Vital Arctic Graphics

People and global heritage on our last wild shores

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People and global heritage on our last wild shores

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Preface by Klaus Toepfer

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The fate of the Arctic environment is no longer solely an Arctic issue. The Arctic and the global environment have never before been so interdependent. Growing demands for oil, gas, minerals and timber in other parts of the world are increasing exploration pressures in the Arctic, and pollutants from all over the planet are accumulating in Arctic food chains and indigenous peoples. At the same time these peoples face the effects of climate change, changes that may produce severe impacts on the rest of the world through increases in sea level from receding sea ice and glaciers, along with changes in sea currents dependent upon the Arctic cycles. These impacts include changing weather patterns and agricultural production for numerous nations around the globe. The very existence of some island nations may be at risk from floods. Climate change also threatens our ability to meet the Millennium goals on the eradication of poverty, the safe and sufficient supply of drinking water, and on limiting the spread of disease.

UNEP particularly welcomes the coming into force of the Kyoto protocol on February 16th, which will, we hope, provide a turning point in our efforts to effectively combat climate change.

This report also shows us that the Arctic holds a unique global heritage: the last continuous undeveloped and unexploited coastal and marine areas. These areas are the lifeblood of Arctic peoples and animals, and they cannot resist the cumulative impacts of all potential pressures. While conservation efforts on land have been significant in some areas, less than one percent of the coastal zones and marine areas have been protected. The coming decade may be our last chance to preserve this global heritage, of which no equivalent remains anywhere on this planet and which is so crucial to Arctic peoples and life. By protecting these areas, we help increase their resilience against inevitable climate change and help support indigenous peoples' right to make their own decisions on the future of the region.

Arctic governments have a special responsibility to protect the Arctic coastal and marine areas, not only because of their intrinsic value to Arctic ecosystems and Arctic indigenous peoples' livelihoods, but also because they form the only such major intact areas remaining on this planet.

A word from Sheila Watt-Cloutier

Chair, Inuit Circumpolar Conference (ICC)

To many environmental organizations the Arctic is "wilderness" to be preserved. To industry it is a "frontier" and a source of energy and minerals to be exploited. But to the 155,000 Inuit living in Canada, Alaska, Greenland and Chukotka in Russia the Arctic is "home" with all that this implies. The same is true for Sami, Athabascans, Gwich'in, Aleuts, and Arctic Indigenous peoples in northern Russia.

Through the Inuit Circumpolar Conference (ICC), Inuit have worked on the international stage for nearly 30 years. The last 15 years has been particularly exciting, for the circumpolar world is taking on many of the features of a geopolitical region. All Arctic Indigenous peoples are committed to protecting our region's natural environment and enhancing our age-old cultures. In 2003, UNEP's governing council passed a resolution to promote sustainable development in the Arctic. This is important for the Arctic is the world's "barometer" when it comes to global climate change. ICC welcomes the interest and engagement of UNEP in the Arctic and looks forward to close co-operation with UNEP in coming years.

ICC welcomes this report as an acknowledgement of the rights and interests of Arctic Indigenous peoples and the need to protect and manage the natural resources upon which they so closely depend.

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The Arctic is home to many indigenous peoples, including reindeer herders, hunters, fishermen and nomads. They all share one common feature: their dependency on a healthy environment to support their livelihoods and chosen ways of life. These ways of life include intimate relationships with land and sea. Caribou, reindeer, fish and sea mammals play a vital role not only for Arctic peoples, but also for the planet's northernmost ecosystems.

Coastal areas are particularly important to Arctic peoples and ecosystems. Caribou and reindeer often travel to the coastal regions for their calving grounds and summer ranges. Many species, such as polar bears and shore birds, breed on land but spend most of their lives and find most of their food at sea or in the drift ice. Accordingly, indigenous peoples have inhabited these resource-rich locations for centuries and even millennia. Today, more than 80% of all Arctic settlements are located along coasts. These coastal areas are also of global significance. Migratory birds from nearly all parts of the planet travel to the Arctic wetlands and coasts to breed. While more than 71% of coasts worldwide are now impacted by development and their coastal-marine areas exposed to industrialized fisheries, the equivalent figure in the Arctic is still less than 7%. By 2050, more than 90% of the world's non-Arctic coasts may be affected by development and exploitation. Hence, the Arctic appears to hold the last of the world's remaining large, undeveloped coastal ecosystems, a unique global ecological heritage.

However, in spite of their unique global and Arctic significance, only about one percent of such continuous areas are protected. In fact, marine protected areas are severely under-represented in the Arctic. While some coasts are protected, the protection does not extend to the marine areas upon which the coastal people and wildlife depend. At the same time, these areas are facing serious threats. Development related to the infrastructure of roads, pipelines, power-lines and hydro-power dams has increased dramatically in the past decades in northern Scandinavia, Russia, northwestern Canada and Alaska. Furthermore, global climate change is resulting in the recession of sea ice and hence increased access to resource exploration and to intensive coastal fisheries. The melting sea and land ice will inevitably cause sea level rise and could also affect currents, with major global implications. Arctic wildlife and plants are facing the cumulative impacts of these pressures and additional pressures from invasive species and pollutants.

Potential impacts on indigenous peoples include increased competition for traditional rights, introduction of pollution and toxins into primary food sources, and introduction of alcohol, drugs and diseases through the social changes that come with industrialization. In addition, they are threatened by increased risks from climate change, such as changes in weather patterns and sea ice. The latter constitutes a considerable risk factor for hunters in the pack ice. A further major threat is the potential loss of game species and the subsequent loss of chosen lifestyles associated with the use of natural resources, in particular, along the coast. Positive opportunities for indigenous peoples in the modern world include improved economic opportunities and employment, and improved access to social services, communication and education.

While the coming into force of the Kyoto protocol is an important step forward, climate change is already impacting the Arctic environment. There are, however, opportunities to help increase the resilience of Arctic ecosystems and people. This can be done by reducing the number and extent of other pressures through development of a stronger network of protected areas and, particularly, through protection of coastal and marine areas against industrialized, often southern-based exploitation. This, in turn, may facilitate sustainable development while protecting the crucial traditional food sources and healthy ecosystems so important to Arctic indigenous peoples. Co-management and close collaboration with indigenous peoples is essential in order to allow them to choose their own way of life and influence the future of the resources that they rely upon. The current lack of protected coastal-marine areas in the Arctic, their global and Arctic significance, and the emerging and hard-to-reverse threats specific to these areas, call for particular concern and attention.

Introduction

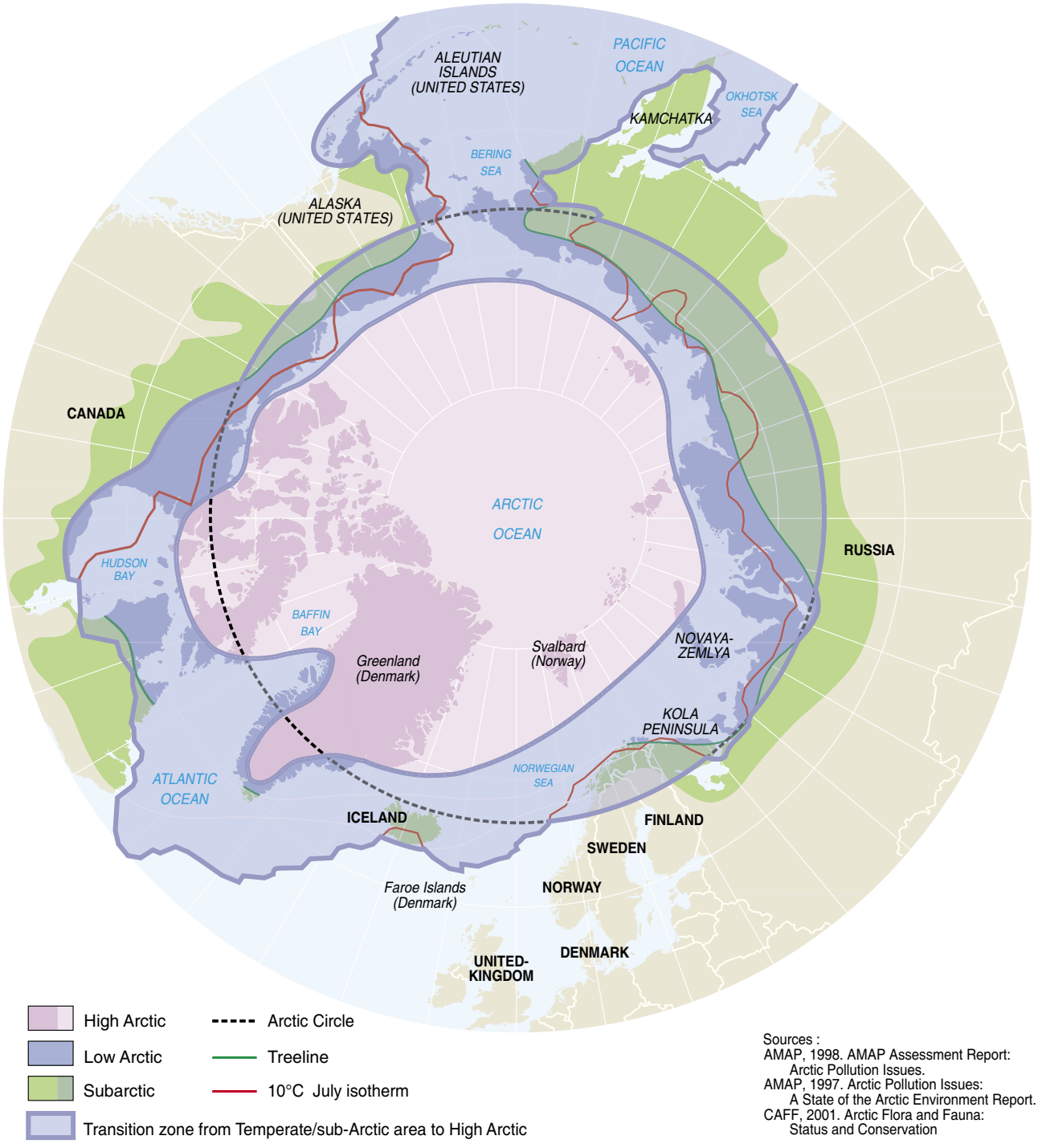
The purpose of this report is to compile a number of "vital" Arctic graphics that describe the Arctic, the livelihoods of Arctic indigenous peoples and the future well-being of this region. It summarizes some key threats that endanger the future sustainability of the Arctic. The coastal regions are particularly important to the ecology and to the peoples of the Arctic and their current protection status is therefore given particular focus.

The Living Arctic – the last unexploited marine and land areas on Earth?

The world's largest remaining intact ecosystems

Definitions of the geographic boundaries of the Arctic vary, including such definitions as the area with a July isotherm below 10° C, vegetation distribution (tundra) or political boundaries, such as the definition by CAFF (CAFF, 2001). Nowhere else on Earth do we find such vast areas of relatively undisturbed marine and coastal eco-systems outside of the Polar regions.

Figure 1. Boundaries of the Arctic. Several definitions of the Arctic as a region exist and are all used extensively.

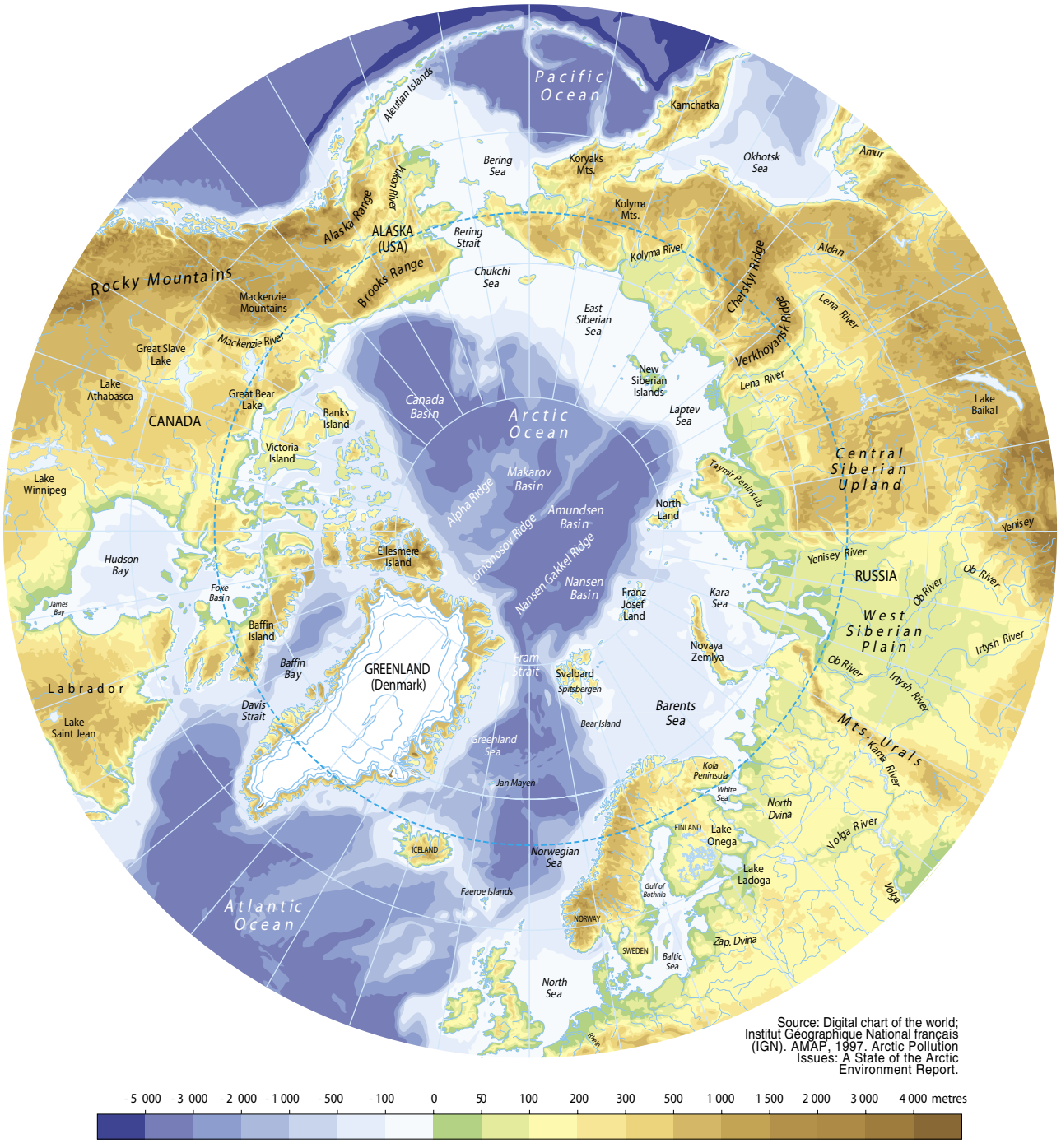


Sources :
AMAP, 1998. AMAP Assessment Report: Arctic Pollution Issues.
AMAP, 1997. Arctic Pollution Issues: A State of the Arctic Environment Report.
CAFF, 2001. Arctic Flora and Fauna: Status and Conservation

From drift ice and coastal plains to rugged mountains

The Arctic is extremely diverse in terms of landscapes, varying from pack and drift ice to rugged shores, flat coastal plains, rolling hills and mountains surpassing 6000 metres above sea level (Denali, 6,194 m asl, in sub-arctic and boreal Alaska). The region has rivers and lakes, tundra and the largest forests in the world (the Russian Taiga).

Figure 2. Topography and bathymetry of the Arctic.



Source: Digital chart of the world; Institut Géographique National français (IGN). AMAP, 1997. Arctic Pollution Issues: A State of the Arctic Environment Report.

