Arctic Biodiversity Trends 2010
Selected indicators of change
This booklet contains the key findings from the Arctic Biodiversity Trends 2010: selected indicators of change report.

The full report and associated materials can be downloaded at www.arcticbiodiversity.is

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Introduction

The Arctic plays host to a vast array of biodiversity, including many globally significant populations. Included among these are more than half of the world’s shorebird species, 80% of the global goose populations, several million reindeer and caribou, and many unique mammals, such as the polar bear. During the short summer breeding season, 279 species of birds arrive from as far away as South Africa, Australia, New Zealand, and South America to take advantage of the long days and intense period of productivity. Several species of marine mammals, including grey and humpback whales, and harp and hooded seals, also migrate annually to the Arctic (Figure I).

In the past 100 years, average Arctic temperatures have increased at almost twice the average global rate. Over the past thirty years, seasonal minimal sea ice extent in the Arctic has decreased by 45,000 km²/year. Along with...
earlier break-up and freeze-up, the extent of terrestrial snow cover in the Northern Hemisphere has decreased and is expected to continue to do so.

The magnitude of these changes will exert major influences on biological dynamics in the Arctic. Some of the most rapid ecological changes associated with warming have occurred in marine and freshwater environments. Species most affected are those with limited distributions or with specialized feeding habits that depend on ice foraging. Other predicted effects of climate change, and other stressors, such as industrial development and resource exploitation, on Arctic biodiversity include:

- changes in the distribution, geographical ranges, and abundances of species (including invasive alien species) and habitats of endemic Arctic species; and
- changes in genetic diversity; and
- changes in the behavior of migratory species.

Arctic warming, with its many and increasing impacts on flora, fauna, and habitats, has heightened the need to identify and fill the knowledge gaps on various aspects of Arctic biodiversity and monitoring. This need was clearly identified in the 2005 Arctic Climate Impact Assessment (ACIA) which recommended that long-term Arctic biodiversity monitoring be expanded and enhanced. The CAFF Working Group responded to this recommendation with the implementation of the Circumpolar Biodiversity Monitoring Program (CBMP, www.cbmp.is).
Following the establishment of the CBMP, the CAFF Working Group agreed that it was necessary to provide policy makers and conservation managers with a synthesis of the best available scientific and traditional ecological knowledge (TEK) on Arctic biodiversity. This initiative, the Arctic Biodiversity Assessment (ABA, www.caff.is/aba), was endorsed by the Arctic Council in 2006. The aims of the ABA are to provide a much needed description of the current state of the Arctic’s ecosystems and biodiversity, create a baseline for use in global and regional assessments of biodiversity, and provide a basis to inform and guide future Arctic Council work. In addition, it will provide up-to-date scientific and traditional ecological knowledge, identify gaps in the data record, identify key mechanisms driving change, and produce policy recommendations regarding Arctic biodiversity. The first deliverable of the ABA is the overview report, Arctic Biodiversity Trends 2010: Selected Indicators of Change which presents a preliminary assessment of status and trends in Arctic biodiversity and is based on the suite of indicators developed by the CBMP.

For the Arctic Biodiversity Trends 2010 report, twenty-two indicators were selected to provide a snapshot of the trends being observed in Arctic biodiversity today. The indicators were selected to cover major species groups that have wide distributions across Arctic ecosystems. Each indicator chapter provides an overview of the status and trends of a given indicator, information on stressors, and concerns for the future.

The ABA is the Arctic Council’s response to global conservation needs. While there is a clear concern for the future of Arctic nature, this applies even more to the global biodiversity. In 2002, the Conference of the Parties to the Convention on Biological Diversity (CBD) established a target, “to achieve, by 2010, a significant reduction of the current rate of biodiversity loss at the global, regional, and national levels as a contribution to poverty alleviation and to the benefit of all life on Earth”. Subsequently, the 2010 Biodiversity Target was endorsed by the World Summit on Sustainable Development (2002) and the United Nations General Assembly. The recent Arctic Council Ministerial meeting noted that the Arctic Biodiversity Trends 2010 report will be an Arctic Council contribution to the United Nations International Year of Biodiversity in 2010 and at the same time a contribution to the CBD’s 3rd Global Biodiversity Outlook to measure progress towards the 2010 Biodiversity Target.
Key findings

