape and ecosystem, especially the unfolding local interactions between environmental, cultural, social and economic conditions.

However, a number of factors can be identified that contribute to successful adaptation in the region. These include:

- Constructive and effective partnerships, in which diverse groups develop a shared vision and work cooperatively to meet common objectives;
- Integration of traditional and local knowledge with scientific knowledge, to ensure accurate information on local conditions, to fully understand the reality of change impacts at the community level, and to empower local communities;
- Effective communication of knowledge to relevant audiences, using easily understood messages and communication in Indigenous languages and a variety of communication methods, including the use of social media;
- Learning from others’ experience, which can prompt adaptation activity and provide helpful background information. The transfer of knowledge can be from other communities, and from ‘boundary organizations’ that aim to link knowledge producers and users, agencies and even other Arctic nations.

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## **FOOD SECURITY IS AN IMPORTANT ELEMENT AND MEASURE OF ADAPTATION SUCCESS**

As well as participating in the cash economy, many people in the BCB region continue to practice subsistence harvesting for a substantial portion of their food. This provides a crucial element of food security for them. It also buttresses social and cultural cohesion and traditional lifestyles, making food security of particular relevance to adaptation.

Food security can be taken as an indicator of the overall state of natural ecosystem health, at least in places where people are still heavily dependent on local, natural food sources. For these people, serious degradation of ecosystems immediately impacts their ability to access, harvest and prepare traditional foods.

Food insecurity can also reflect another suite of challenges such as lack of employment opportunities, income instability, and the availability and affordability of store foods. This indicator may apply equally to Indigenous and non-Indigenous families, and should be monitored more closely and methodically by governments across the region. At present, almost half of Indigenous families across the region report moderate or extreme levels of food insecurity, suggesting that they are struggling to adapt to recent changes.

Not only do hunting, fishing and gathering contribute to food security for Indigenous and non-Indigenous families alike, these activities also represent an inseparable linkage between local ecosystems and the physical, economic, and socio-cultural wellbeing of communities. Thus, adaptations to changing environmental conditions that enhance the ability to harvest traditional foods is a key strategy in the region. These adaptations can include

local, informal changes in practices, but will also require consideration of revisions to governance and hunting and fishing regulations. Adaptation strategies to address food insecurity could also include greater government and community support for food sharing networks, community food freezers, increased provision for hunter-support programs, and increased educational outreach about nutrition and the importance of traditional foods.

However, in the context of food insecurity, empowerment of local communities to develop adaptation strategies that are consistent with their values, priorities and life experiences are more likely to be effective than region-wide solutions imposed by governments. There is also a strong case for promoting the teaching of traditional land and ocean knowledge, hunting/fishing skills, and Indigenous languages within schools to support adaptation capacity, cultural pride, and self-reliance.



Our supply of protein and fat during the long polar winter depends on the success of the autumn walrus hunt ... As a result, almost every man is able to provide his family with food, guaranteeing enough to eat for a long period ... This means that the coastal inhabitants of Chukotka are highly vulnerable to any temporal or special changes in the migration of marine mammals.

Eduard Zdor, Executive Secretary of the Chukotka Association of Traditional Marine Mammal Hunters, Chukotka, Russia





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## THE MIXED ECONOMY WILL PLAY AN IMPORTANT ROLE IN HOW PEOPLE IN THE BCB REGION ADAPT TO CHANGE

In addition to recognizing the vital role of subsistence practices among Indigenous Peoples in the BCB region, it is also important to acknowledge the significance of the cash economy. Most BCB communities are likely to continue to depend on a mixture of the cash economy and subsistence activities, and the relationships between the two are complex and subtle. For example, an employment income may help hunters participate more often in subsistence harvesting, but could also reduce the time available for hunting and fishing.

For small communities in the region, appropriate and sustainable economic development is a key factor in their capacity to adapt. Three industries in particular – tourism, commercial fisheries, and extractive resource industries – either have made significant economic contributions to the region, or have the potential to do so in future. Employment by government (local, regional and federal) is and will likely continue to be another major contributor to the Arctic cash economy. Helping people within the region to adapt to change is likely to require that these economic sectors, among others, are provided with the appropriate political and regulatory support to allow them to thrive. However, their development will also be heavily influenced by political and economic forces outside the Arctic in addition to the local effects of climate change.