Covered in ice and snow for most of the year

Most of the Arctic is covered by ice and snow for more than eight and even up to twelve months a year, but conditions are highly variable, ranging from snow several metres deep each winter to the polar deserts of northern Greenland with only 50-100 mm of precipitation annually. A large portion of the Arctic is underlain by permafrost. Permafrost, defined as ground that does not thaw for two or more years, can reach a thickness of up to 1000 metres, as it does on the North Slope of Alaska. It extends through as much as 50% of Canada and 80% of Alaska (Clark, 1988). During summer, the top centimetres, sometimes down to several metres, thaw, resulting in unique geomorphological phenomena such as thermokarst, frost mounds, high- and low-centred polygons, earth hummocks (thufur), palsas and pingos. The latter are mounds up to 45 metres high with slopes as steep as 45 degrees and massive ice cores covered by a thin layer of soil. Such frost phenomena create crucial topographic diversity in otherwise flat coastal plains and impact snow ablation, nutrient cycles, and vegetation characteristics. They are crucial to foraging and insect relief habitat for caribou (Nellemann and Thomsen, 1994), as well as nesting habitat for numerous bird species. In fact, since snow provides insulation against the severe cold of winter, even minor topographic relief has major implications for vegetation distribution and nutrient cycling, and therefore for both plants and wildlife.

Source:International Permafrost Association, 1998.
Circumpolar Active-Layer Permafrost System (CAPS), version 1.0.

Figure 3. Permafrost distribution in the Arctic.

Unique adaptations of plants and wildlife to the cold

Arctic vegetation is less diverse compared to that of more southerly latitudes, but it nonetheless includes a wide range of plant life with unique adaptations to a harsh environment. There are taiga forests of pine, spruce, willow, birch and poplar, flat tundra, steppe landscapes, wetlands, polar deserts, and cliffs fringed at their bases by rich vegetation fertilized over decades by the droppings of nesting seabirds. Ground lichens play an important role in many regions as the primary food source for reindeer and caribou during winter. Some vegetation types are found only in the Arctic and are under acute threat from rising temperatures.

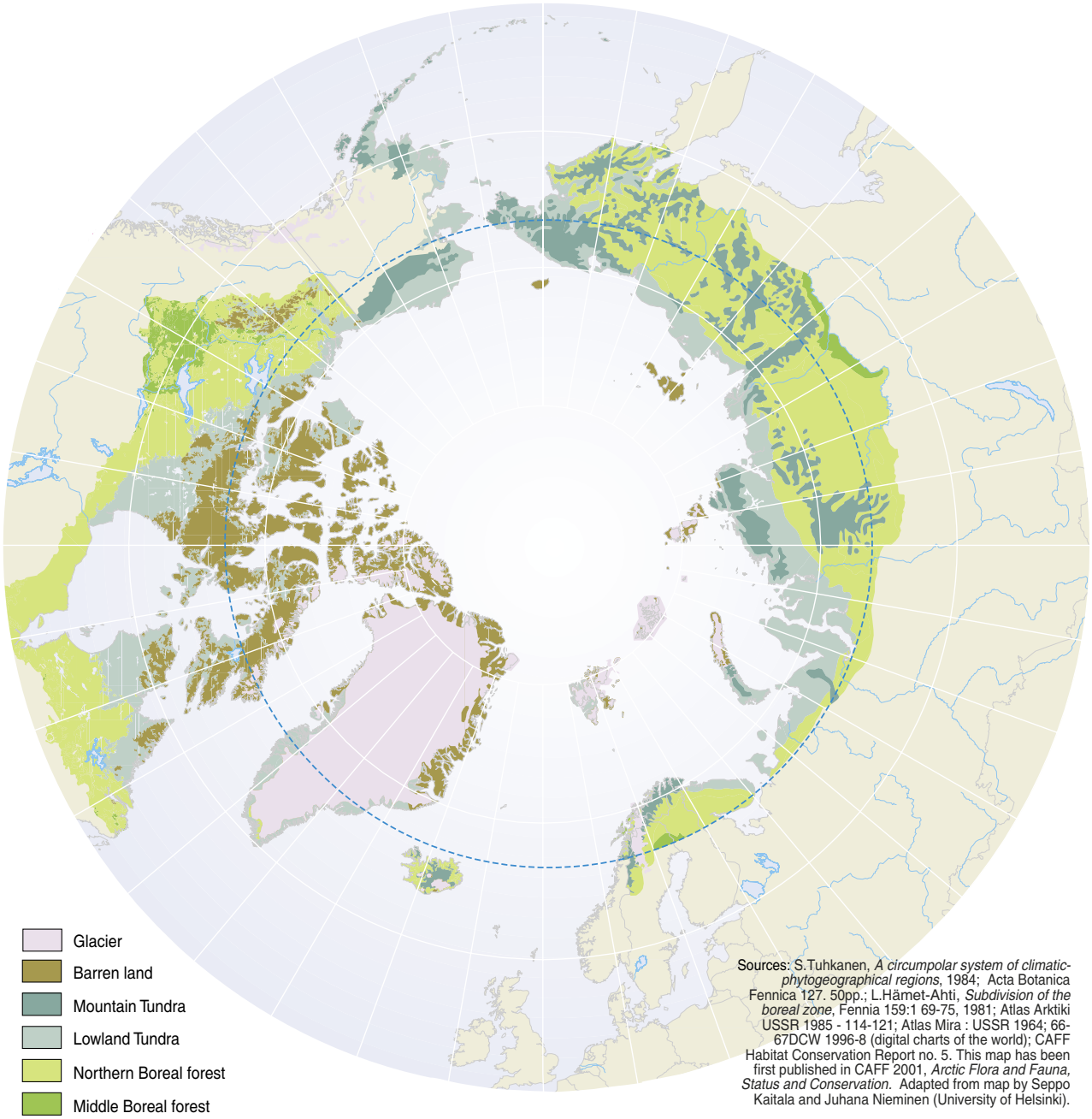


Figure 4. Vegetation distribution of the Arctic and Sub-Arctic. The most recent detailed map is available at www.geobotany.uaf.edu/cavm and www.caff.is. The Circumpolar Arctic Vegetation Map (CAVM) project is an international effort to map the vegetation and associated characteristics of the circumpolar region, using a common base map. The base map is a false colour infrared image created from Advanced Very High Resolution Radiometer (AVHRR) satellite data.

The Arctic is characterized by extremes of sunlight, darkness and colours

The Arctic is often described as a place of utter darkness or white snow in winter and of midnight sun during the summertime. In fact, there are few places on Earth where the sun displays so much variation in colour due to the low angle of the sun reflected on the mountains, snow and sky over long periods of time. North of the Arctic Circle the sun disappears during winter for days to months, depending upon latitude, leaving the sky in a palette of blues, greys, reds, oranges and purples. The moon, snow, angle of the sun and the northern lights add to this diversity.

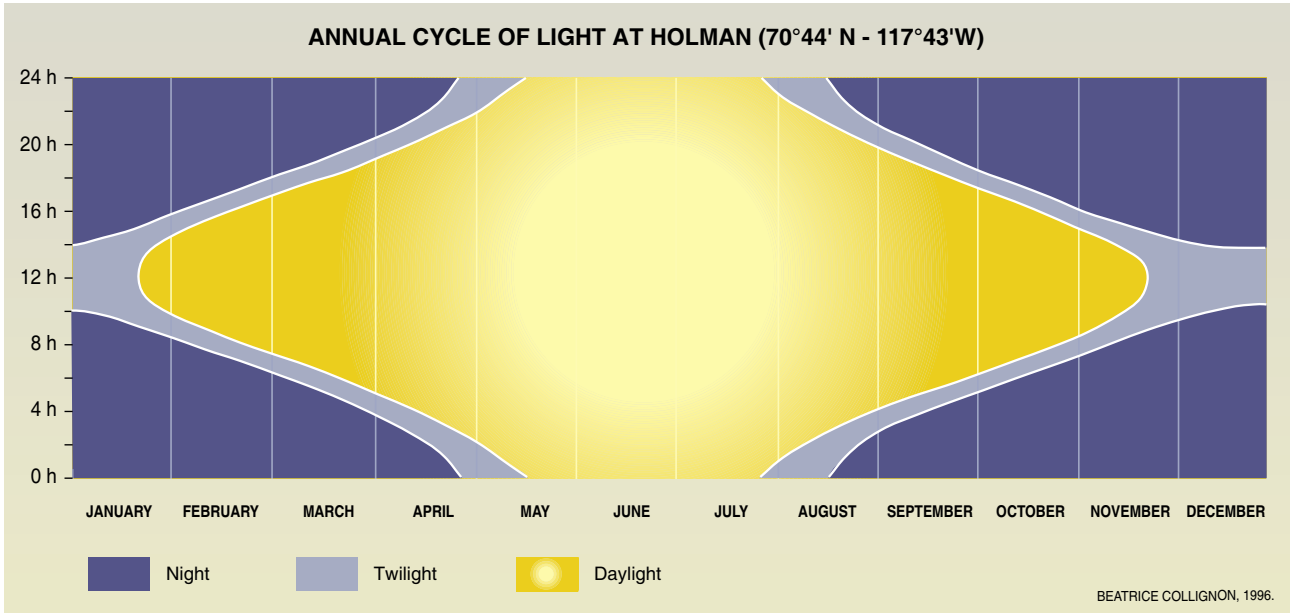
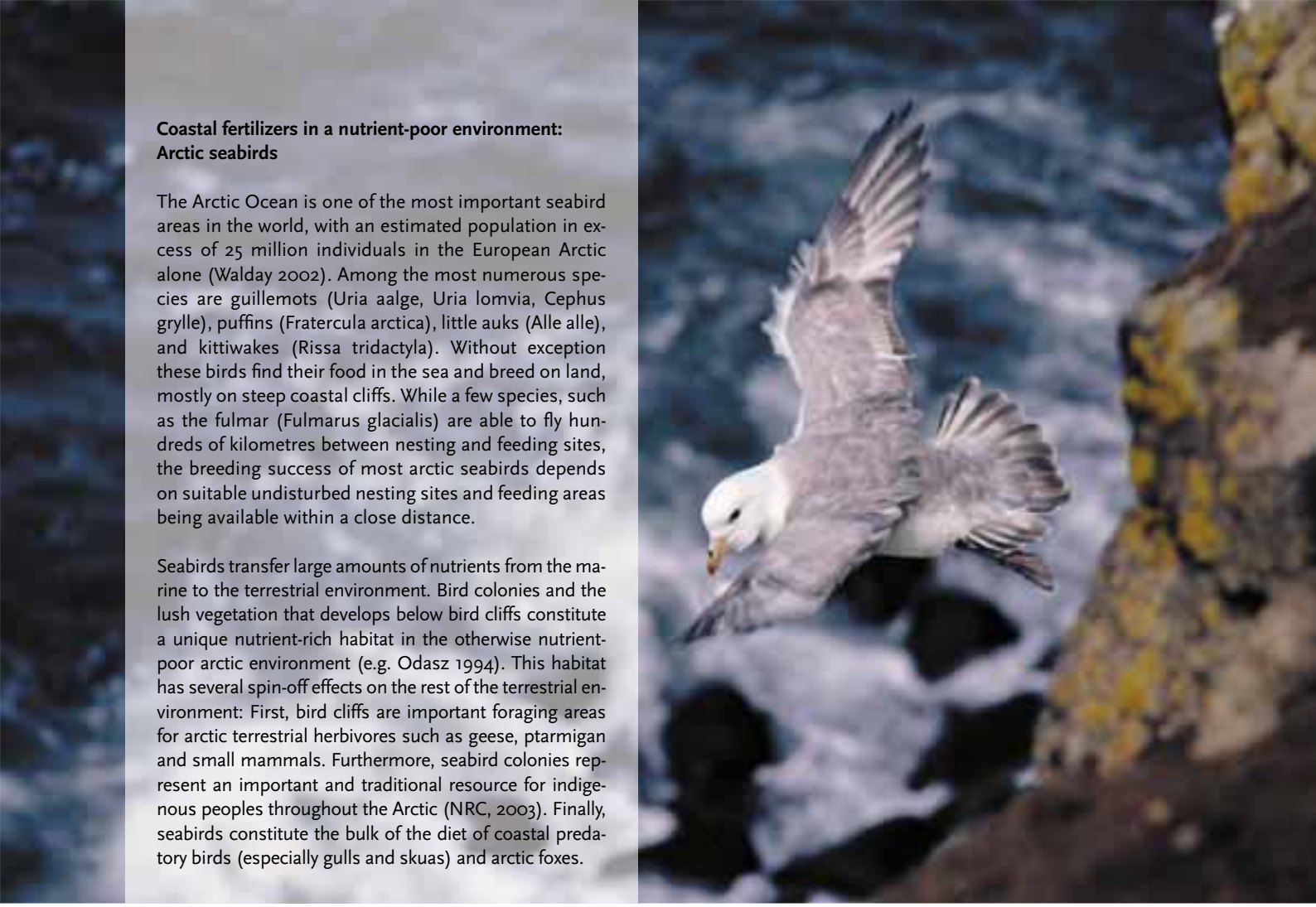


Figure 5. Annual cycle of sunlight in the Arctic.



Coastal fertilizers in a nutrient-poor environment: Arctic seabirds

The Arctic Ocean is one of the most important seabird areas in the world, with an estimated population in excess of 25 million individuals in the European Arctic alone (Walday 2002). Among the most numerous species are guillemots (Uria aalge, Uria lomvia, Cephus grylle), puffins (Fratercula arctica), little auks (Alle alle), and kittiwakes (Rissa tridactyla). Without exception these birds find their food in the sea and breed on land, mostly on steep coastal cliffs. While a few species, such as the fulmar (Fulmarus glacialis) are able to fly hundreds of kilometres between nesting and feeding sites, the breeding success of most arctic seabirds depends on suitable undisturbed nesting sites and feeding areas being available within a close distance.

Seabirds transfer large amounts of nutrients from the marine to the terrestrial environment. Bird colonies and the lush vegetation that develops below bird cliffs constitute a unique nutrient-rich habitat in the otherwise nutrient-poor arctic environment (e.g. Odasz 1994). This habitat has several spin-off effects on the rest of the terrestrial environment: First, bird cliffs are important foraging areas for arctic terrestrial herbivores such as geese, ptarmigan and small mammals. Furthermore, seabird colonies represent an important and traditional resource for indigenous peoples throughout the Arctic (NRC, 2003). Finally, seabirds constitute the bulk of the diet of coastal predatory birds (especially gulls and skuas) and arctic foxes.

The Arctic: a breeding ground for birds

During the summer, the sun never or nearly never sets, resulting in a short but intensive breeding season where millions of migratory birds arrive in the Arctic to breed. The majority of these birds seek the wetlands and coastal shores of the tundra plains. No other place on Earth receives so many migratory species from nearly all corners of the planet. The Arctic coastal regions therefore hold a very special global conservation value.

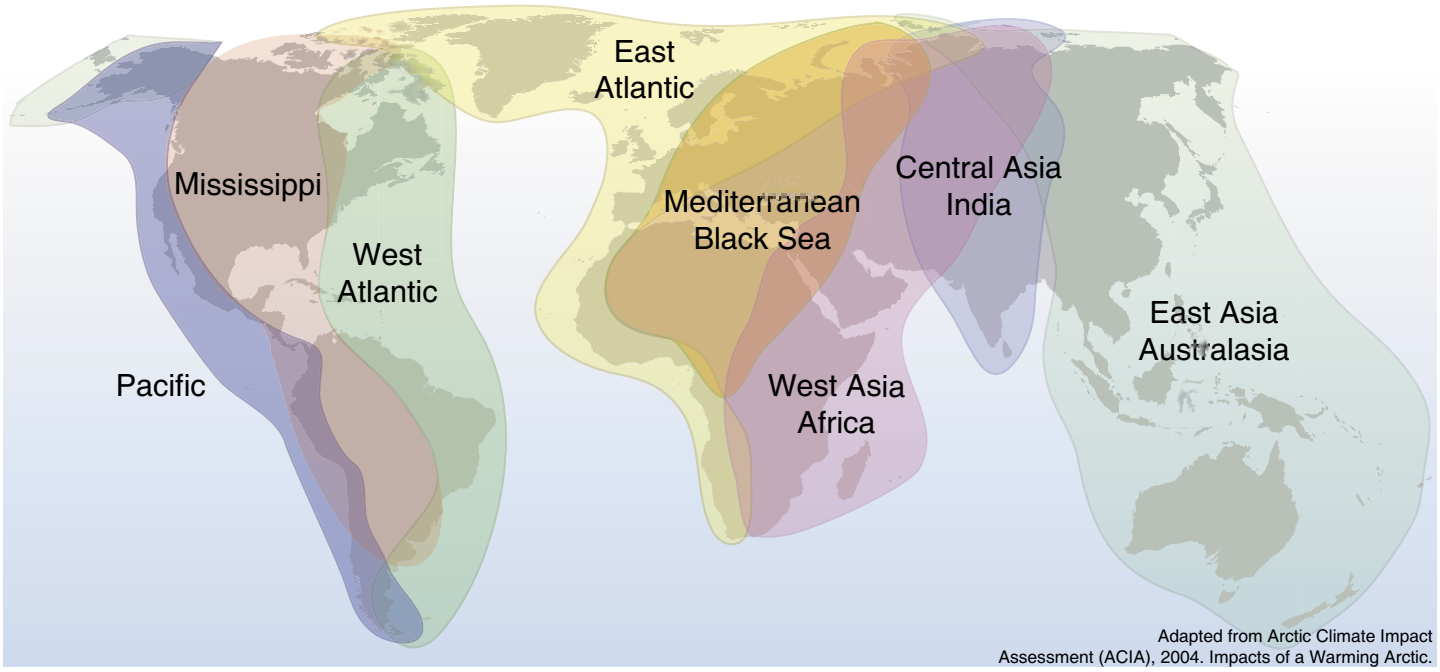


Figure 6. Major global bird migration routes to the Arctic. Bird species that migrate to the Arctic coasts and wetlands arrive from nearly every corner of the planet.