In 2008, the United Nations Environment Programme (UNEP) passed a resolution expressing ‘extreme concern’ over the impacts of climate change on Arctic indigenous peoples, other communities, and biodiversity. It highlighted the potentially significant consequences of changes in the Arctic. Arctic Biodiversity Trends – 2010: Selected Indicators of Change provides evidence that some of those anticipated impacts on Arctic biodiversity are already occurring. Furthermore, although climate change is a pervasive stressor, other stressors, such as long range transport of contaminants, unsustainable harvesting of wild species, and resource development are also impacting Arctic biodiversity. These key findings reflect the information in the 22 indicators presented in this report. A more complete scientific assessment of biodiversity in the Arctic will emerge from the full Arctic Biodiversity Assessment, currently in preparation.
Unique Arctic habitats for flora and fauna, including sea ice, tundra, thermokarst ponds and lakes, and permafrost peatlands have been disappearing over recent decades.

Sea ice supports a vast array of life in the Arctic and represents a critical habitat for many species. Sea ice, however, is being lost at a faster rate than projected by even the most pessimistic of climate change scenarios, such as those reported by the Intergovernmental Panel on Climate Change (IPCC). Early warning signs of losses in the sea-ice food web include declines in populations of some species associated with sea ice, such as ivory gulls and polar bears.

The plant communities that make up tundra ecosystems—various species of grasses, sedges, mosses, and lichens—are, in some places, being replaced by species typical of more southern locations, such as evergreen shrubs. Trees are beginning to encroach on the tundra and some models project that by 2100 the treeline will have advanced north by as much as 500 km, resulting in a loss of 51% of the tundra habitat. Depending on the magnitude of change, the resulting ecosystems may no longer be considered "Arctic." The result may be that many of the species that thrive in the Arctic today may not be able to survive there in the future.

Thermokarst lakes\(^1\) and ponds are the most biologically diverse aquatic ecosystems in the Arctic. While drainage and appearance of thermokarst lakes is a relatively common and natural occurrence, over the past 50 to 60 years, studies have shown a net loss of these lakes in some places such as the continuous permafrost zone of northern Alaska and northwestern Canada, and the discontinuous permafrost zone of Siberia. Meanwhile, a net gain of thermokarst lakes has been observed in the continuous permafrost zone of Siberia. The effects of these habitat shifts on local aquatic populations, migratory species, and vegetation are the subject of continuing investigations.

Permafrost peatlands represent unique ecosystem diversity, provide key habitats for some species, maintain hydrology and landscape stability, and hold an enormous stock of organic carbon. Climate change combined with other impacts is leading to a decrease in the extent and duration of permafrost in northern peatlands. Melting permafrost and peatland degradation release greenhouse gases that create a positive feedback for further climate change.

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1. Thermokarst lakes and ponds are formed by the thawing of permafrost.
Wild reindeer and caribou are very important to the livelihoods of Arctic peoples. Since the 1990s and early 2000s, however, herds have declined by about one-third, from 5.6 to 3.8 million. While this may be a result of naturally occurring cycles, the ability of these populations to rebound is uncertain given the multiple stressors to which they are now exposed, such as climate change and increased human activity.

Although much has been learned, information is deficient on many species and the relationship to their habitat. Even for charismatic animals such as the polar bear, trends are known for only 12 of 19 subpopulations; eight of these are declining.

Arctic shorebirds, such as the red knot, migrate long distances to breed in the Arctic. Evidence indicates that shorebird populations are declining globally. Of the six subspecies of red knot, three are declining while the other three are either suspected of being in decline or their status is unknown.

The Arctic Species Trend Index (ASTI), which provides a snapshot of vertebrate population trends over the past 34 years, shows a 10% overall decline in terrestrial vertebrate populations. The decline partially reflects declining numbers of some herbivores, such as caribou and lemmings, in the high Arctic. In the low Arctic, vertebrate populations have increased, driven by dramatically increasing populations of some goose species, which have now exceeded the carrying capacity of the environment to support them.

