



# STATE OF THE **ARCTIC** CONFERENCE

Summary of Key Policy-Relevant Arctic Science



# MAINTAINING FUNCTIONING ARCTIC ECOSYSTEMS IS VITAL TO ALL PEOPLE ON EARTH. THE ARCTIC PLAYS CRITICAL ROLES IN THE EARTH'S PHYSICAL, CHEMICAL, AND BIOLOGICAL BALANCE.



*This brochure contains key policy-relevant science presented at the 2010 State of the Arctic Conference where 448 participants from 16 countries gathered to discuss climate change in the Arctic and anticipate its effects around the world.*

## INTRODUCTION

### Arctic-Global Linkages: Local, Circumpolar, and Global Implications

The arctic environment is changing rapidly and dramatically as the region experiences more rapid warming than the rest of the world. Those outside of the arctic region should be concerned – changes in the Arctic impact us all.

- The Arctic serves as Earth's 'thermostat' because its cold air and surface temperatures drive atmosphere and ocean circulation, which influence global weather and climate patterns. Consequently, continued warming in the Arctic will alter climate and weather far beyond the Arctic.
- Current and projected changes alter ecosystems and have serious consequences for arctic residents and nations, which in turn affects arctic governance.
- The loss of summer and autumn sea ice will impact weather patterns throughout the world.
- Loss of sea ice has profound socioeconomic consequences due to its role in transportation, fisheries, hunting, polar animal habitat and more.
- The Arctic stores huge amounts of carbon, keeping carbon dioxide and methane levels in the atmosphere lower than they would otherwise be. Future increases in these greenhouse gases could cause rapid and dangerous changes in the climate system.



# IMPLICATIONS FOR CIRCUMPOLAR NATIONS

## SECURITY, COMMERCE, AND ARCTIC GOVERNANCE

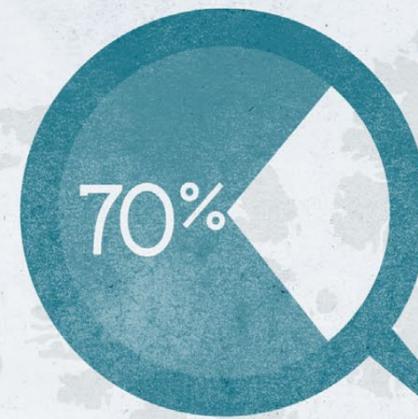
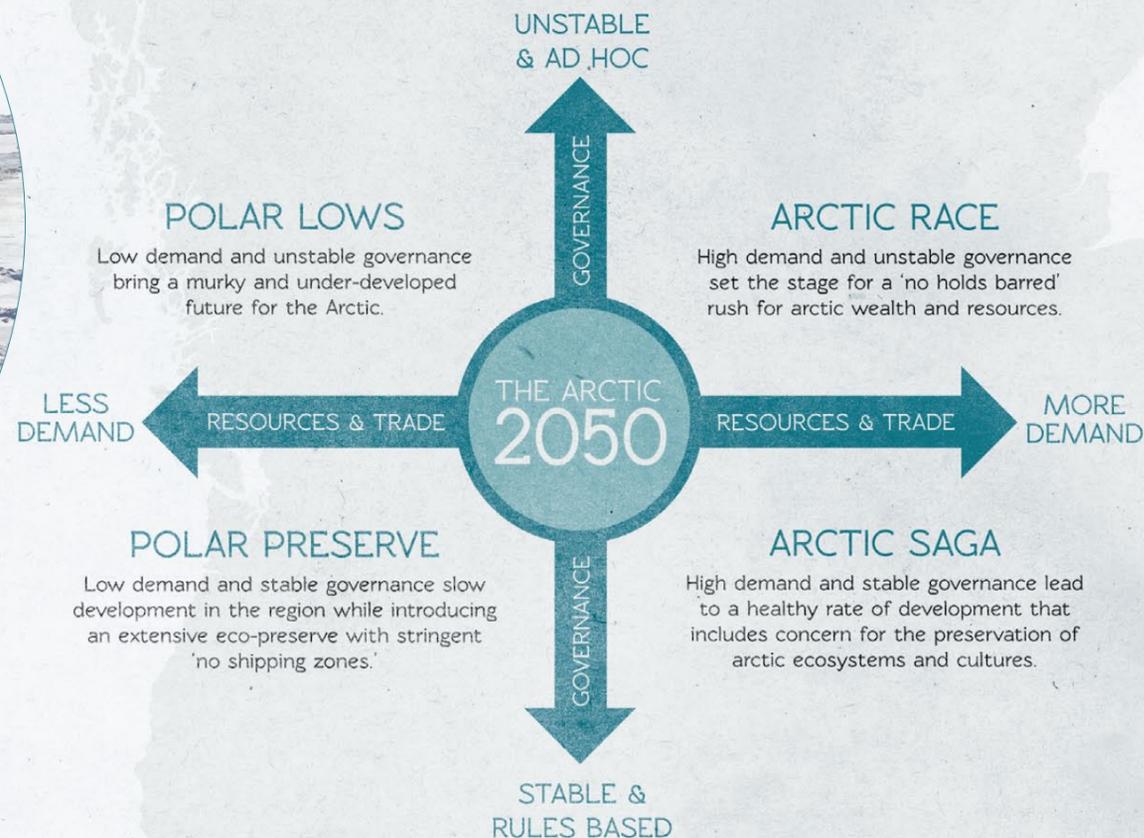
There are many social, economic, and national security issues associated with changes in the Arctic. Human activities likely to be dramatically altered by arctic change include subsistence hunting, tourism, mineral and energy resource development, marine transportation, and commercial fishing.