The Arctic coastal food web

An important feature of Arctic ecosystems is the strong dependency of people and wildlife on the interactions between land, coastal and marine resources. Reindeer/caribou, sea mammals and eggs all provide a major contribution to the diet of arctic peoples (NRC, 2003). The diversity and productivity of ecosystems across the Arctic is to a large extent based upon a continuous flow of resources and nutrients between the terrestrial and the marine environment. Furthermore, many Arctic species including birds, reindeer/caribou and sea mammals are migratory or travel long distances, seasonally crossing both land and ice. Hence, they depend upon free access to large amounts of continuous habitat.

The vastness of the Arctic wilderness does not mean it is uninhabited. For thousands of years, people have lived and relied on arctic land and sea for subsistence, as well as for cultural and religious identity.

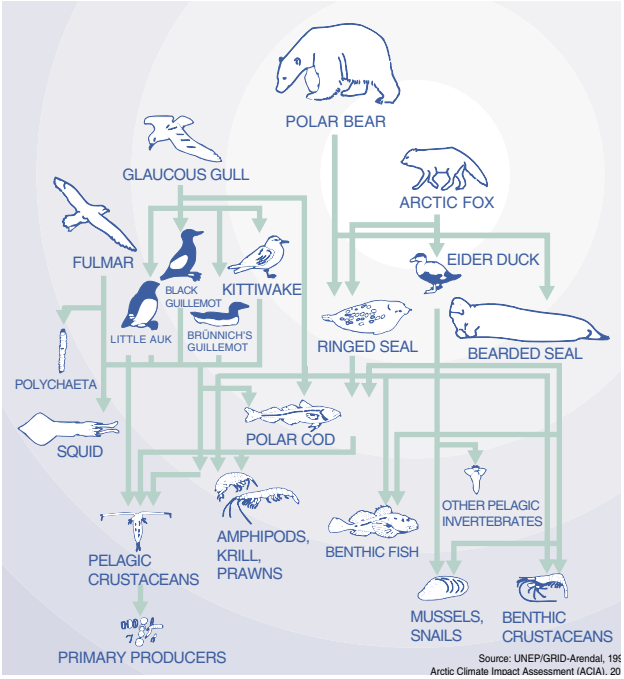
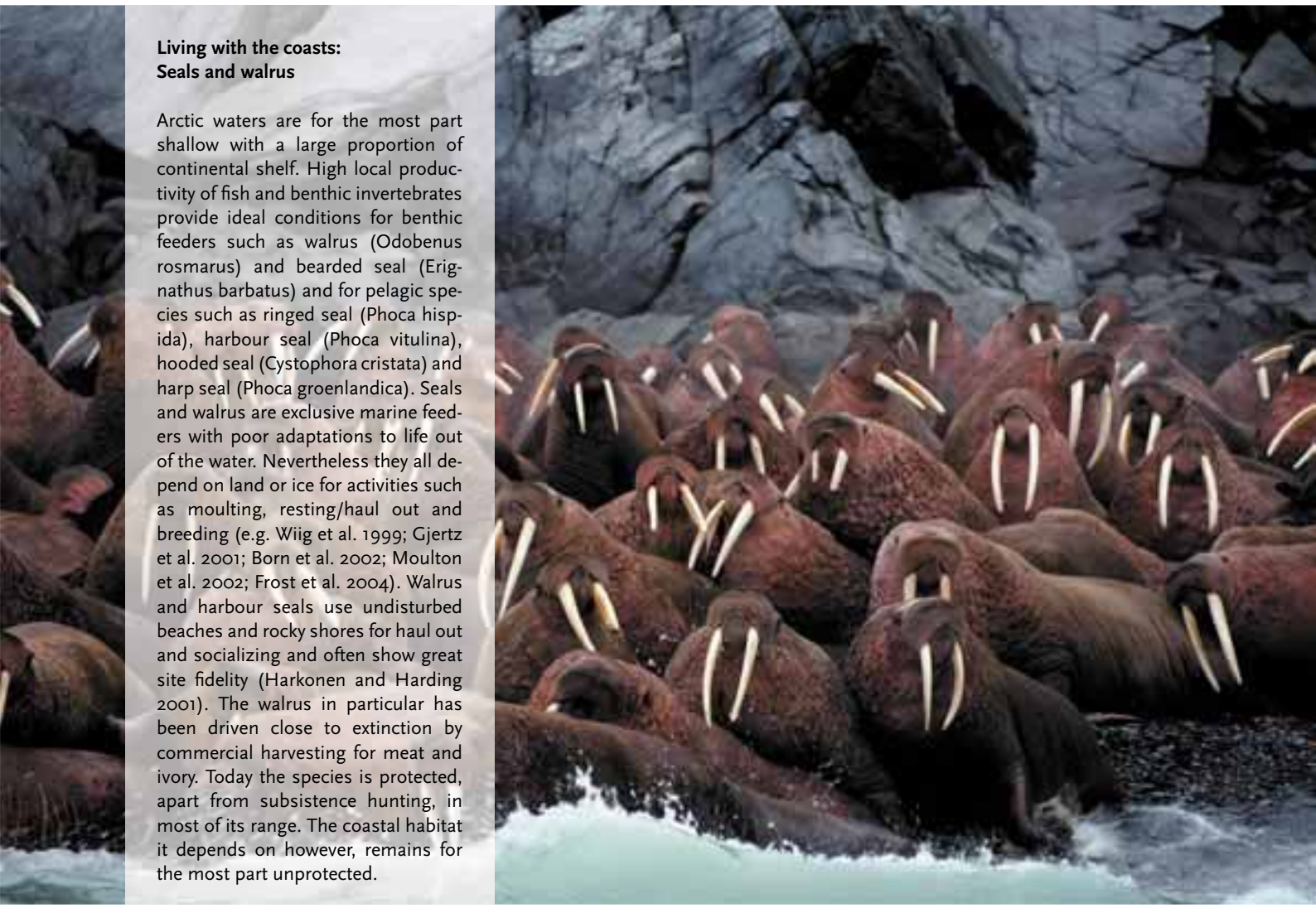


Figure 7. The coastal Arctic food web is closely related to drift ice conditions and seasonal use of shorelines by both terrestrial and sea mammals. Numerous species depend upon each other and the transport of food to and from the marine areas to the coast and inland. Indigenous peoples use most of the food chain and traditionally use both environments for hunting, fishing and gathering.



Living with the coasts: Seals and walrus

Arctic waters are for the most part shallow with a large proportion of continental shelf. High local productivity of fish and benthic invertebrates provide ideal conditions for benthic feeders such as walrus (Odobenus rosmarus) and bearded seal (Erignathus barbatus) and for pelagic species such as ringed seal (Phoca hispida), harbour seal (Phoca vitulina), hooded seal (Cystophora cristata) and harp seal (Phoca groenlandica). Seals and walrus are exclusive marine feeders with poor adaptations to life out of the water. Nevertheless they all depend on land or ice for activities such as moulting, resting/haul out and breeding (e.g. Wiig et al. 1999; Gjertz et al. 2001; Born et al. 2002; Moulton et al. 2002; Frost et al. 2004). Walrus and harbour seals use undisturbed beaches and rocky shores for haul out and socializing and often show great site fidelity (Harkonen and Harding 2001). The walrus in particular has been driven close to extinction by commercial harvesting for meat and ivory. Today the species is protected, apart from subsistence hunting, in most of its range. The coastal habitat it depends on however, remains for the most part unprotected.

Hunting and scavenging on the coasts: The arctic fox

The adaptations of the arctic fox (Alopex lagopus) to life in the cold enable it to survive and remain active year round, despite a body weight of a mere 3-4 kg (Prestrud 1991; Fuglei and Øritsland 1999; Fuglei 2000). The arctic fox has historically been a valued game species due to its thick winter fur. Although the species is found both in coastal and inland regions, population densities tend to be higher and the production of kits more stable in coastal areas. The most likely reason for this discrepancy is that inland populations rely on more fluctuating food sources (small mammals, ungulate carcasses from natural deaths and predation by large predators).

The arctic fox can be described as a terrestrial predator and scavenger. Nevertheless, its survival depends on the marine environment in many parts of the Arctic. First, marine resources (seals, tidal invertebrates, seabirds, eggs) constitute 50-100% of arctic fox diet in coastal areas (Frafjord 1993; Angerbjörn et al. 1994; Hersteinsson and Macdonald 1996; Eide et al. in press). Foxes regularly follow polar bears out on the ice and scavenge on the carcasses of marine mammals killed by bears. Second, the availability of marine resources have been shown to directly affects the population dynamics of arctic foxes (Roth 2003), acting as a stabilizing alternative resource in years of low densities of small mammals. This suggests that - at least in the more extreme parts of the species range - a source-sink system may exist where inflow of individuals from coastal populations acts to stabilize or even maintain low productivity inland populations. The arctic fox is an important agent in the transfer of energy from sea to land (Carlton and Hodder 2003) and the maintenance of complete ecosystems comprising the marine, coastal and terrestrial environments is vital to its survival.

Breeding on the coasts, living in the pack ice: The polar bear

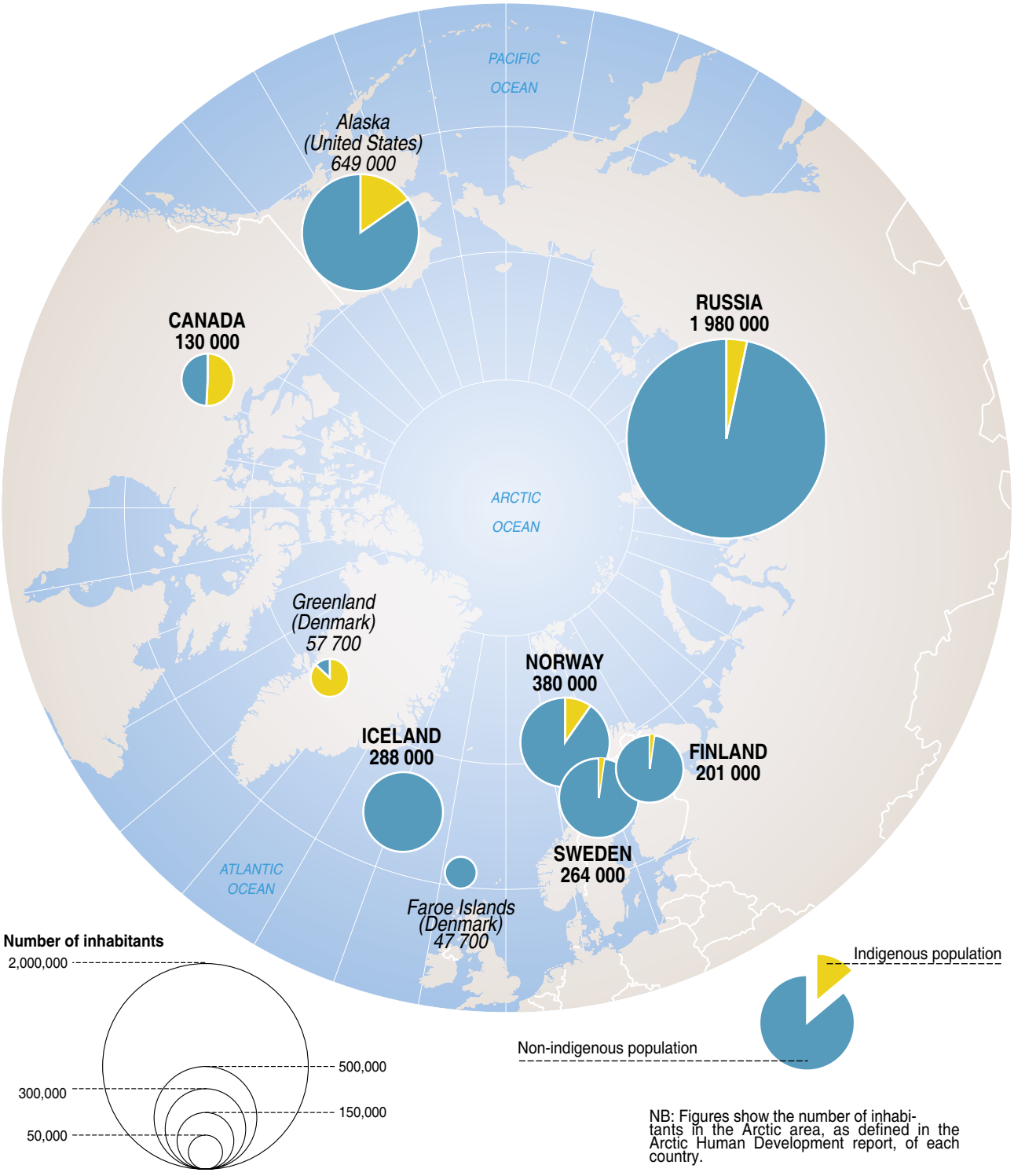
Although the polar bear (Ursus maritimus) is described as a marine mammal, depending almost entirely on marine food sources (Ramsay and Hobson 1991), this species is a classic example of the intimate connection that exists between land and sea in arctic environments. Polar bears rely on fast ice or pack ice for hunting and spend most of their time on the sea ice, roaming over several hundred thousand square kilometres (e.g. Born et al. 1997; Mauritzen et al. 2001; Wiig et al. 2003). In addition, female bears are entirely dependent on undisturbed coastal areas for denning (Larsen 1985; Stirling and Andriashek 1992; Amstrup 1993; Amstrup and Gardner 1994; Messier et al. 1994; Clark et al. 1997; Van de Velde 2003). A breeding female bear spends as much as 6 months on land from entering the maternity den in late October/ November, until the cubs are old enough to follow her out on the ice. Individual bears regularly become stranded on land when the ice retreats in summer. At the southern edge of its range polar bears are routinely forced to deal with long periods without ice. This is the case for instance in Hudson Bay, Canada where the bear population spends close to 4 months on land during the ice free period (Stirling et al. 2004), surviving on stored fat.

Since the essential resources for polar bears include both undisturbed coastal land areas and fiord- and pack ice for hunting seals, the polar bear is faced with terrestrial and marine threats: Increased infrastructure development and exploitation along arctic coastlines pose a direct threat to important polar bear denning areas (e.g. Amstrup 1993), as well as deteriorating the adjacent marine habitat and increasing the chance of human-bear conflicts. As the permanent ice cover retreats, new coastal areas become available for development. The retreating ice also means a loss of polar bear foraging habitat, forcing bears on land more often and for longer periods. This will affect the physical condition, reproduction and survival of the bears and potentially extirpate local polar bear populations altogether (Stirling and Derocher 1993; Stirling 1997).

Arctic indigenous peoples

Depending on the definition of the boundaries to the region, the Arctic is home to some 4 million inhabitants. Roughly a third of this total population are indigenous peoples, spread over numerous communities around the Arctic. The indigenous proportion of different areas varies significantly, from the Inuit comprising 85% of the population of the Nunavut territory in Canada, to the Sámi accounting for 2.5% of the population in the northern Scandinavia and the Kola Peninsula.