Sector-specific issues and all decisions regarding resource and economic development in the region should involve participation and empowerment of all stakeholders living and working in the BCB region, including rural, Indigenous communities. Their views should be sought early and substantively in planning processes, as they are often well positioned to evaluate any trade-offs between economic development and local environmental impacts.

The cumulative impacts of resource development, climate change, and socio-economic change also pose challenges to community understanding. Thus, continued advice on these matters from external expert partners should be part of the adaptation planning process.

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## A SUSTAINABLE SEAFOOD INDUSTRY COULD PROVIDE ECONOMIC BENEFITS AND SUPPORT SUBSISTENCE ACTIVITIES

In the Bering Sea, the seafood industry represents a significant actual or potential economic opportunity for Alaskan and Chukotkan communities. In the Russian Federation there is a significant fishery in the Anadyr River Basin, and there are small but locally significant fisheries in the Kotzebue/Norton Sound area of Alaska.

Opportunities for commercial fisheries further north over most of the BCB area are limited for the foreseeable future because of a moratorium in the U.S. part of the Arctic Ocean, and there are no commercial fisheries in the Canadian Beaufort at this time. This situation may change depending on how climate change and ocean acidification affect the distribution of fish stocks.

Fisheries in the region not only have significant potential for sustainable economic development, but could support subsistence activities, with associated social and cultural benefits. The Community Health Services Department of the Aleutian/Pribilof Islands Association has speculated that one explanation for the extremely low suicide rate of the Aleut People compared with other Alaskans is the ready access to relatively lucrative fishing industry jobs that are also culturally close to their traditional practices.

The sustainability of commercial fishing will depend upon a variety of factors, including traditional knowledge of harvest species and regulatory measures, the effects of climate change on ecosystems, scientific fish stock assessment, and natural population variability. The ability of communities to economically benefit from fisheries also depends on investment in infrastructure.

The sustainable development of fisheries will benefit from co-management structures that take into account all of the potential users of the resource, and ensure that the community is closely involved in its management. It is critically important, and in the best interests of local residents, that the limits on fish stocks and productivity are well understood, to build sustainable fisheries and prevent overfishing.

The following are action-oriented statements based on the findings in the BCB regional science report

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## **COMMUNITY INVOLVEMENT, AND BETTER ADAPTATION PLANNING, IS NEEDED WITH REGARD TO THE ROLE OF EXTRACTIVE INDUSTRIES IN THE BCB REGION.**

The BCB region spans parts of three countries that have derived significant economic benefit from oil, gas and mining. Oil and gas production, and mining of diamonds, gold and zinc are likely to be mainstays in different parts of the BCB economy for decades to come. Reduced sea ice could increase access to resources in the region, and provide longer operating seasons, potentially offering a boost to industry.

However, the extractives sector also faces risks from climate change, such as the effects of permafrost thaw on infrastructure, transport routes, waste containment and hydrology. Thus far, adaptation has not generally been given a high priority in this sector, although the environmental extremes in which these industries operate may promote operational resilience.

These extractive industries, which rely on the exploitation of non-renewable resources, cannot be characterized as sustainable. The boom-and-bust cycles typical of commodity markets can lead to community problems. Jobs and incomes disappear and skilled workers tend to leave to find new employment when these industries close. Conversely, when an industry commences operations, the influx of non-resident workers can put strains on housing and local services.

Some extractive activities in the region, with strong community investment programs and/or a high degree of Inuit involvement, can be considered success stories. For example, mining in Chaun-Chukotka is viewed positively by the Chukchi people due to its corporate social responsibility programs and funding for local events, while Alaskan Inuit own the Arctic Slope Regional Corporation, which owns oil leases on Inuit land.

Well-designed and managed operations, with community input at all levels, can ensure effective and mutually beneficial partnerships. The finite nature of the resources involved requires that community planning for the time when those resources are exhausted needs to be part of project approval processes. Additional regulatory intervention and expert guidance may be needed to ensure these industries are better equipped to deal with climate change, including requirements around environmental assessment and public disclosure.

