BCS 312: Land and Environments of the Circumpolar North II

Module 6/7: Management of Aquatic and Terrestrial Resources and Environments

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Overview

This module summarizes issues that currently threaten the biodiversity of circumpolar regions such as climate change, the accumulation of environmental pollutants, increased levels of resource development, invasive species, habitat fragmentation, and increased shipping and air traffic. The module examines how conservation measures such as the World Conservation Union's Red List and Protected Areas can be used to monitor and protect biodiversity. Finally, the mechanisms by which Indigenous peoples are involved in the management of natural resources is examined along with current and potential future legal frameworks governing environmental protection in circumpolar regions.

Learning Objectives

In the context of aquatic and terrestrial resources and environments, upon completion of this module, you should be able to:

1. Assess potential threats and effects of climate change on biodiversity and human activities in circumpolar regions.
2. Assess the potential of circumpolar biodiversity to resist change.
3. Examine the effectiveness of conservation strategies in addressing environmental threats and identify the forms they take.
4. Identify various protected areas and their purposes and distribution in the North.
5. Explain co-management in the context of sustainable development and Indigenous peoples' rights.
6. Summarize long-term national and international environmental law stewardship strategies.

Required Readings (including web sites)

Schindler, D.W. and J.P. Smol. 2006. Cumulative Effects of Climate Warming and Other Human Activities on Freshwaters of Arctic and Subarctic North America. Ambio 35:160-168.

Usher, M.B., T.V. Callaghan, G. Gilchrist, B. Heal, G.P. Juday, H. Loeng, M.A.K. Muir and P. Prestrud. 2004. Managing the Arctic's biodiversity. Section 10.5.4 of the Arctic Climate Impact Assessment. Available online: http://www.eoearth.org/article/Managing_biodiversity_conservation_in_a_changing_environment_of_the_Arctic

Nowlan, L. 2001. Arctic Legal Regime for Environmental Protection. IUCN, Gland, Switzerland and Cambridge, UK and ICEL, Bonn, Germany. Executive Summary. (pages ix to xi).

Arctic Biodiversity Trends Report 2010. Indicators at a glance. Available online: http://www.arcticbiodiversity.is/images/stories/AB_Trends_Indicators_at_a_glance.pdf

Arctic Biodiversity Trends Report 2010, Key Findings Report. Available online: http://abt.arcticportal.org/images/stories/report/pdf/Key_Findings.pdf

Arctic Biodiversity Trends Report 2010: Changes in Protected Areas (pgs 96-99). Available online: http://www.arcticbiodiversity.is/index.php/en/downloads

Key Terms and Concepts

- Arctic Greening
- Bioaccumulation
- Biodiversity
- Biomagnification
- Biome
- Climate Change
- Co-management
- Conservation Biology
- Environmental Stewardship
- Invasive Species
- Phenology
- Protected Area
- Sustainable Development
- Stewardship

Learning Material

Introduction

The circumpolar region is a unique and fragile ecosystem under increasing pressure from accelerated resource extraction and global environmental issues, most notably **climate change** and the accumulation of environmental pollutants. In this module, climate change specifically refers to the change in climate caused by human activity and defined by the United Nations Framework Convention on Climate Change as “a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods.” (UNFCCC, 1994).

The circumpolar region is home to an array of wildlife found nowhere else and a critical component of the earth’s physical, chemical and biological regulatory system (McRae et al., 2010). Despite its remoteness and harsh climate, the circumpolar region has also been home to populations of Indigenous peoples for thousands of years. The circumpolar region has undergone change before, but the speed with which climate change is acting in northern latitudes and the rush to exploit its resources pose significant threats. This module summarizes these threats and examines the conservation, **co-management** and legal mechanisms required for the circumpolar North’s protection. Co-management is an important concept for the maintenance of circumpolar resources and involves “the sharing of power and responsibility between government and local resource users” (Berkes et al., 1991).