Living as herders, hunters, and gatherers, Arctic indigenous peoples have developed their lifestyles through co-evolution with their surroundings, mainly based on reindeer/caribou systems on land and on sea mammals in coastal areas.



Sources : United States: US Census Bureau, 2002 and United States department of commerce 1993; Canada: Statistics Canada, 1995 and 2002; Greenland: Statistics Greenland, 1994 and 2002; Faroe Islands: Faroe Islands Statistics, 2002; Iceland: Statistics Iceland, 2002; Norway: Statistics Norway, 2002; Sweden: Statistics Sweden, 2002; Finland: Statistics Finland, 2002; Russia: State Committee for Statistics, 2003; Republican information and publication center, 1992; State committee of the Russian Federation for statistics 1992. AMAP, 1998. AMAP Assessment Report: Arctic Pollution Issues. AMAP, 1997. Arctic Pollution Issues: A State of the Arctic Environment Report. Stefansson Arctic Institute, 2004. Arctic Human Development Report.

Figure 8. Population distribution and indigenous peoples in the Arctic. Note that except for Greenland and Northern Canada, indigenous peoples form a minority, though they can form the majority in local communities. They are therefore particularly vulnerable to increased immigration by non-indigenous people as a result of industrial development, and to increased competition for resources.

Figure 9. Arctic indigenous peoples form a very diverse group with regard to languages, culture and traditions.

Indo-European family
- Germanic branch

Uralic family
- Finno-Ugric branch
- Samoyedic branch

Altaic family
- Turkic branch
- Tungusic branch

Chukotko-Kamchatkan fam.

Isolated languages
(Ketic and Yukagir)

Eskimo-Aleut family
- Inuit group (of Eskimo br.)
- Yupik group (of Eskimo br.)
- Aleut branch

Na-Dene family
- Athabaskan branch
- Eyak branch
- Tlingit branch

Notes:
Areas show colours according to the original languages of the respective indigenous peoples, even if they do not speak their languages today.

Overlapping populations are not shown. The map does not claim to show exact boundaries between the individual language groups.

Typical colonial populations, which are not traditional Arctic populations, are not shown (Danes in Greenland, Russians in the Russian Federation, non-native Americans in North America).

Adopted from map by W.K. Dallmann published in Stefansson Arctic Institute, 2004. Arctic Human Development Report. Data and information compiled by W.K. Dallmann, Norwegian Polar Institute and P. Schweitzer, University of Alaska Fairbanks. Further modified after expert feedback.

Figure 10. Indigenous settlements in the Arctic. As in the past, today's settlements are usually located in resource-strategic positions, with territoriality and social networks adapted to the movements of reindeer/caribou or the seasonal abundance of sea mammals. Most indigenous settlements are small consisting of only a handful of people, other are communities of several thousand people. Notice that many dots simply represent seasonal settlements and camps, not established communities.

Sources : United States: US Census Bureau, 2002 and United States department of commerce 1993; Canada: Statistics Canada, 1995 and 2002; Greenland: Statistics Greenland, 1994 and 2002; Faroe Islands: Faroe Islands Statistics, 2002; Iceland: Statistics Iceland, 2002; Norway: Statistics Norway, 2002; Sweden: Statistics Sweden, 2002; Finland: Statistics Finland, 2002; Russia: State Committee for Statistics, 2003; Republican information and publication center, 1992; State committee of the Russian Federation for statistics 1992 ; World Wild Fund (WWF) Norway.

Of some 370 settlements in the tundra regions of the circumpolar Arctic, more than 80% of these are located on the coast. The main exception is Siberia, where many settlements occur along major rivers. Several thousand settlements also exist in the forests, generally in resource locations related to the migration of reindeer and caribou. While many hunters and herders have embraced aspects of modernity, many also retain their close relationship with wild animals and the land. Reindeer/caribou and sea mammals have been and continue to be the most important subsistence resources for Arctic indigenous peoples.

Elders still maintain a strong position among indigenous people. Here, the Inuit elder Noah Piugaattuk of Igloolik, Nunavut, Canada shares some of his extensive knowledge with a local cultural historian, Louis Tapardjuk.

Indigenous culture groups that herd and/or hunt reindeer/caribou include (but are not limited to): in Eurasia, Saami, Nenets, Komi, Khanti, Dolgan, Nganasan, Yukagir, Even, Evenk, Sakha (Yakut), Chukchi, Koryak, and Chuvan; and in North America, Gwich'in, Iñupiat, Dogrib, Koyokon Dene, Metis, Cree, Chipewyan, Innu, Naskapi, Yupiit, Inuvialuit and Inuit (UNEP, 2001). For virtually all indigenous peoples living on the coasts, fishing and hunting for sea mammals has a long history (Lyman, 1995; Ackerman, 1998; UNEP, 2001; Friesen and Morrison, 2002).

The use of Arctic resources by people from outside the region has a long history. In the 1600s, Europeans sailed north for whales, walrus, and fish. In the 1700s, Russian fur traders reached from Asia across to Alaska, leading to the extinction of the Steller sea cow and the near-extinction of the sea otter. In the 1800s, American whalers sailed through the Bering Strait and decimated the bowhead whale and Pacific walrus populations. In the Barents Sea, and in the waters of Greenland and the Canadian Eastern Arctic Americans and Europeans hunted bowhead and other large whales to near extinction. In addition, the feeding of the whaling crews led to the loss of muskoxen in northern Alaska, and decimation of reindeer on Svalbard.

Contact between the new arrivals and indigenous peoples led to large changes, too. Missionaries brought a new religion and way of living. Modern weapons changed hunting practices. The newcomers also introduced alcohol, and diseases that killed a large proportion of the people in many areas. There are few estimates available on the impact on indigenous populations in the Arctic and Sub-Arctic of diseases brought by the white man, though they were probably severe. For North-America as a whole it has been estimated that while non-Indian-Indian conflicts killed around 10 percent of the tribal populations, diseases killed somewhere between 25-50 percent, typically smallpox, measles and cholera (Waldman, 2000). In the northern regions, such as in the Northwest Territories, there were major tuberculosis epidemics around 1790, and typhus in the Hudson Bay region around 1902 (Waldman, 2000). However, most epidemics were never recorded, but still had severe impacts on many tribes even far out into the last century. Many missionaries also brought in a new religion and culture, which impacted societies in sometimes sustainable, but also frequently destructive ways. Outsiders also brought an end to the fear of starvation, with which some Arctic peoples had always lived; they also brought modern health care, as well as formal schooling, which sometimes damaged cultures, but also provided many indigenous peoples with the skills they would eventually need for promoting their own rights.

In the 1800s and 1900s, mineral exploitation grew rapidly with mining for lead, nickel, zinc, and other metals in many countries. There was a gold rush in the Yukon, the production of oil in northern Alaska and the discovery of diamonds in Russia and Canada. Prospectors continue to search for new deposits, while land claims agreements and other forms of local self-determination give indigenous peoples a greater voice, and a greater share, in the course of development.

Figure 11. States, organizations and strategical issues in the Arctic: People across borders. Through numerous fora, Arctic peoples now seek to define a sustainable balance in their participation between the cash economy and their traditional pursuit. Their right to influence the future of the coastal regions is under heavy pressure from industrial fisheries and exploration activities based much further south.

Sources : Arctic Council; Norwegian Polar Institute, *Permanent Participants of the Arctic Council*, map complied by Winfried Dallmann; Global Security, Washington DC; Department of Foreign Affairs and International Trade of Canada; International Boundaries Research Unit Database, University of Durham. Updated with expert feedback.

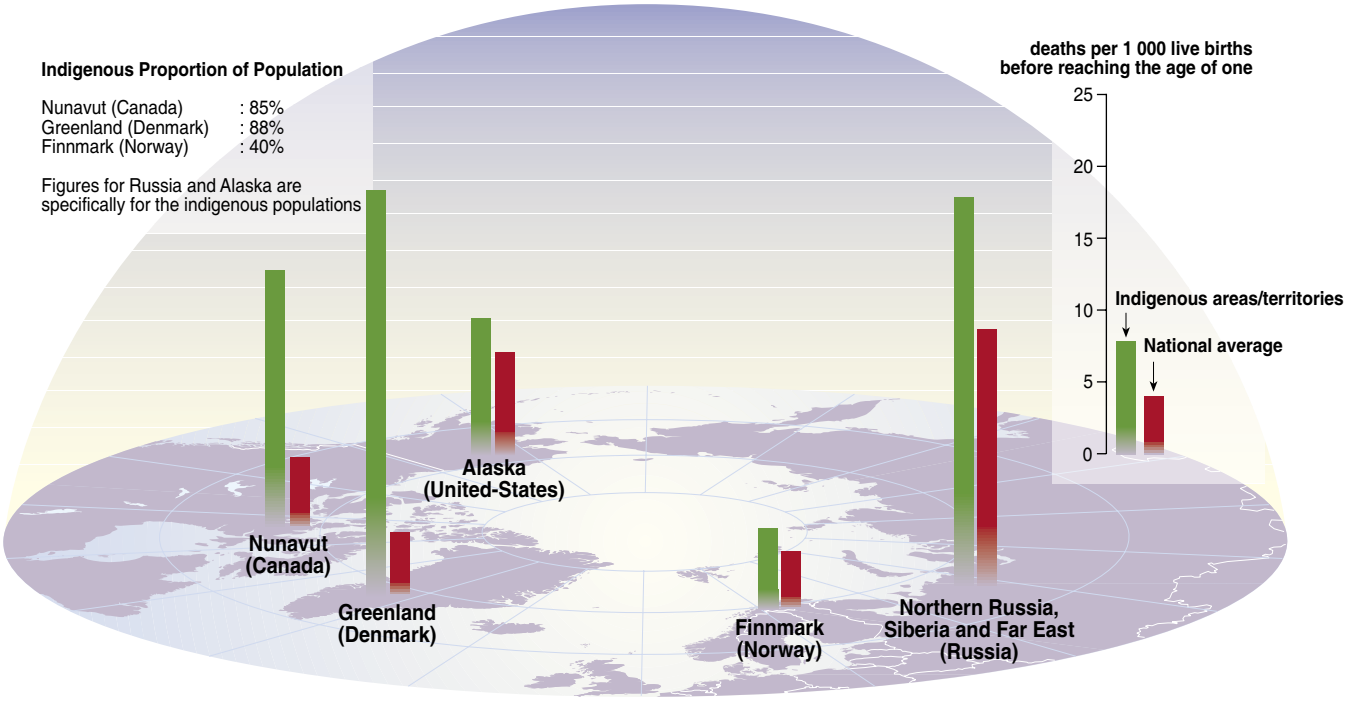
Indigenous Arctic peoples face many challenges. Their standards of living are much lower than in the rest of the industrialized countries to which they are associated. The data for the Arctic countries suggest that infant mortality is much higher for indigenous peoples than for the general populations of these nations (Bjerregaard and Munksgaard, 1999; Statistics Greenland, 2002; Jenkins et al., 2003; Wells, 2003). (The exception being that Alaskan natives have a lower infant mortality rate than the US average. However, Alaskan natives have double the infant mortality rates of non-native Alaskans) (Wells, 2003). Infant mortality is defined as the number of deaths among infants in their first year, per 1,000 live births. At the population level, it is an indicator for maternal health, child health, access to health services, and environmental conditions. It is associated with such factors as the number of births per mother, the interval between births, the mother's age, duration of breastfeeding, access to prenatal and natal care, and access to sanitation, and electricity (WHO, 2001; 2003).

In the Arctic countries there are also other significant disparities in health status between indigenous populations and national averages. For example, life expectancy for indigenous Greenlanders is much lower than that for Danes (Statistics Greenland, 2002). The same relationship is observed for arctic indigenous populations in Canada (Nunavut) and the US (native Alaskans) (WHO, 2001; 2002; Wells et al. 2003). In Russia, average mortality rates have increased significantly since the collapse of the Soviet Union, and in Siberia and Chukotka, where there are many predominantly indigenous communities, mortality rates are much higher than the national average (Jenkins et al., 2003).

Reliable and current data on Arctic indigenous health is, however, difficult to find. Key indicators are most often presented as national averages, thus masking the differences between vulnerable indigenous communities and the total population, and making it difficult for planners and development agencies to target the most critical regions.

For most indigenous people, wealth is possessed through their culture and close ties to the land and its abundant wildlife. Changes in these ecosystems, whether from climate change or industrial development produce greater socio-economic and cultural impacts than elsewhere in industrialized countries. The Arctic is now being made accessible to the rest of the world. Choices are being made today, by governments and local communities, as infrastructure and access is growing, that will determine whether or not the Arctic will continue to possess large, intact and productive ecosystems in the future. Policies that support external interests in resource extraction in the Arctic need to account for indigenous resources and livelihoods in the full array of impacts related to development activities.

Figure 12. Infant mortality in selected regions of the Arctic. Infant mortality is generally higher among indigenous peoples than the average populations.



Sources: Arctic monitoring and Assessment Programme (AMAP), 2003. AMAP Assessment 2002: Human Health in the Arctic. United Nations Development Programme (UNDP), 2004. Human Development Report. Goskomstat 2002; N. Zubarevich, *Economic and Social Development of the Northern Indigenous People*, Moscow, 2003; *Russia: Case Study on Human Development Progress Toward MDGs at the Sub-National Level*, UNDP Occassional Paper, 2000; Statistics Canada 2001 (http://www.statcan.ca/english/Pgdb/health21a.htm); Alaska Native Epidemiology Center/Alska Native Health Board, 2003; *Progress Toward Healthy Alaskans 2010 Goals for Alaska Native Babies: 1998-2000* http://www.anhb.torg/sub/epi/documents /birth%20doc%202003.pdf; Statistics Greenland, Average 1996-2000 http://www.statgreen.gl/english/publ/yearbook /2002/chapter%2017.pdf; Central Statistical Bureau of Norway 1999; http://www.ssb.no/dode_en/arkiv/art-2001-06-14-01-en.html

Contaminants

Traditional lifestyles with extensive use of food from sea mammals, wildlife and birds eggs make arctic peoples extremely vulnerable to accumulation of toxins, POPs (persistent organic pollutants) and heavy metals. Indeed, Indigenous peoples in the Artic have some of the highest known exposures to these chemicals even though have not used or benefited from industries associated with these chemicals.

POPs include a wide range of industrial chemicals as well as those produced as a by-product of industrial processes. Indigenous peoples and other northern residents who depend on traditional food sources may suffer negative side effects due to long term exposure to these pollutants.

POPs pose serious health and environmental risks, as they are often toxic, stay in the environment for long periods of time allowing them to be transported large distances from their sources, and have a tendency to accumulate in mammals and concentrate in the food chain. Indigenous peoples in the Arctic depend on traditional diets. It is an important part of their cultural identity and a vital source of nourishment. Other sources of food often do not exist. In eating their traditional diets they are exposing themselves to POPs that accumulate in the fatty tissues of animals.