Populations of some very abundant seabirds, such as common eiders, are generally healthy. Some Arctic seabird populations, such as murres, may be showing divergent trends. Their populations fluctuate in relation to major climate regimes in the Northern hemisphere, while others are still affected by overharvesting.

Freshwater Arctic char populations appear to be healthy in comparison to those in more southern locations. For marine fish, there is evidence of a northward shift in the distribution of some species in both exploited and unexploited stocks. The shifts appear to be the result of climate change, in addition to other pressures, such as fishing.

Climate change is emerging as the most far-reaching and significant stressor on Arctic biodiversity. However, contaminants, habitat fragmentation, industrial development, and unsustainable harvest levels continue to have impacts. Complex interactions between climate change and other factors have the potential to magnify impacts on biodiversity.

The life cycles of many Arctic species are synchronized with the onset of spring and summer to take advantage of peaks in seasonal productivity. Earlier melting of ice and snow, flowering of plants, and emergence of invertebrates can cause a mismatch between the timing of reproduction and food availability. In addition, warming sea temperatures in some areas has led to a northward shift in the distribution of marine species, such as some fish species and their prey. These changes have been implicated in massive breeding failures for some seabirds, and subsequent population declines. Arctic biodiversity is impacted by factors outside the Arctic, including the long-range transport of contaminants through air and water, habitat changes along migratory pathways, and invasive alien species. Increasing contaminant loads have been documented in some polar bear subpopulations, possibly as a result of dietary shifts due to declining sea ice. Red knots are highly dependent upon a limited number of key stopover and wintering sites making them vulnerable to habitat changes occurring outside of the Arctic.
Since 1991, the extent of protected areas in the Arctic has increased, although marine areas remain poorly represented.

Between 1991 and 2010, the extent of the Arctic that has some form of protected status doubled from 5.6% to 11%. There are now 1,127 protected areas covering 3.5 million km² of the Arctic. 40% of these areas have a coastal component but it is not possible at present to determine the extent to which they incorporate the adjacent marine environment. With rapid climate change and the emerging potential for multiple human impacts in the Arctic, there is a pressing need to assess the effectiveness of current terrestrial protected systems as a conservation tool. In the marine environment, where there are far fewer protected areas, the urgent need is for the identification and protection of biologically important marine areas.

Changes in Arctic biodiversity are creating both challenges and opportunities for Arctic peoples.

Declines in Arctic biodiversity may affect the availability of traditional foods. Coupled with decreasing access to freshwater and the unpredictability of winter ice, sustaining traditional ways of life may become more difficult. On the other hand, range extensions of southern species, shifting habitats, changes in resource use, among other factors, may provide opportunities to harvest new species.

Long-term observations based on the best available traditional and scientific knowledge are required to identify changes in biodiversity, assess the implications of observed changes, and develop adaptation strategies.

Significant difficulties were encountered in preparing this report because most countries do not have internal long-term biodiversity monitoring programs. Where such programs do exist, the data collected is not consistent across the circumpolar region.

In a few cases where coordinated monitoring efforts have a long history (e.g., seabirds), trend information is reliable and conservation strategies based on the results of monitoring have been successful. The 2005 Arctic Climate Impact Assessment recognized that long-term monitoring would greatly help detecting early warning signals and development of adaptation strategies.

Changes in Arctic biodiversity have global repercussions.

The importance of Arctic ecosystems for biodiversity is immense and extends well beyond the Arctic region. The Arctic, for example, supports many globally significant bird populations from as far as Australia and New Zealand, Africa, South America, and Antarctica. Declines in Arctic species, therefore, are felt in other parts of the world.
Emerging issues and challenges

Since the publication of Arctic Flora and Fauna: Status and Conservation in 2001, many changes have occurred in the Arctic environment. Most notably, the significance of climate change as an impact factor has been greatly elevated, in the Arctic as well as at a global scale. A warming climate in the Arctic is projected to set off many environmental changes including melting sea ice, increased run-off, and an eventual rise in sea level with immense coastal implications. Some of these changes are already being felt. Increasing temperatures are already showing many effects on Arctic biodiversity including the northward movement of more southern species, shrubbing and greening of the land, changing plant communities and their associated fauna, increases in migrating invasive species displacing native Arctic inhabitants, and the emergence of new diseases. Additionally, changes in the timing of events (phenology) are an aspect of change which may lead to mismatches between related environmental factors. As a result, some local biodiversity may be in imminent danger of extinction.