6.1 Threats to Circumpolar Biodiversity

Biodiversity is the variability among living organisms from all sources including terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are a part. Biodiversity includes diversity within species, between species and of ecosystems (CBD, 1992). Circumpolar ecosystems and northern biodiversity are under increasing pressure from a number of sources, including:

- Climate change,
- Invasive species,
- Resource development,
- Accumulation of environmental contaminants,
- Habitat fragmentation, and
- Increased shipping and air traffic.

A brief summary of how these threats may affect Arctic ecosystems follows as well as an assessment of the potential for northern biodiversity to resist change.

Learning Highlight 1

Circumpolar ecosystems and northern biodiversity are under increasing pressure from a number of sources.

Climate Change

By 2100, the Arctic is expected to warm 3°C to 5°C over land and 7°C over the oceans resulting in a 50 percent decline in the extent of summer sea ice and dramatic changes to ecosystems. Changes are already occurring with river flows to the Arctic generally declining in North America while those in Eurasia are increasing (Schindler and Smol, 2006). A project using satellite imagery to track changes in 10,000 Siberian lakes from the early 1970s to the early 2000s noted a widespread decline in lake abundance and lake surface areas in regions of discontinuous permafrost despite slight increases in precipitation (Smith et al., 2005). Melting permafrost was behind the decline. Changes in river flows and lake characteristics may have profound effects on aquatic resources in the region.

Warmer conditions and longer ice-free seasons have shown increased growth and survival of fish in Arctic lakes (McDonald et al., 1996). Climate change may also result in increased snow thickness and the decline in under-ice photosynthesis could cause increased incidences of winter fish kills in shallow lakes (Schindler and Smol, 2006). Figure 1 shows projected reductions in snow for the years 2080 to 2100 as estimated using a specific climate change model, which projected loss of snow amounts with decreases of 60 to 80 percent in monthly maximum snow water equivalent (SWE) over most middle latitudes by the end of this century. However, in some areas there is a projected 10 to 50 percent increase in SWE. This is one modeling scenario of how monthly maximum SWE may change over time. It is important to note that SWE presents an important factor for ecosystems, water and human activities. Future changes in snow cover and snow extent will have important effects.

Learning Activity 1

Looking at Figure 1, is your region predicted to experience an increase or decrease in monthly snow water equivalent? Describe how this change might impact biodiversity and conservation strategies in this area.