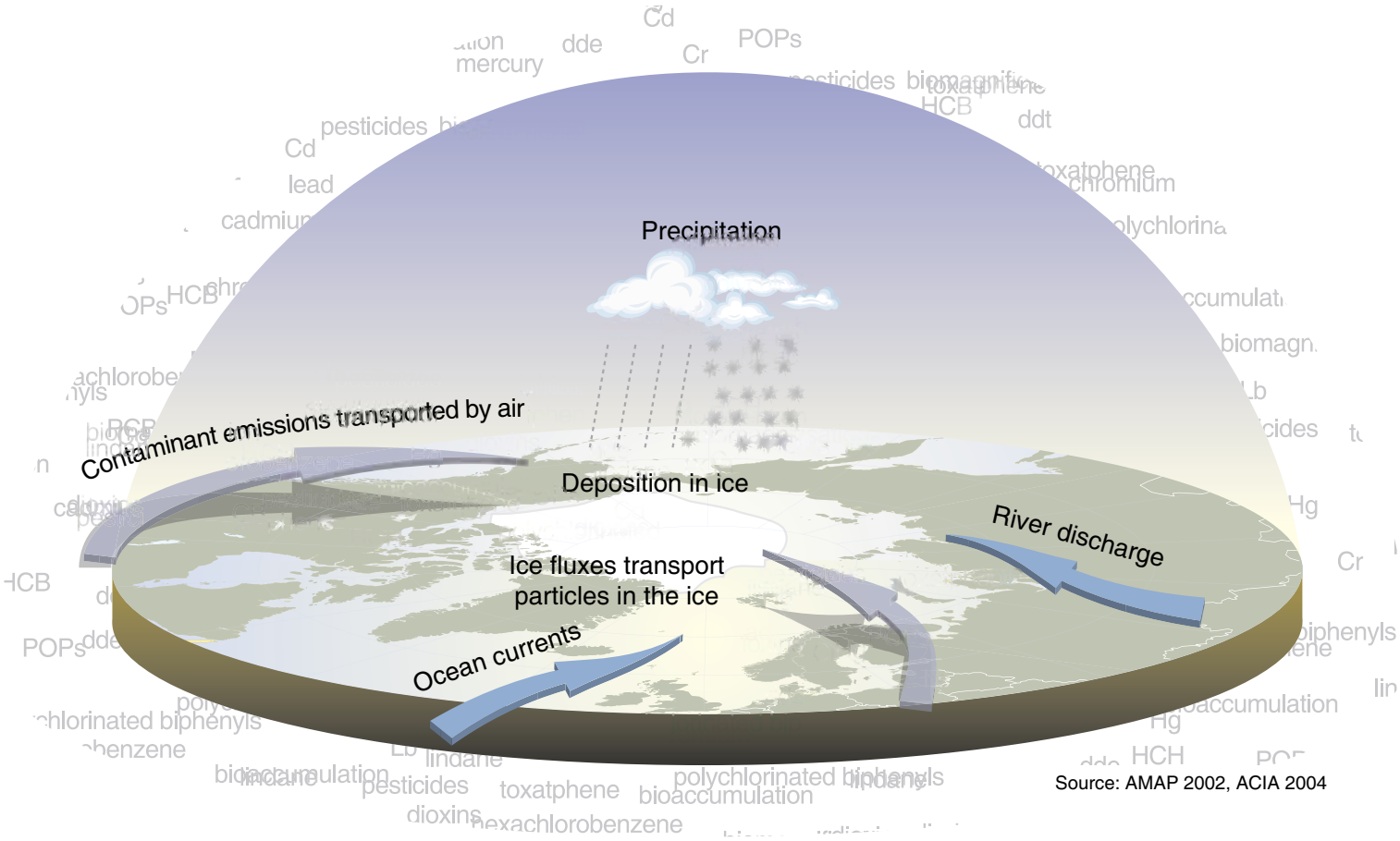
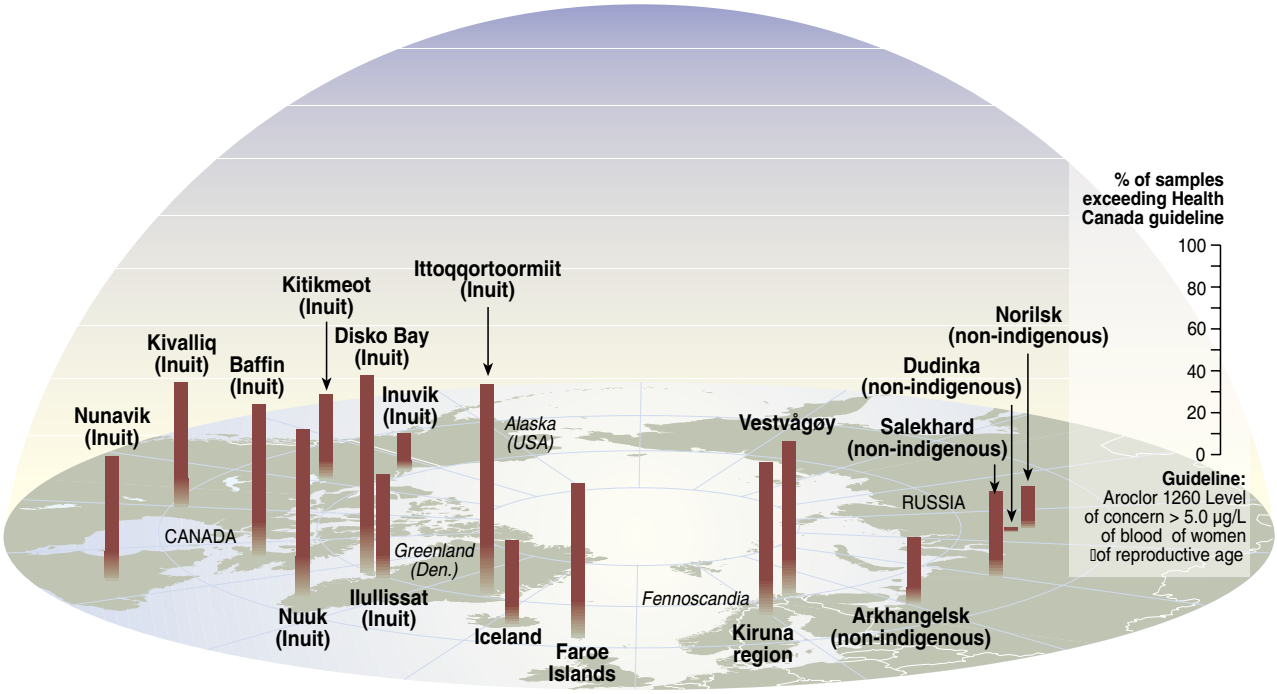
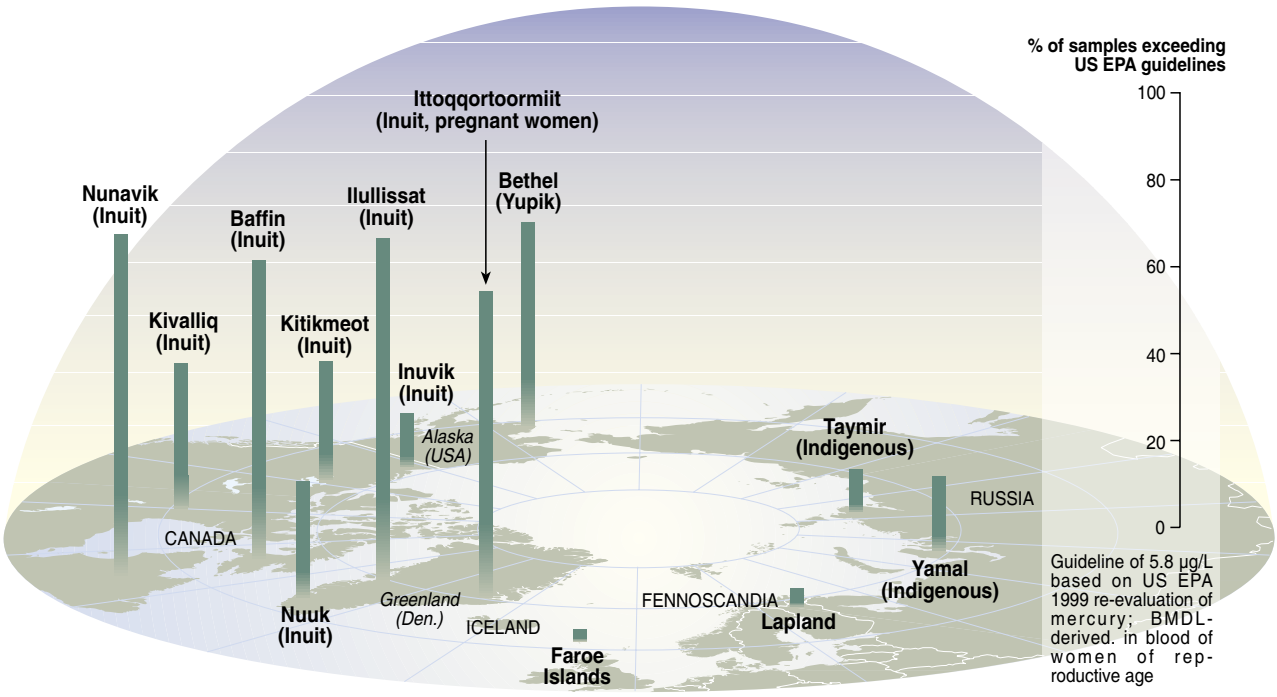


Figure 13. Contamination pathways. Many POPs (persistent organic pollutants) and heavy metals from emissions further south are accumulated in Arctic food chains and ultimately in indigenous peoples. While fear of these compounds sometimes has resulted in abandonment of traditional foods, this has also led to more unhealthy food habits acquired from non-indigenous peoples. Most indigenous peoples in smaller communities still supply a large share of their household foods from natural resources.

Mercury is one of the most toxic heavy metals. The main man-made sources come from the burning of fossil fuels and garbage. The effects of mercury poisoning have been observed in the neurological, sensory and reproductive systems in mammals, fish and birds. Mercury is a nerve toxin that can damage the brain. Young children and the growing fetus are vulnerable during critical stages of brain development. Mercury poses serious health and environmental risks. Mercury is a global contaminant, transported over long distances by air currents from sources in the industrialized world, as well as from rapidly developing industrialized regions in Asia and Africa. Mercury emissions are expected to increase with the demand for coal, especially in China. There is evidence of higher levels in the Arctic and in humans in the region (AMAP, 2003). Indications also suggest these levels are increasing (AMAP, 2003). Some groups of indigenous peoples in Greenland and in Arctic Canada have been found to have very high exposure to mercury (AMAP, 2003). Daily amounts from eating traditional foods exceed WHO recommendations. It has also been found that Mercury levels in blood are above WHO levels (WHO, 2001; 2002).



Source: Arctic monitoring and Assessment Programme (AMAP), 2003. AMAP Assessment 2002: Human Health in the Arctic.



Source: Arctic monitoring and Assessment Programme (AMAP), 2003. AMAP Assessment 2002: Human Health in the Arctic.

Top: **Figure 14. PCBs in the blood of Arctic peoples.**

Bottom: **Figure 15. Mercury levels in the blood of indigenous women of reproductive age.**

Cree hunters line up to discuss hunting strategies in James Bay, Canada.

For Arctic indigenous people, the changes of the modern World bear both new opportunities and challenges.

Positive opportunities associated with industrialization may include revenues from development, increased access to jobs, improved access to and quality of health care, social services and education. Increased and improved communication and transport are also valuable factors associated with changes in the Arctic.

Negative impacts and challenges that indigenous peoples are faced with include loss of services and income when companies focussed on short-term profits close their operations, unwilling changes in chosen lifestyles, increased introduction of alcohol and drugs and diseases, increased unsustainable tourism, competition for traditional rights, loss of traditional game species, pollution and toxins in primary food sources, as well as increased risks from climate change, such as changes in weather patterns and sea ice, the latter a considerable risk factor for hunters in the pack ice (Berman et al., 2004; George et al, 2004; Norton and Gaylord, 2004; Voinov et al., 2004). A serious threat is the increased access by southern-based fishing industries to coastal trawl fisheries and coastal development by mining and petroleum companies, with the imminent threat to coastal resources by pollution, toxins or oil spills. Heavy traffic in itself may result in large-scale avoidance by many game species, while a large number of tourists or immigrant workers may compete for traditional rights (UNEP, 2001).

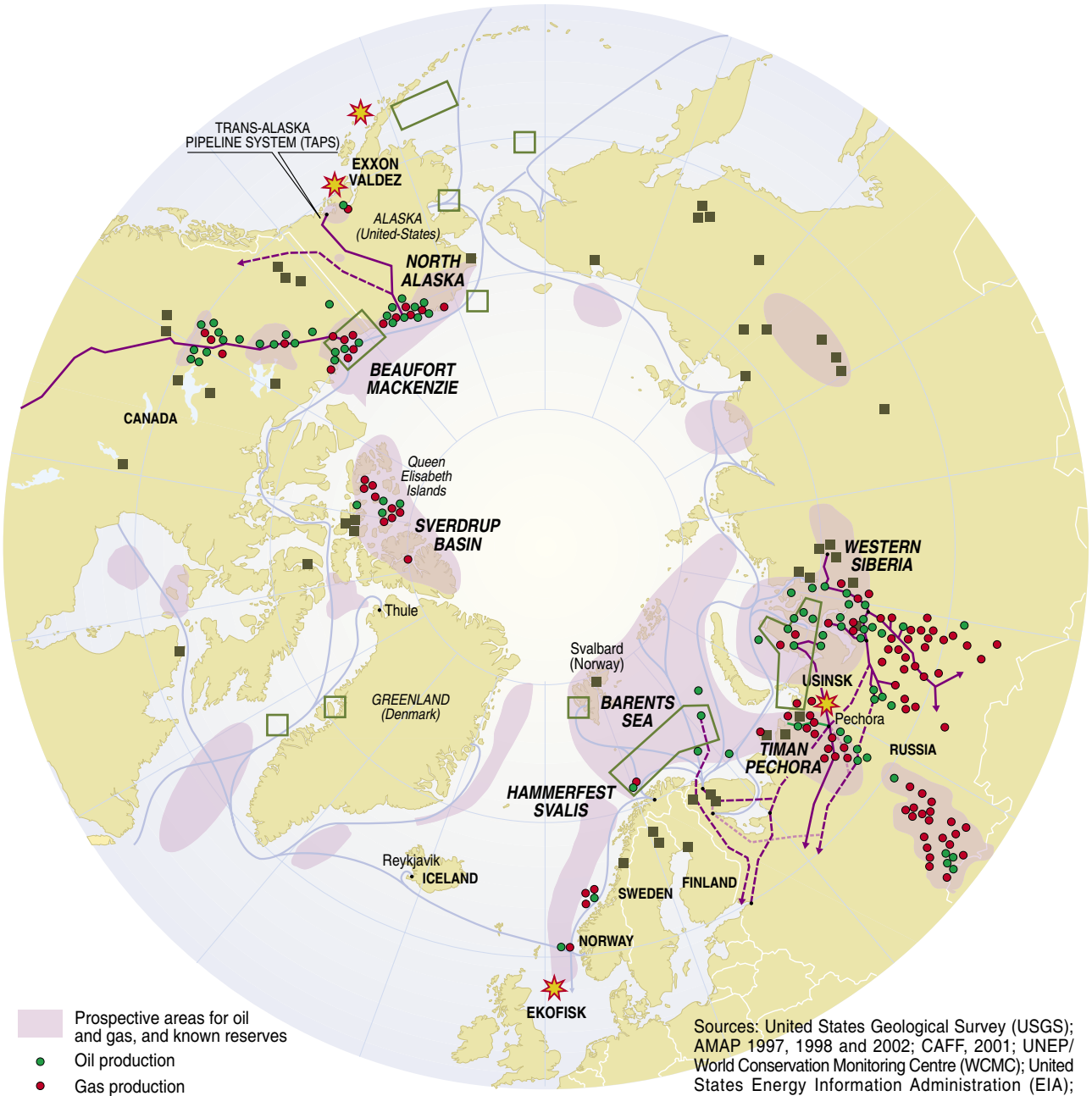
Development in the Arctic:
Economic opportunities, environmental and cultural challenges

The wilderness of the Arctic has not remained intact this long due to strong legislation and good spatial planning practices, but rather because of the remoteness from industrial centres, inaccessibility, and harsh climatic conditions of this region, protected vastly by the pack ice during winter. These conditions are now changing. Infrastructure is moving in, investments are being made in extractive industries, and global warming is opening up sea routes to previously inaccessible areas. Arctic spaces and ecosystems are thus no longer protected by nature and geography as they were in the past.

The Arctic holds large reserves of hydrocarbons and minerals (Ivanov 1999). Today oil and gas exploitation development is the keystone to many northern economies.