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## **IMPROVED INFRASTRUCTURE AND GOVERNANCE ARE NEEDED TO SUPPORT TOURISM AND SHIPPING IN THE REGION**

Sustainable tourism – that is, tourism that minimizes negative impacts and maximizes socio-cultural, environmental and economic benefits for Arctic residents – can bolster cultural pride, and bring cash income, as well as educating outsiders about the region. Decreasing sea ice and longer open-water seasons could allow greater marine transport in the Arctic region, for cargo shipping as well as for tourism. While there are questions about the economic attractiveness of trans-Arctic shipping, marine transport is critical for supplying coastal communities in many parts of the BCB region.

Both tourism and cargo shipping will depend on significant improvements in supporting infrastructure. Presently, only about 1% of Canadian Arctic waters are surveyed to modern hydrographic standards. Search and rescue, wharf, and repair infrastructures are currently very limited along the Northwest Passage; hydrographic charts are often of poor quality, and there are potential negative environmental impacts, especially in the event of an accident. In addition, national and international Arctic maritime governance structures will need to be clarified, such as the implementation of the United Nations Convention on the Law of the Sea. Cruise ship tourism that involves visits by passengers to communities will require port facilities for access, and greatly improved search and rescue capabilities.

The Arctic Council has made a number of recommendations for adaptation measures to reduce risk and prepare for increased regional shipping. Among other things, they include increased international cooperation, the engagement of the International Maritime Organization, the approval of the polar code, uniformity of governance across the region, strengthening safety and search and rescue capacity, and surveys of local and Indigenous use of marine waters. Some tourist operators, meanwhile, have complained about the lack of streamlined governance, especially concerning burdensome permitting requirements.



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## IMPROVED GOVERNANCE IS NEEDED TO SUPPORT ADAPTATION ACTION IN THE BCB REGION

Governance and related institutional arrangements will be critical factors in successful adaptation to change within the BCB region. Much more work is needed by regional and national governments to deal with even the most urgent needs, such as coastal villages threatened by erosion.

Governance systems in the region vary substantially from one country to another, and are changing – for example as a result of the de-centralization underway in Canada and Russia, and self-government agreements with Indigenous Peoples. These changes will be important for adaptation and the development of more resilient communities, because they vest more authority in local and regional governments, which is where key decisions about effective adaptation actions are likely to be made and enacted.

Given the dynamic regional environmental and socio-economic conditions, Arctic governance systems will need to remain flexible and adaptive to meet future challenges. It will also be necessary for non-Arctic institutions with interests in the region to engage with local actors in adaptation planning for the region, while remaining sensitive to the priorities and concerns of Arctic residents.

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## THERE ARE A NUMBER OF CHARACTERISTICS OF GOVERNANCE THAT HAVE BEEN SHOWN TO SUPPORT ADAPTATION. THESE INCLUDE:

- Ability to respond to change in a timely fashion;
- Flexibility, allowing institutions to respond to anticipated and unanticipated change;
- Cross-scale interactions, in which overlapping institutional arrangements offer redundancy in the event of system failures, and provide opportunities for action across different scales of governance.
- Partnership with local communities in co-management arrangements.
- Consideration of short-term disaster risk management together with longer-term adaptation.
- Recognition of the larger context of change, including multiple stressors and cumulative effects.

Adaptation planning needs to be better supported and should consider inputs from more local scales of decision-



making (village-by-village, or networks of villages). There needs to be a concerted approach in each of the BCB countries to develop a local, community-based (or network of communities) adaptation strategy that is inclusive with respect to engagement (bringing together villagers, government, and the private sector), and comprehensive with respect to identifying, evaluating, and deciding on priority concerns in planning.

This process should include a shared/unified political approach for acquiring sustained funding to address climate impacts. There is a need to move away from reactive, emergency responses, and from scattered and fragmented governmental funding for issues, to a more thoughtful, proactive and sustained approach to adaptation planning.



Photo: iStock

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## **NEW APPROACHES ARE NEEDED THAT LINK SCIENCE, COMMUNITIES AND OTHER STAKEHOLDERS WITH ADAPTATION ACTIONS IN THE BCB REGION**

This study has identified a need for new approaches to link science and adaptation action in the region, including the formulation of scenario models that linking the combined effects of economic and resource development with social and environmental change.