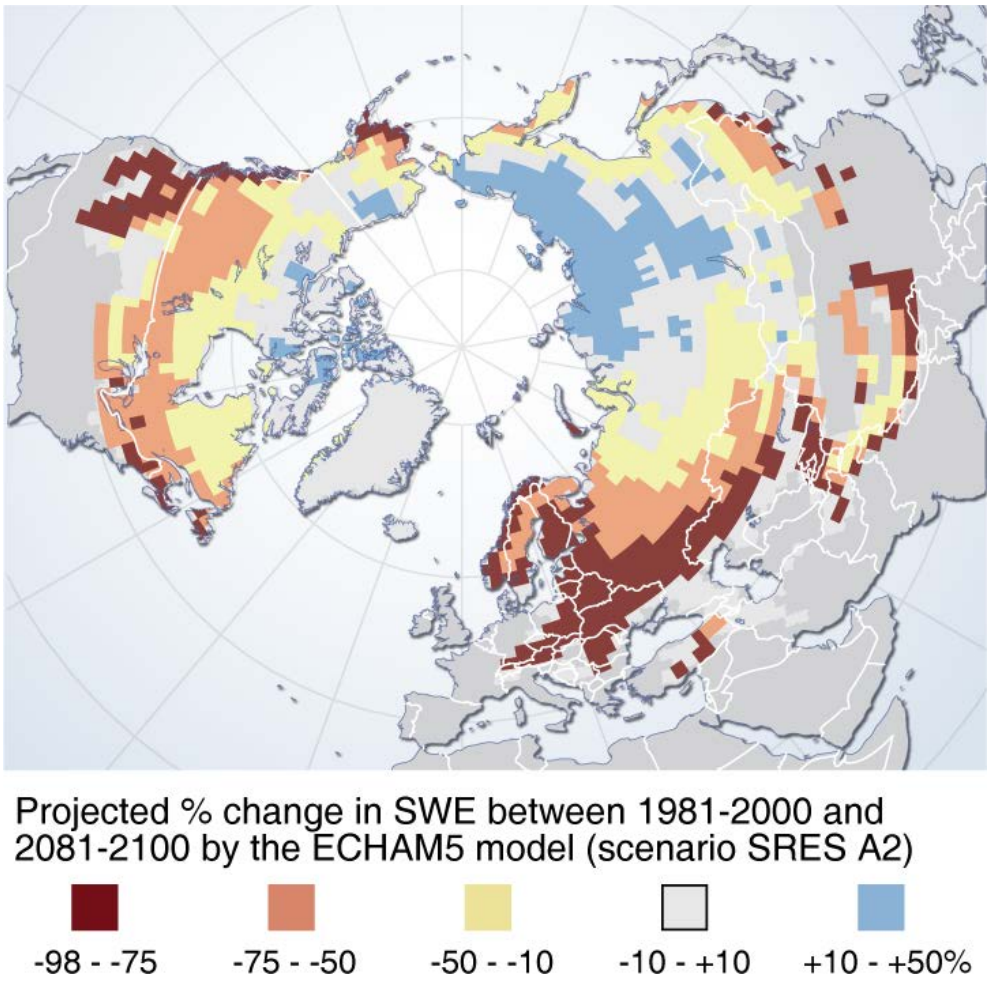

Figure 1. Projected reduction in snow water equivalent (SWE) for 2080 to 2100 (R. Brown, Environment Canada; data ESG (2007). WCRP CMIP3 Multi-Model Dataset. Earth System Grid.

In addition to climate change effecting predicted variations in snowfall amounts, there is significant evidence that arctic vegetation has undergone shifts in recent decades (Figure 2). Some regions have shown a significant increase in vegetative productivity, known as "**arctic greening**," which refers to an increase in vegetative productivity over the Arctic and an increase in the length of the growing season. The northward movement of the treeline is encroaching on the southern margin of the tundra and may result in future tundra habitat loss. Climate warming may contribute to a change in the distribution or composition of circumpolar plant species. Arctic greening will likely result in an eventual increase in the amount of vegetation present in circumpolar areas; however, arctic greening is also predicted to lead to a decrease in the total diversity of plants unique to these regions. The increase in length of growing season is of particular interest to the study of **phenology**, which examines shifts in plant and/or animal life cycle events as a result of seasonal or climatic alterations.