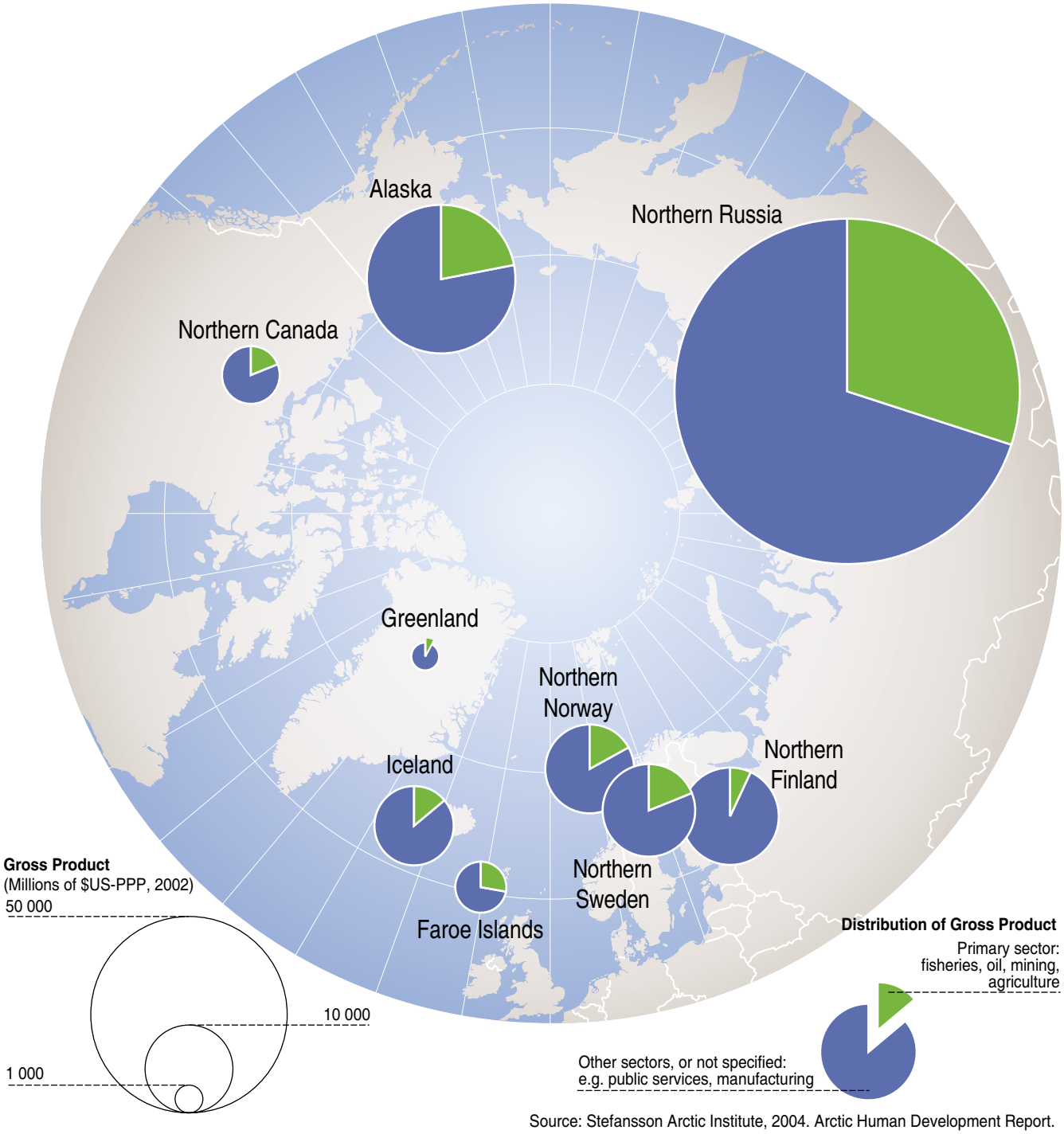
Oil and gas development is accelerating other development in the Arctic through the creation of roads, economic activity and new settlements. Two corridors of development in particular will carry major influence on the future of many Arctic indigenous peoples, 1) The Beaufort-Mackenzie-North Slope corridor which is associated with gas and oil and also increased mining; and 2) the Barents Sea-Pechora basin oil and gas fields. Both projects bring new economic activity and development into vulnerable regions with traditional caribou hunting or reindeer herding and many sensitive coastal and marine habitats.

Figure 16. Industrial development in the Arctic. The Arctic has been opened up for increased exploration of petroleum, gas and mining activities. The Barents Sea, the Mackenzie Valley in Canada and the Alaskan North Slope, are the areas of chief interest at the moment. Notice that the shipping routes in Northern Canada are not open today because of ice. The Northern Sea Route north of Russia is partly open today.



Sources: United States Geological Survey (USGS); AMAP 1997, 1998 and 2002; CAFF, 2001; UNEP/ World Conservation Monitoring Centre (WCMC); United States Energy Information Administration (EIA); International Energy Agency (IEA); Barents Euro-Arctic Council (BEAC); Comité professionnel du pétrole (CPDP), Paris; Institut français du pétrole (IFP), Paris; National Oceanic and Atmospheric Administration (NOAA); The World Bank; Alaska Department of Environmental conservation, Division of Spill Prevention and Response; United States Coast Guard (USCG).

Figure 17. The largest economies in the Arctic belong to Alaska (US) and Russia, mainly because of mining and petroleum activity. Regions that are still heavily dominated by more traditional subsistence activities, such as hunting and fishing, in Greenland and in Northern Canada, have much lower gross products. Similarly, reindeer herding in Russia and Scandinavia is of substantial importance to the livelihoods and lifestyles of reindeer herders like the Saami and the Nenets but does not contribute greatly to the gross products of these regions.



Source: Stefansson Arctic Institute, 2004. Arctic Human Development Report.

Historical development of oil wells in northern Canada

Some areas, like northern Scandinavia, the Mackenzie Valley region in Canada and the North Slope of Alaska, have seen increased development primarily in the past few decades.

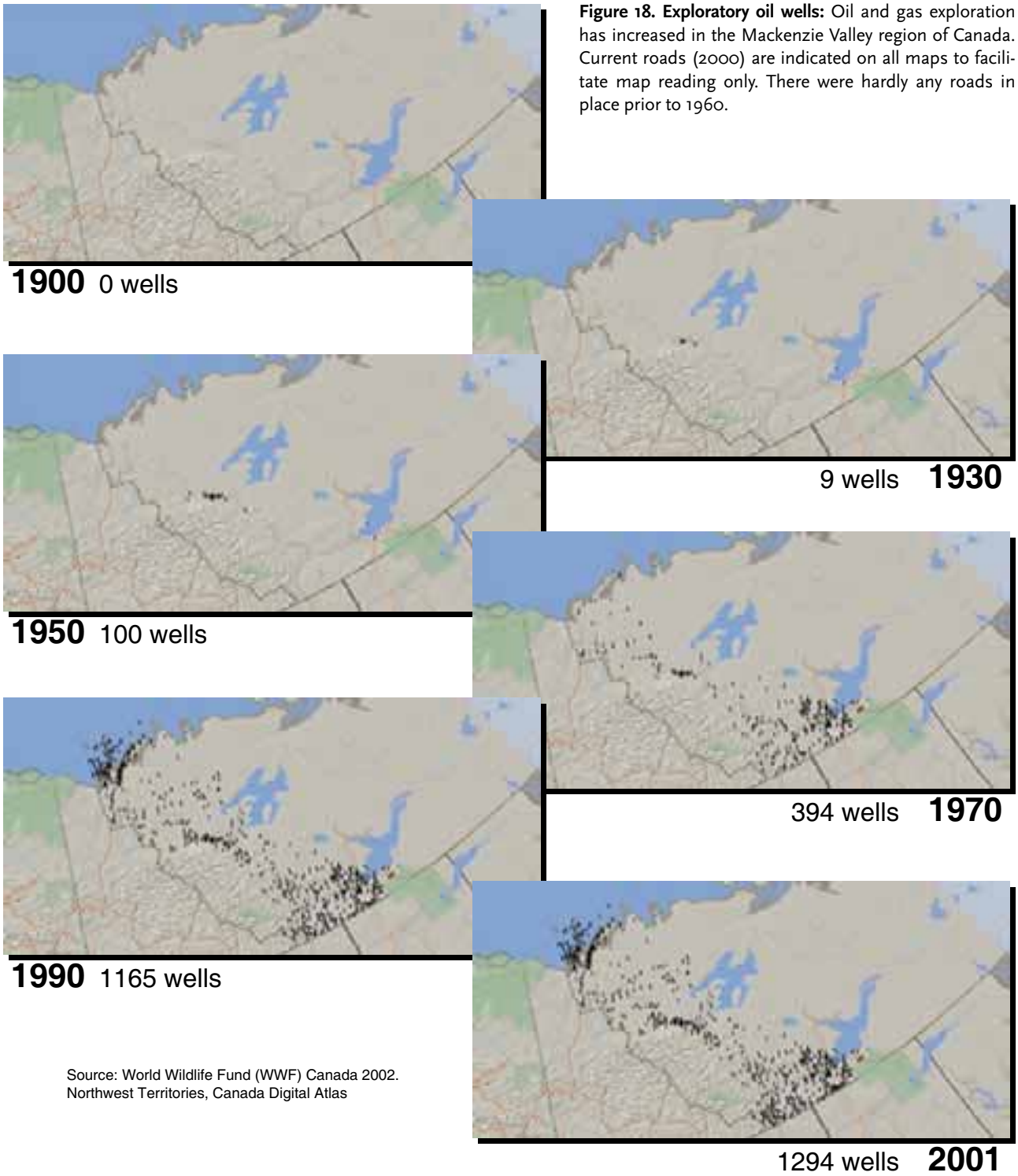
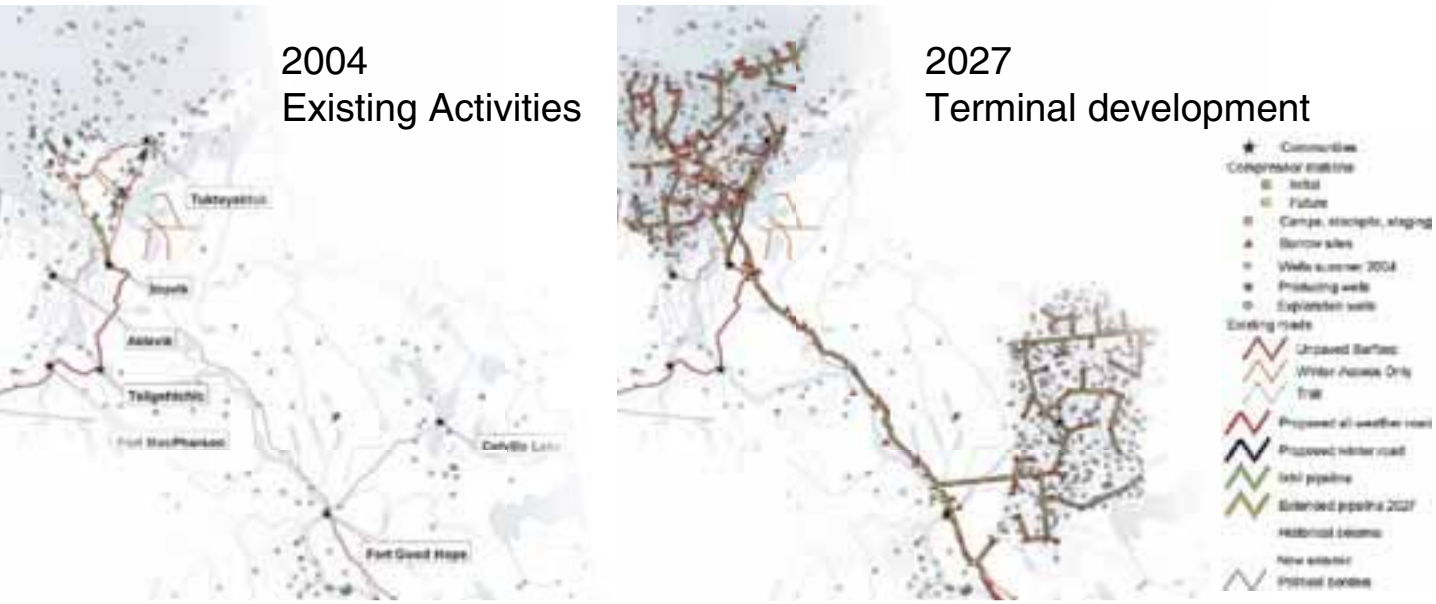


Figure 18. Exploratory oil wells: Oil and gas exploration has increased in the Mackenzie Valley region of Canada. Current roads (2000) are indicated on all maps to facilitate map reading only. There were hardly any roads in place prior to 1960.

Source: World Wildlife Fund (WWF) Canada 2002. Northwest Territories, Canada Digital Atlas



Source: Adapted from CARC (2004), data from NWT digital atlas, WWF (2002).

Figure 19. Existing and planned development in the Mackenzie Valley, Northwest Territories, Canada. (Courtesy of Cizek and Montgomery, 2004; www.carc.org).

Cumulative impacts of development in the Arctic

Development in the Arctic is not limited to oil and gas exploration. Mining operations and hydro power development, power lines, windmill parks and military bombing ranges have also been developed across the past decades. Growing affluence allows ever-greater numbers of tourists to visit remote areas. All of these activities require infrastructure that produces additional impacts through fragmentation, direct habitat destruction, and the provision of corridors for people to reach new areas. For many indigenous peoples and organizations, revenues from development are often not made available to them, or they become entirely dependant upon them, which, in turn, raises serious problems if companies leave or new, more damaging exploration is planned (NRC, 2003).

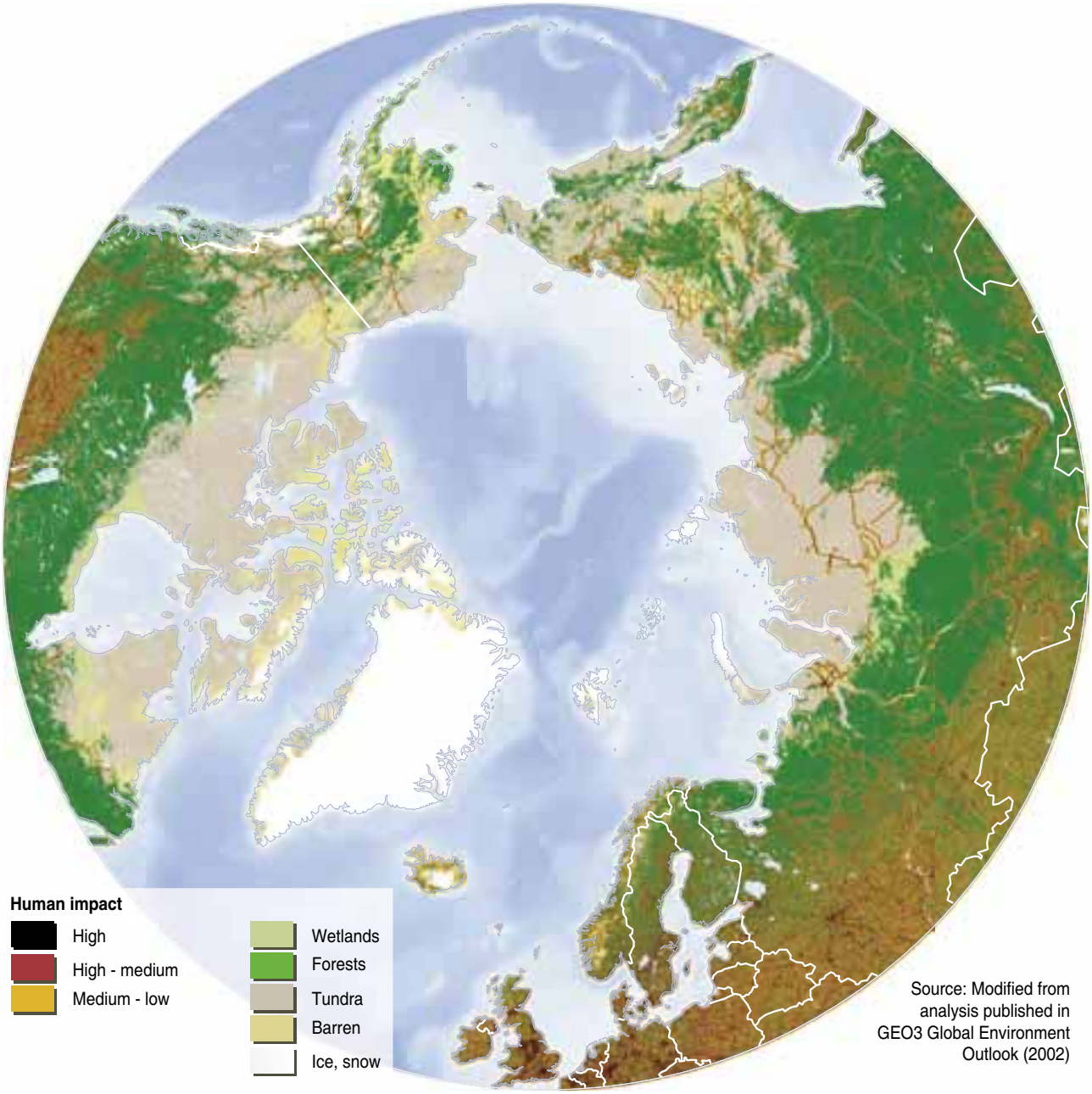


Figure 20. Cumulative impacts of development in the Arctic. Overview of the pressure on biodiversity, including reindeer and caribou, from infrastructure development. Note that most of this development is less than 100 years old, with little impact in the Arctic. (Source, www.globio.info).