The “usability” of scientific research is increasingly valued by funders, however gaps remain in enhancing communication and partnership between scientists and local communities in the research process, and more effort needs to be expended on communication and trust-building. So-called ‘boundary organizations’ – such as the Alaska Center for Climate Assessment and Policy, or the Northern Climate Exchange – can help foster adaptation by enabling communication and fostering knowledge exchange between scientists and decision-makers, and in fostering dialogue between groups that seldom communicate.

There is also a need for scientific processes that are transparent, collaborative and accessible to communities and stakeholders, especially in utilizing traditional and local knowledge. This includes direct engagement with communities, assistance in helping them achieve their self-identified adaptation goals, and the creation of multi-scale, multi-sector networks that are local to international in scope. Their goal should be to effectively develop and implement shared adaptation solutions.

Scenario planning, in use for some decades in the private sector, can be a useful tool for understanding and preparing for rapid change, where a range of uncertainties and potential impacts are involved. The process involves identifying key drivers of change and critical unknowns while generating shared understanding among stakeholders and scientists regarding the potential for, and implications of, alternative futures. The process can utilize traditional and local knowledge alongside scientifically derived knowledge. Scenario planning can also identify communication gaps and divergent approaches to how different parties frame the problems involved.


# Concluding remarks

The Arctic and the regions explored as part of the AACA project are complex systems undergoing rapid environmental and societal change. It is evident that climate change is an important driver of change, but it is not the only one. Adaptation strategies should therefore reflect a broader context than climate change alone. By integrating knowledge from many different fields of expertise, and across regions with large cultural diversity, multiple uses and users of local resources, and ambitious development plans for the future, AACA has broken new ground. Using a multidisciplinary approach, applying this across wide geographical and societal scales, and looking decades ahead has been a challenge.

The information reviewed in the BCB report described the many interlinked chains of cause-and-effect that are irreversibly altering social systems, the physical environment, the ecosystems supported by this environment, and the impacts and responses of the human communities to those alterations. Understanding the impacts of a rapidly changing Arctic environment is complicated by the dynamics of changing economies, demographics and social structures.

The people of the region are highly capable and motivated to defend their lifestyles and protect their investments. Adaptation is both difficult and natural. In some communities, the challenges may be too great without national intervention. At whatever level adaptation is carried out, communities need additional support to adapt successfully to change.





The BCB report has identified a number of directions for further work on climate change adaptation by the Arctic Council and governments within the region. Additional assessment is required of the usefulness and specificity of BCB scenarios that are used as tools for planning. The creation of a comprehensive database of adaptation activities would inform adaptation planning in the region. A network might be established for sharing information and expertise, to support capacity building, knowledge development and the exchange of experiences related to adaptation. An initiative to focus on adaptation tools, such as guidelines, protocols, processes and techniques to implement adaptation activities could facilitate the capture of concrete and practical adaptation practices.

There would also be merit in focusing on a particular sector, such as shipping, mining, or fisheries, for example. A specific focus could assist in targeting resources and support an in-depth analysis of an issue of broad relevance across the BCB region. A focus on education would also be useful, given that access to education creates a more informed and resilient workforce.

This AACA pilot study has shown that building shared knowledge and understanding of cumulative and cascading impacts is key to developing effective policy responses. However, as this has been a pilot project not all aspects of science to knowledge to decision-makers have been addressed. An even closer connection between scientists, Indigenous Peoples and other decision-makers are needed. Adaptation to change, and building adaptive capacity and resilience, is an evolving and dynamic process, constantly responding to an increasing knowledge base as well as to the actual or expected effects of change. It is a learning process, in which the Arctic Council and its working groups can play a constructive role in future years.

This document presents a summary overview of the scientific report detailing the results of the Adaptation Actions for a Changing Arctic (AACA) – Bering-Chukchi-Beaufort (BCB) regional pilot study coordinated by AMAP. More detailed information on the results can be found in the AACA 2017 science reports.  
For more information, contact the AMAP Secretariat.



This document was prepared by the Arctic Monitoring and Assessment Programme (AMAP) and does not necessarily represent the views of the Arctic Council, its members or its observers.

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