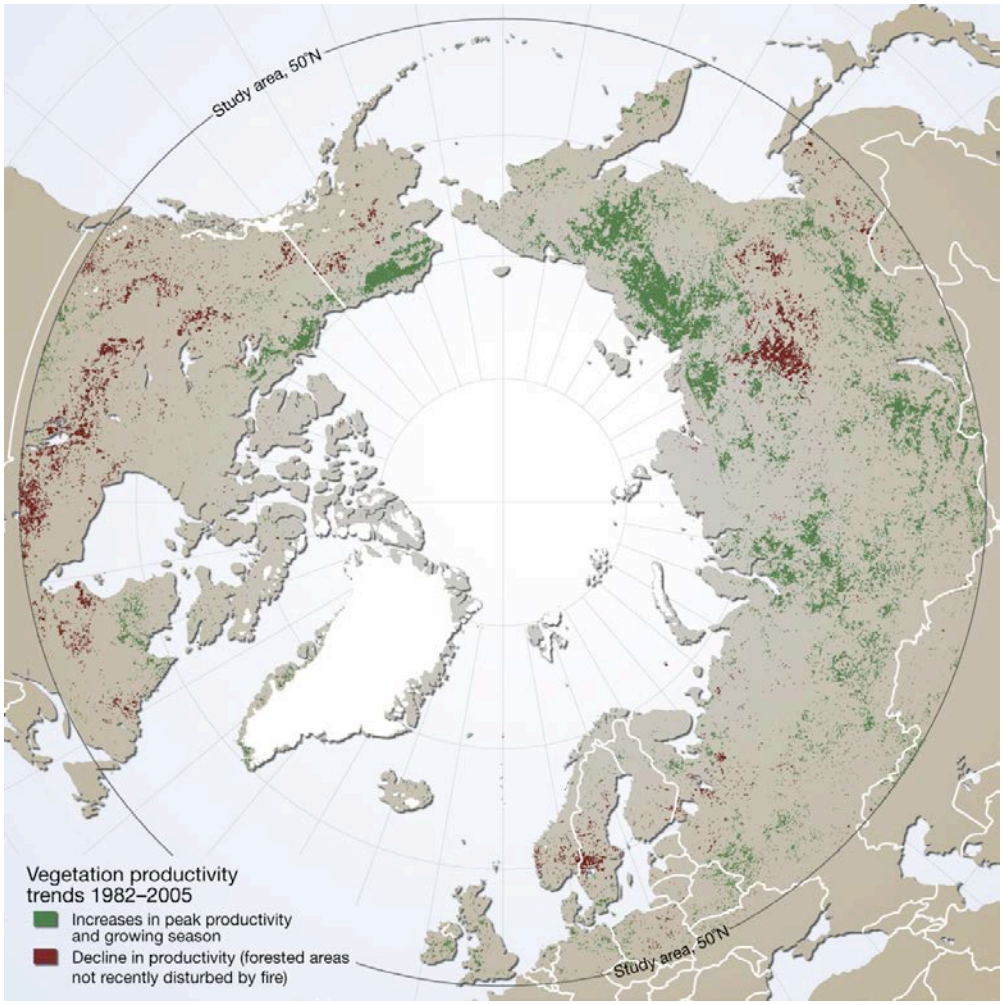

Figure 2. Vegetative productivity trends 1982 to 2005. Trends in productivity derived from a 1982 to 2005 time series of vegetation indices. Significant positive trends, showing as green, indicate an increase in both peak productivity and growing season. Negative trends, showing as red, represent forested areas not recently disturbed by fire that declined in productivity. (Arctic Biodiversity Trends 2010 – Selected indicators of change. CAFF International Secretariat, Akureyri, Iceland. May 2010. Henry, G. and Elmendorf, S., Indicator #11 Greening of the Arctic, page 63.)

Learning Activity 2

Looking at Figure 2, is your region or a circumpolar region of your choice experiencing greening? Describe some changes you have observed or read about that lend either support or opposition to this position.

Invasive Species

Global warming is causing displacement of existing circumpolar species and ecosystems as **invasive species** and ecosystems expand northward. Invasive species are non-native animals or plants introduced or entered into an environment that have become a nuisance through rapid spread and increase, often to the detriment of native species. Optimal habitat for native circumpolar species will decline as environmental conditions begin to exceed their physiological tolerances and/or ecological optima, while changing conditions will become more favourable for southern species (Prowse et al., 2009). For example, muskrat numbers are projected to increase in high-latitude lakes, ponds and wetlands because of expected increases in aquatic vegetation (Thorpe, 1986). The northern limit of yellow perch is also expected to expand in coming decades (Figure 3; Prowse et al., 2009). Shifting environmental conditions are likely to introduce new animal-transmitted diseases and redistribute existing diseases, which may affect key economic resources and human populations (Prowse et al., 2009).

Figure 3. Present and projected future distribution limits of yellow perch in North America. Projected future distribution assumes a 4°C increase in mean annual temperature (Source: Prowse et al., 2009).

Learning Activity 3

Considering your region or a circumpolar region of your choice, what changes in the phenology of native plants or animal species have you observed or read about?

Resource Development

Arctic and sub-Arctic regions are important sources of oil and natural gas with 10 percent of the world's oil and 28 percent of its natural gas coming from the region. Russia is currently the principal producer of hydrocarbons in the Arctic, supplying 80 percent of the oil and 99 percent of the gas. Oil and gas exploration and production are expected to increase as global energy demand grows and conditions become more

favourable for exploration. A 2008 report by the US Geological Survey estimated that the Arctic holds 13 percent of undiscovered oil and 30 percent of undiscovered natural gas in the world. Exploration and drilling is proceeding in the Beaufort Sea, the Russian continental shelf and recently off the coast of Greenland.