The Arctic wildlife and flora are sensitive to fragmentation and development and major development projects are still controversial (NRC, 2003). The fragmentation of Arctic habitats will, at the levels of development predicted, seriously threaten biodiversity and ecosystem function (UNEP, 2001). Coastal regions are particularly vulnerable, because they constitute key breeding areas for so many species. In Scandinavia, the main calving and summer ranges of semi-domesticated reindeer owned by Saami reindeer herders have suffered greatly due to piecemeal development, most often with only symbolic or no compensation at all. These areas also hold an important cultural and historic value, as they represent the summer homes of many semi-nomadic herders. Indeed, Northern Scandinavia has the highest development pressure anywhere in the Arctic today. Development of cabin resorts, bombing ranges, road construction, mining, hydro power, and power wind mill parks threaten the access of Sámi reindeer herders and their reindeer to traditional grazing areas. Already, perhaps as much as 35% of the ranges may be lost or compromised as a result of disturbance (UNEP, 2001; EEA, 2003). By 2050, perhaps as much as 78% of the coastal ranges may become unavailable, thereby seriously jeopardizing the future of reindeer herding in the region (EEA, 2004).

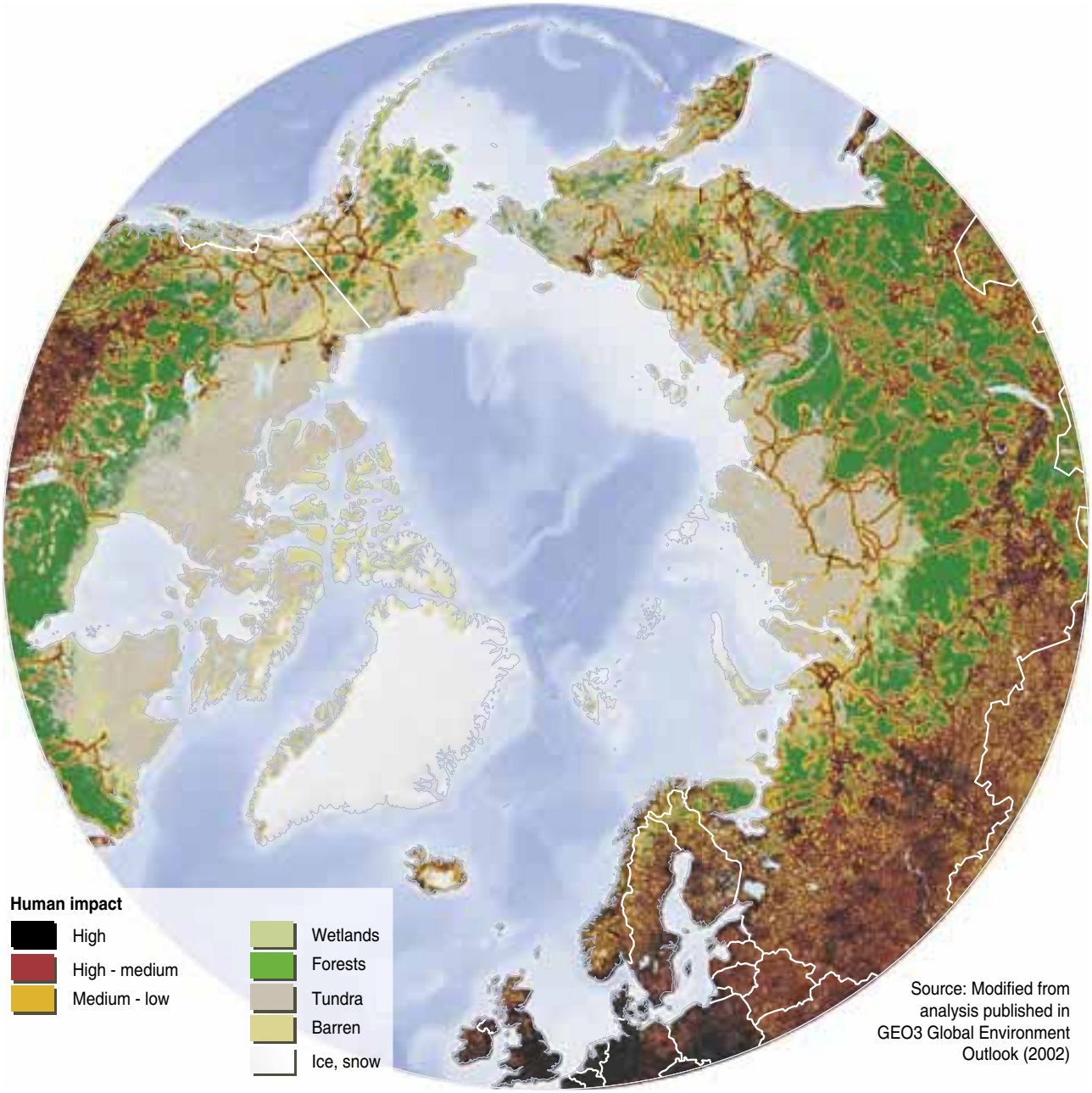


Figure 21. Scenarios of development. Extent of human impacts on biodiversity of piecemeal development of infrastructure by 2032 with continued development rates under a market forces favourable scenario (UNEP, 2001; 2003; Nellemann et al. 2003). Notice that this model-generated scenario currently underestimates the rapid exploration and development activity taking place on the North Slope of Alaska and in the Mackenzie Valley region in Canada (see separate maps). Some estimates (UNEP, 2001) project that perhaps as much as 80 percent of the Arctic land area will become impacted by development by 2050 if current trends continue.

Caribou calving on the coasts: Pressure of industrial development

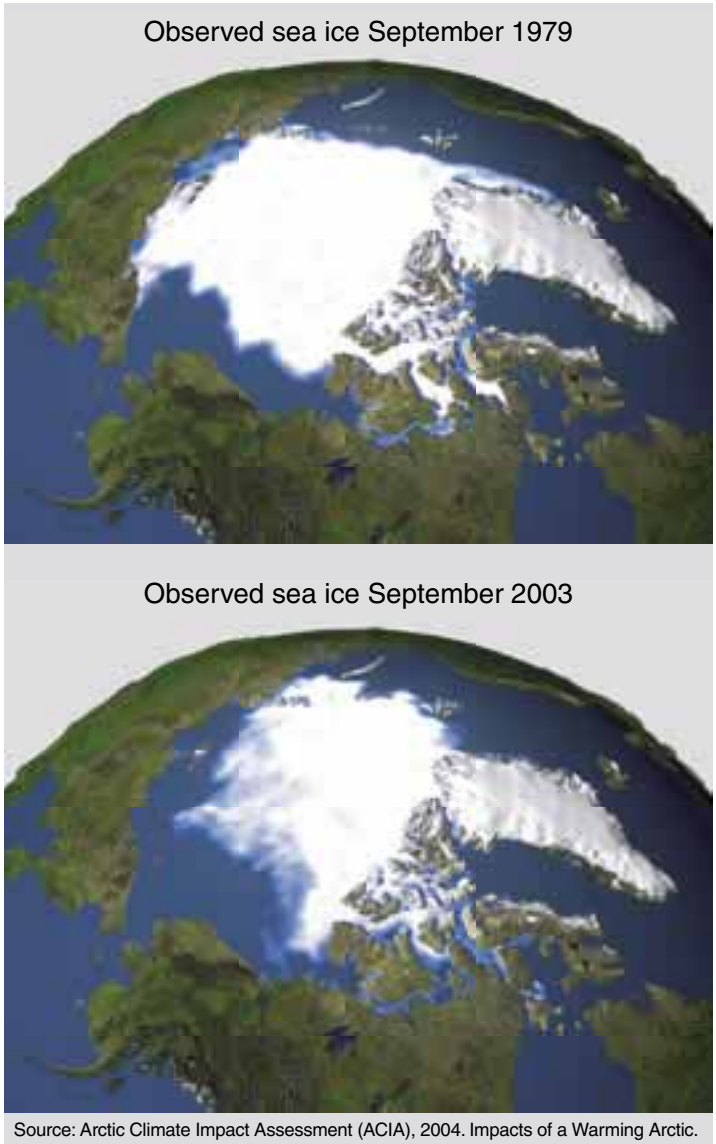
A large proportion of caribou and reindeer migrate to coastal regions for calving and for the summer. Coastal areas are of major importance for the productivity of these herds. Throughout the Arctic, caribou and reindeer are under pressure from development including pipelines, roads, oil fields, mining operations, tourist resorts, hydro power and power lines, dams and military bombing ranges. Forestry and progressing development appears historically and in recent times to displace or even result in abandonment of areas by both caribou and reindeer (NRC, 2003; Schaefer, 2003; Nellemann et al., 1996, 2003). In Alaska, caribou have been displaced during calving due to infrastructure in the Prudhoe Bay and Kuparuk oilfields (NRC, 2003); hydro power development has displaced caribou in Quebec, logging operations have displaced caribou in various parts of Canada (Chubbs et al., 1993; Smith et al., 2000; Dyer et al., 2001; 2002) and tourist resorts and powerlines are displacing both wild and semi-domesticated reindeer in Scandinavia (Vistnes et al., 2001; 2004; Nellemann et al., 2000; 2001; 2003).

Large-scale and long-term recession may also take place, with impacts on indigenous peoples who depend so strongly on the caribou and reindeer. Patterns of range recession of woodland caribou (Rangifer tarandus caribou), 1880-1990 Ontario, Canada, indicated that half of historic woodland caribou range had been lost, a rate of disappearance of 34,800 km 2 per decade, and a northward range recession of 34 km per decade. The mean population density was one group per 1,900 km2, suggesting an average loss of 18 caribou wintering areas per decade during this period. There was a strong coincidence between the recent southern limits of caribou occupancy and the northern front of forest harvesting and road development, implying an anthropogenic agent of decline (From Schaefer, 2003). The caribou in these areas have now been lost as a strong traditional and cultural source of subsistence hunting for many of the indigenous peoples including the Cree. As development moves north, the same impacts may await caribou and reindeer in the Arctic.

Climate change

Satellite observations of minimum sea-ice concentration 1979–2003

The Kyoto protocol takes effect on February 16th 2005, providing an important tool against human induced climate change. However, in the Arctic, climate change is already happening.



Source: Arctic Climate Impact Assessment (ACIA), 2004. Impacts of a Warming Arctic.

Figure 22. Satellite observations of the polar ice cap indicate a decrease in summer (minimum) sea ice in the Arctic. This decrease has substantial impacts on much of the wildlife, i.e. diminishing the hunting success of polar bears. It also greatly increases the acute risk to indigenous hunters on the pack ice as conditions become increasingly unpredictable.

The 3rd IPCC report estimates that warming in the Arctic will occur at twice the global average in a range of 1.4 to 5.8 oC over the next century. The recently released report, the Arctic climate impact assessment (ACIA, 2004), confirms these numbers and concludes that the average temperature in the Arctic has already increased at twice the global average over the past 50 years. Temperature is projected to increase by 5-7 oC over the next 100 years. Already the vast pack ice, so crucial to people for wildlife, travel and hunting, is diminishing, though with great annual variations.

Changes in permafrost and the polar cap in the coming decades

Along with increased shipping and access to tourism, coastal communities face increasing exposure to storms and overall coastal erosion.

Furthermore, vast areas with permafrost will melt, resulting in erosion, infrastructure problems and substantial increases in methane previously stored in the permafrost, thereby further accelerating climate change. Vast unpolluted and unexploited marine areas and coastal shores will not remain isolated and inaccessible much longer.

This is of particular concern, because these coastal areas are probably the most critical for Arctic indigenous peoples and the entire Arctic ecosystem. These areas are also of substantial global significance. Indeed, mapping of impacts of infrastructure development on the Worlds coastal areas by the GLOBIO 2.0 model (www.globio.info) indicate that more than 71% of the world's coastlines outside of the Arctic and Antarctic are now impacted by development. This figure will increase to more than 90% by 2050 with continued development. The majority of the coastal areas are also heavily exposed to trawlers and other forms of industrialized fisheries.

While arctic ecosystems may adapt to rapid climate changes, they will not be able to withstand these pressures combined with industrial exploration of land and marine resources.