- Opening arctic sea routes will have global economic, trade, and security implications, and will likely introduce invasive species into the arctic marine ecosystem.
- The prospect of future mineral extraction from areas currently covered by sea ice is already creating international tensions as countries seek to exercise and expand their rights in their Exclusive Economic Zones, which extend 200 nautical miles offshore.
- Geopolitical issues will influence economic opportunities and generate new security risks as the summer sea ice continues to diminish.



The Arctic Marine Shipping Assessment (AMSA), approved by the Arctic Ministers in April 2009, focuses on arctic marine safety and marine environmental protection. The AMSA team identified two key uncertainties that may determine the future of arctic marine transportation: governance, and natural resource development and trade. The graphic below shows different scenarios for arctic marine shipping in the year 2050. Will the Arctic see a no holds barred rush for wealth and natural resources, or will high demand and stable governance lead to a healthy rate of development that includes concern for the preservation of arctic ecosystems and cultures?



ABOUT 70% OF THE WORLD'S WHITE FISH SUPPLY COMES FROM THE ARCTIC.

## IMPLICATIONS FOR INDIGENOUS & LOCAL COMMUNITIES

- 155,000 Inuit live in the Arctic, spread across Greenland, Canada, Alaska, and Chukotka (Russia). Inuit communities are located on the coast or major waterways to the sea, and sea ice has always been an extension of Inuit land. Life in the Arctic is dependent on movement, and sea ice is integral to that movement, serving as a seasonal highway.
- Changes in temperature, seasonal patterns, sea ice, and wind dynamics are affecting travel routes to hunting areas and community infrastructure, and are exacerbating hazards associated with travel and subsistence. These effects have implications for food security, the integrity of buildings and transportation infrastructure, resource development, and culture.
- About 70% of the world's white fish supply comes from the Arctic. Planning for arctic fisheries of the future is dependent upon developing new management plans and governance structures to accommodate international boundary conflicts, indigenous rights to resources, and the organization and oversight of arctic marine science initiatives. It is important to understand how changes in fisheries fit within a changing arctic context, especially with oil and gas development.
- Erosion along high latitude shorelines is among the highest in the world. Arctic shorelines and communities such as Shishmaref, Alaska, are becoming increasingly vulnerable to longer exposure to ice-free seas and impacts from storms.



# OBSERVED AND PROJECTED CHANGES IN THE ARCTIC

## SEA ICE



- The arctic sea ice extent shows the most dramatic change among all arctic climate elements
- The rate of loss tripled during the 2000s compared to that in the 1970s–1990s.
- At the present rate of change the **summer Arctic Ocean will likely be ice-free within a century and possibly within 20–30 years**, a condition that has not existed for at least a million years.
- Sea ice changes are not easily reversible and they are diminishing the normal role of sea ice as a global thermostat.

## CARBON CYCLE/METHANE



- Methane is an important greenhouse gas with a warming potential 20–25 times higher than carbon dioxide.
- Expected global climatic changes are likely to dramatically increase arctic temperatures, thawing frozen soils and altering soil moisture patterns. These changes could switch the Arctic from being a net carbon sink to being a net carbon source to the atmosphere.
- Massive amounts of methane are stored in frozen arctic soils called permafrost. Warming has already begun to release methane from these soils. A temperature threshold likely exists beyond which permafrost degradation becomes rapid and widespread, instigating sharp increases in methane emissions that will strongly increase the rate of global warming. The timing and rate of such a release remain unknown.

## ECOSYSTEMS/SPECIES DISTRIBUTION



- Climate change puts a great deal of stress on arctic ecosystems and the biodiversity they support. There is growing evidence of **rapid and widespread change in arctic marine and terrestrial ecosystems**, and those that are adjacent to year-round sea-ice will experience the greatest changes.
- Warming of the Arctic Ocean projected by the end of the century will come at the cost of a major loss of biodiversity, including some beloved icons of the Arctic, such as polar bears.
- There is mounting evidence that terrestrial and marine ecosystems in the Arctic will experience rapid, nonlinear responses to climate change. **The evidence suggests we are very close to reaching a critical tipping point at which these changes are irreversible.**



EVIDENCE SUGGESTS WE ARE VERY CLOSE TO REACHING A CRITICAL TIPPING POINT AT WHICH THESE CHANGES ARE IRREVERSIBLE.

## IN CLOSING

As highlighted in this brochure, dramatic and widespread changes in the Arctic affect important activities including tourism, subsistence hunting, resource development, commercial fishing, marine transportation, and national security. What is happening in the Arctic affects us all. A great deal is at stake, economically, culturally and environmentally. Available data suggests that some of these trends are still reversible, but the window of opportunity is unlikely to remain open indefinitely. Bold visions and bold actions are needed to preserve this critical part of our world.



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