Learning Highlight 2

Caribou and Reindeer are members of the same species *Rangifer tarandus.*

In addition to oil and gas exploration, Arctic regions are being explored for gold, silver, uranium, base metals and diamonds. Deforestation is a concern in northern Russia as it affects the number of grazing pastures available for domesticated reindeer. The development of hydropower in northern Norway has led to conflict between the Indigenous Sami population and industry and governments to the south. Populations of *Rangifer tarandus* (the scientific name for reindeer and caribou) have been decreasing in most locations (Figure 4). As of 2009, *Rangifer* populations had declined by approximately 33 percent since peaking in the 1990s to 2000s, i.e., 3.8 million compared to 5.6 million. The declines are likely natural cycles but may be driven or amplified by atmospheric changes in combination with changing harvest practices and industrial developments.

Learning Activity 4

What is an important economic resource to your region or a circumpolar community of your choice? Research how the exploitation of this resource is expected to change in the near future.

Figure 4. Distribution and observed trends of wild *Rangifer* populations throughout the circumpolar Arctic. Note: Wild boreal forest reindeer have not been mapped by CARMA and are not represented. Source: CARMA: The CircumArctic Rangifer Monitoring and Assessment Network. 2009. http://www.carmanetwork.com/display/public/home

Accumulation of Environmental Contaminants

The Arctic is a natural sink for toxic chemicals such as mercury and persistent organic pollutants (POPs). Various pathways transport pollutants to the Arctic, including ocean and river currents, atmospheric pathways and migratory birds (Schindler and Smol, 2006). Cold temperatures inhibit the breakdown of chemicals in the Arctic. Toxins are taken up by wildlife through contaminated air, soil, water and food. If toxins are taken up by organisms faster than they are lost, the toxins will **bioaccumulate**. Toxin levels tend to increase as they move up the food chain through a process known as **biomagnification,** posing risks to Indigenous peoples eating a traditional diet.

The release of some chemicals, which can bioaccumulate and biomagnify, such as polychlorinated biphenyls (PCBs), has been controlled and their concentrations in northern fish and mammals appear to be declining. However, compounds such as polybrominated diphenyl ethers (a common flame retardant) and perfluorinated

compounds (multi-use chemicals) are still increasing (Bidleman et al., 2003; Schindler and Smol, 2006). Mercury levels also continue to rise, which may be related to changes in ice cover and permafrost melting or the release of mercury during forest fires (Prowse et al., 2009; Schindler and Smol, 2006).

Habitat Fragmentation

Habitat fragmentation is a serious threat to Arctic ecosystems as increased resource development and human populations lead to road and pipeline construction that often impedes migration in river systems. Hydropower development causes fragmentation of aquatic environments, while significant freshwater supplies are often drained during construction of ice roads. For example, the 2010 Arctic Biodiversity Trends Report (Readings 4-6) noted that in Russia the main threat for the most productive Nenets and Yamalo-Nenets autonomous areas' reindeer herding regions is rapidly accelerating oil and gas extraction (Arctic Biodiversity Trends Report, 2010).

Land infrastructure represents a fragmentation of natural ecosystems, splitting expanses of land and creating traffic and noise pollution disturbances. Infrastructure development promotes construction of roads, houses and other facilities. Figure 5 shows habitat fragmentation caused by infrastructure development.