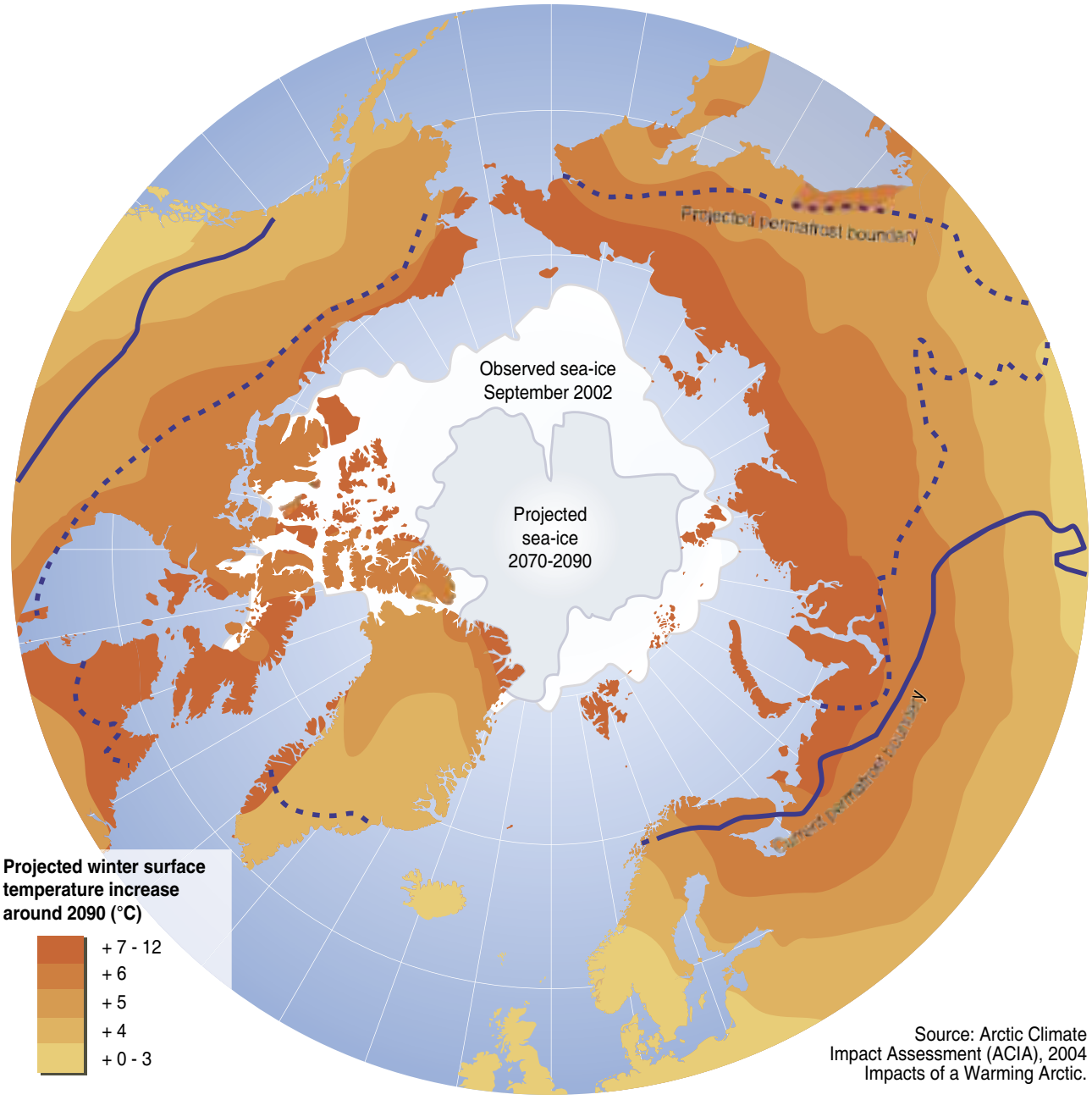
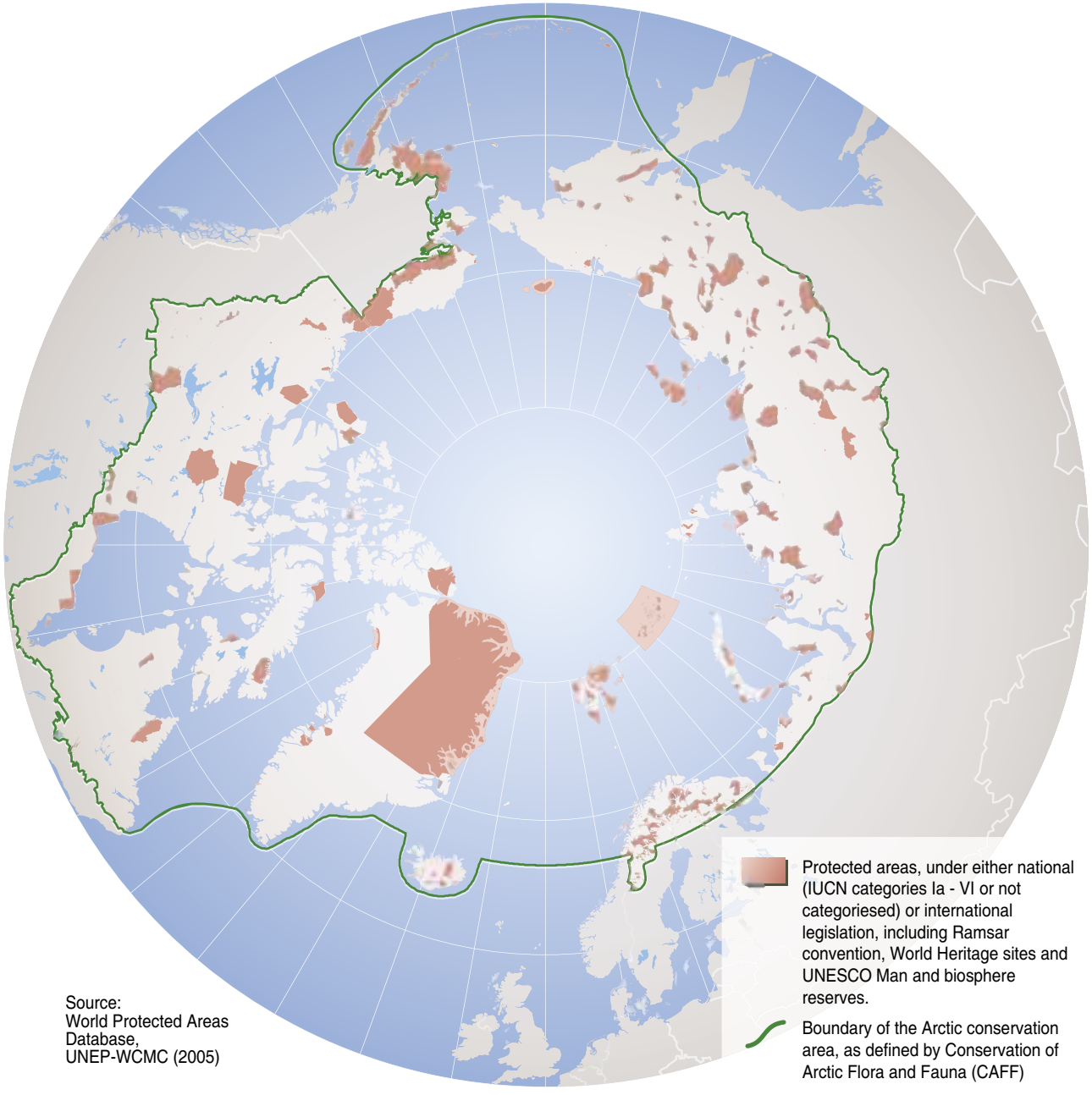


Figure 23. Climate change scenario for the end of the century. Increased transport in the Arctic of people and goods will become accelerated due to decreased extent of ice. This will not only increase the amount of oil transport and accelerate coastal development, it will also open up new regions for fisheries and shipping. As a result, fragmentation of the Arctic environment will increase which, may threaten marine life and increase the probability of the introduction of invasive species through, for example, the dumping of ballast water from other regions as well as oil spills.

Protected areas in the Arctic 2002
– the coastal marine deficit

Figure 24. Protected areas of the Arctic as recognized by the IUCN in the World Protected Areas Database at UNEP-WCMC, 2005. Some areas, like the Dehcho territory in Canada have been placed under interim protection. Information from Russia may be incomplete. Note the lack of marine protected areas, despite their ecological significance and importance to indigenous peoples.



The Arctic appears to hold the world's last remanining undeveloped coastal ecosystems – but less than 1 percent of the marine coastal areas are currently protected. Only 7% of the Arctic coastlines were impacted by development in 2002 and only 0.8% had severe impacts, apart from coastal fisheries Hence, the Arctic now appears to hold the world's last remaining undeveloped coastal ecosystems – but less than 1 percent of the marine coastal areas are currently protected. Indeed, while large land area in some regions have been set aside, the marine component – so critical to arctic food chains and coastal ecosystems – remains vastly unprotected. These ecosystems also represent those at the highest risk as access increases for industrial trawlers, fisheries and industrial exploration of minerals and petroleum along the coasts, and as new infrastructure and the receding sea ice open up new areas for exploitation.

Progress on protected areas network in the Arctic

The Arctic region is shared by eight Arctic nations, each of which individually and as a group has committed to the conservation of its diverse biosystems using a variety of techniques, including establishing protected areas as an important tool for ecosystem, habitat, and species conservation. Under the Arctic Environmental Protection Strategy (AEPS), and later, the Arctic Council (AC), the eight countries agreed to work together to create a protected areas network to encompass the circumpolar Arctic. The Circumpolar Protected Areas Network (CPAN) Expert Group falls under the CAFF Working Group of the Arctic Council. CPAN's members are representatives from each Arctic Council national government, Permanent Participants (six indigenous organizations), and Official Observers.

The CPAN process is a cooperative effort to protect important areas of the unique Arctic environment, including all levels of biodiversity through a system of protected areas. CPAN is intended to help member nations in a number of ways, including providing a baseline for identifying the most significant gaps in national protected area networks, and by being an instrument for practical cooperation among participants. Additionally, CPAN promotes extant domestic and international policies and legislations with regard to protected areas throughout the Arctic.

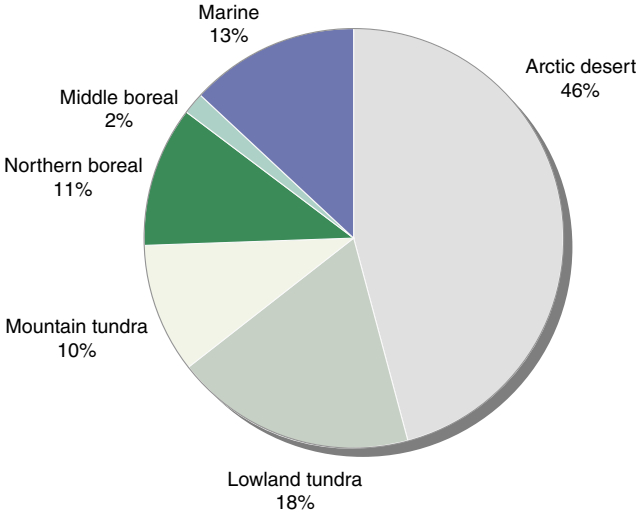
The activities of CPAN are guided by the CPAN Strategy and Action Plan, ratified by the AC Ministers in 1996. Participation in CPAN meetings is open to any environmental and protected area experts interested in Arctic conservation and protected area management. Further information regarding CPAN may be obtained by contacting the CAFF International Secretariat at www.caff.is.

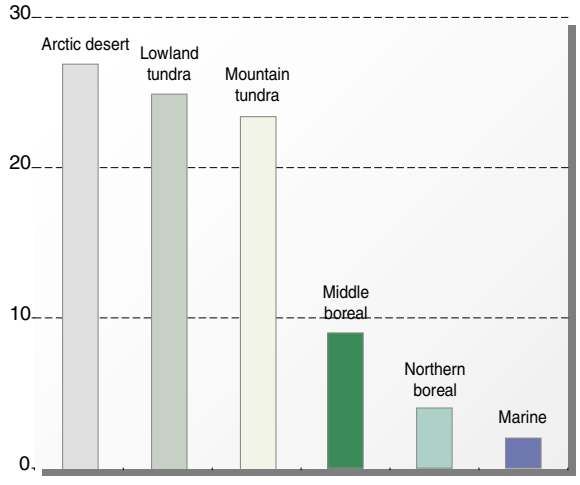
As part of its conservation mandate, CAFF completed the CPAN Strategy and Action Plan in 1996. The overall aim of CPAN is to maintain the biological diversity of the Arctic in perpetuity through establishment of a well managed network of protected areas, representative of the wide range of Arctic ecosystems. It further aims to improve the physical and managerial links among circumpolar protected areas. The CPAN Strategy and Action Plan specifies a series of actions to be taken both at the national and circumpolar levels to address gaps in habitat protection and to advance the functioning of the network. The CPAN Strategy and Action Plan has received Ministerial endorsement by the Arctic Council.

After the Fourth Ministerial Meeting of the Arctic Council, the governments in the Arctic region made major advancements in providing specific commitments through the Reykjavik Declaration to indigenous peoples and to protect the marine environment, including:

"..Endorse the Arctic Marine Strategic Plan (AMSP) and encourage its implementation through the working groups and other mechanisms and in cooperation with regional and global bodies"..
"..Support the continued implementation of the Regional Programme of Action for the Protection of the Arctic Marine Environment from Land-based Activities (RPA) and note the ongoing efforts of the Russian Federation and other Arctic States to implement their respective National Programmes of Action for the Protection of the Arctic Marine Environment"...
"Encourage continued and enhanced efforts of CAFF in promoting the implementation of the Circumpolar Protected Area Network and relevant initiatives of the Arctic Marine Strategic Plan" and
"...Support the continued cooperation with indigenous peoples of the Arctic, the use of their traditional knowledge of flora and fauna, and efforts toward community-based monitoring of the Arctic's living resources".

This declaration brings hope that the governments will now take responsibility to fulfil these commitments through implementation at the country level of larger coastal and marine protected areas.





Source: CAFF, 2001. Arctic Flora and Fauna: Status and Conservation.

Figure 25. Percentage of the Arctic in different biomes (left) **and the proportion of them currently protected** (right) (CAFF, 2000).

Conclusion

The Arctic coastal areas are not only vital to indigenous peoples and ecosystems, they also represent the world's remaining intact ecosystems including land, coast and sea. In many protected areas, indigenous peoples can retain their traditional rights of subsistence hunting. In order to implement these intentions, it is of major importance that the appropriate resources are allocated to relevant agencies and organizations to ensure that an actual implementation of a marine protected areas network is developed together with co-management systems.

Hence, an opportunity exists to help strengthen the resilience of Arctic ecosystems to climate change by minimizing the extent of other pressures. This, in turn, can help indigenous peoples buy the time they need to help shape and define their own future and manage the resources upon which many still depend in a sustainable manner.

Figure 26. Current unprotected marine areas bordering on coastal protected areas. These coastal zones include some of the very last continuous ecosystems where terrestrial, coastal and marine areas are industrially unexploited. Through co-management practices, indigenous peoples can retain their traditional subsistence rights while still protecting important traditional resources for future generations.

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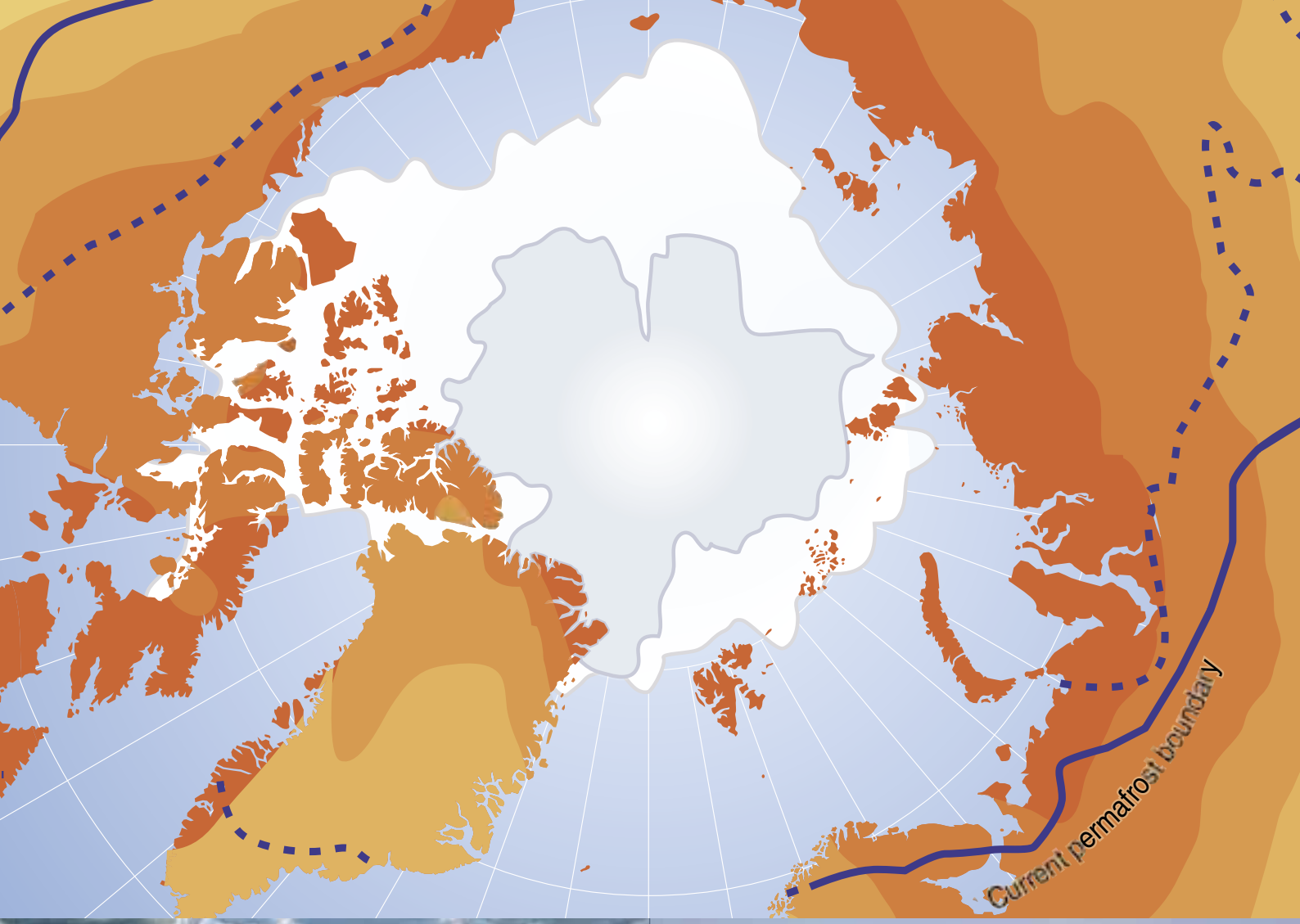
Current permafrost boundary