Although we have learned much since 2001, many questions remain unanswered. We do not know enough about the effects of climate change on biodiversity, what these changes mean to local flora and fauna, and what effects they have on natural resources, many of which are of great importance to local peoples. The Arctic Climate Impact Assessment clearly demonstrated a general lack of information on quantified effects of climate change on biodiversity. It is not enough to show that climate change results in changes to the physical environment. Directly or indirectly, the peoples of the Arctic live off the biological products of land, freshwater, and sea through hunting, fishing, and agriculture. It is vital that we are able to detect changes and how they vary geographically, between species, populations, and biological communities. We need to understand the complex interactions between climate and communities of Arctic species. Although this information is beginning to surface, the accumulation of data on biodiversity is still trailing climate modeling and the gathering of information on the abiotic environment.

A number of challenges are envisaged for Arctic biodiversity. With a warming climate, shipping and resource development (e.g., oil and gas exploration) are likely to increase, with a potential for increased pollution and disturbance to Arctic biodiversity. More development may lead to different human settlement patterns and changes in resource use. Decreased ice cover may increase the number of areas accessible to fisheries and make new species economically available and so create both opportunities as well as challenges for sustainable use. Many Arctic species also migrate great distances throughout the world and so are subject to environmental changes during their travels, including carrying pollutants back to the north in their bodies.
Because they move through Arctic as well as non-Arctic territories, international cooperation beyond the Arctic is needed for their concerted and sustained conservation.

One response to greater human pressures in the Arctic is the creation of protected areas. Although improving, current protected areas are still inadequate in representation of habitats and ecosystems. For instance, it is generally recognized that marine protected areas are particularly scarce. Even a full overview of biologically sensitive areas in the Arctic marine ecosystem, including on the high seas areas beyond national jurisdictions, is lacking. However, protected areas are only one aspect of biodiversity conservation as climate change inevitably calls for greater attention to more general conservation measures due to shifts in distributions and new introductions into local flora and fauna.

Addressing the pressures facing Arctic biodiversity requires better and more coordinated information on changes in biodiversity. Through the Circumpolar Biodiversity Monitoring Program, CAFF has brought together numerous datasets that indicate changes in biodiversity. This program is an effective response to the many challenges that are envisaged in the wake of climate change in and changing human use of the Arctic regions. Much data already exists on Arctic biodiversity but the challenge is to bring these data together, to analyze and identify the gaps in circumpolar monitoring, and put them to use to facilitate better informed policy decisions. The aim of the CBMP is to cover all ecosystems at all levels, from the genetic to the ecosystem level, using the latest technologies, as well as traditional ecological knowledge of the northern peoples. The CBMP is a process that cannot be implemented all at once but is well underway with the establishment of monitoring networks, indicators and indices, and management tools such as the Circumpolar Seabird Information Network. The CBMP is a definite response to the international commitments that the Arctic countries have undertaken on halting loss of biodiversity. The results are of practical use for the many questions facing the Arctic countries and the Arctic Council in their deliberations. The current challenge is to use the data available in a better and more coordinated way, fill gaps in knowledge, and increase the geographic coverage of Arctic information for the conservation and sustainability of the environment, as well as for the benefit of decision-makers, Arctic peoples, the science, and the global community at large.

Aspects of vanishing local knowledge, such as Arctic languages and traditional ecological knowledge, need to be fully recognized and acted upon. Climate change and all the associated issues – be they of the natural environment or human-related – pose a new suite of challenges for biodiversity and peoples of the Arctic. Taking care of the environment poses major challenges for the Arctic Council and all other stakeholders interested in the north. CAFF, as the biodiversity arm of the Arctic Council, contributes towards seeking appropriate solutions to those challenges.
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