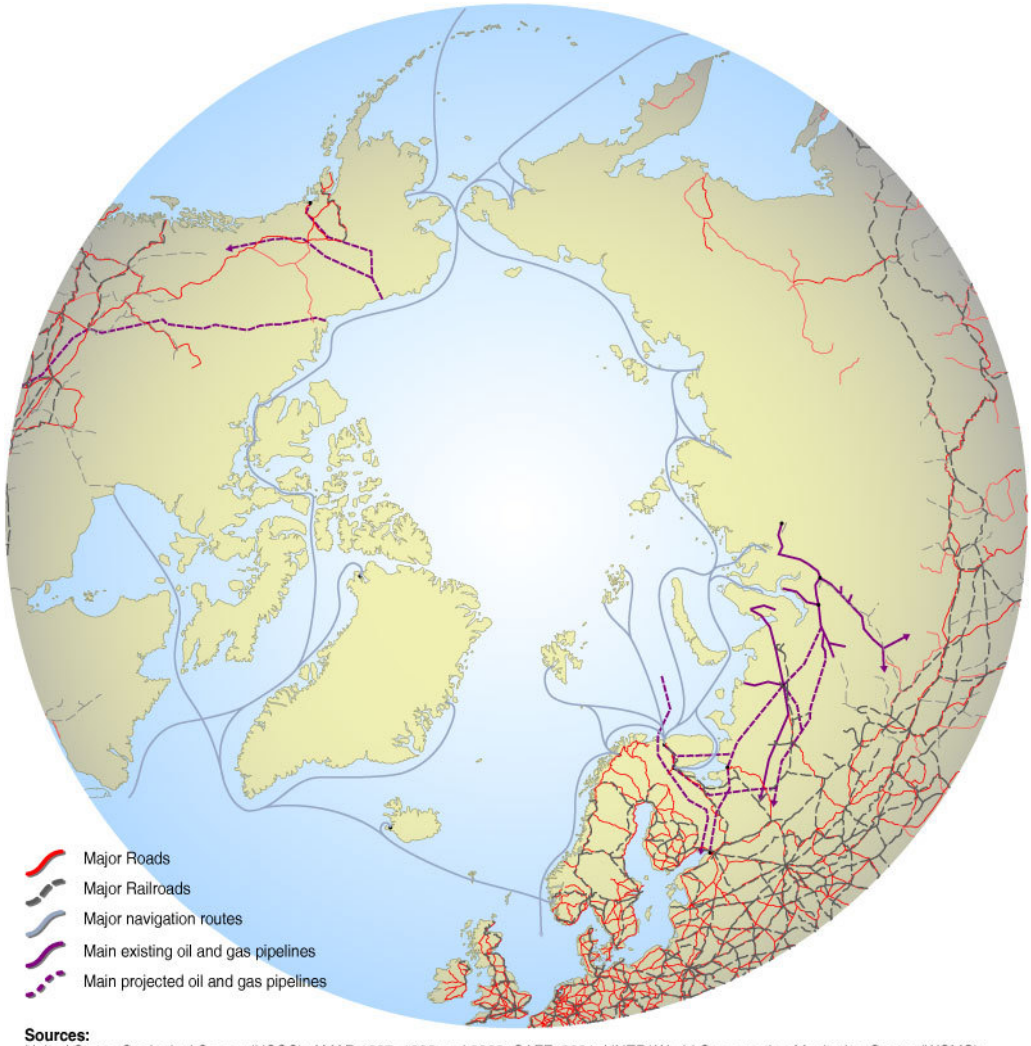

Figure 5. Circumpolar transportation routes, roads, shipping and pipelines. Source: UNEP/GRID-Arendal Maps and Graphics Library (2007). http://maps.grida.no/go/graphic/arctic-transportation-routes-roads-shipping-and-pipelines

Increased Shipping and Air Traffic

Sea shipping represents a lesser threat to habitat fragmentation than terrestrial shipping. There are risks related to transporting goods by water that could present environmental hazards such as oil spills or the unintentional transport of invasive species. As circumpolar ice melts the Northwest Passage and the Northern Sea Route have become more navigable. These routes offer shorter and more economical ways to transport goods between Asian and European markets. Higher volumes of marine traffic bring increased risks of accidents, release of ship-borne contaminants and transfer of invasive species in the ballast tanks of large ships.

Increased air traffic servicing mineral and oil and gas developments, higher human populations and greater tourism increases contaminant amounts released into Arctic

ecosystems. Increased resource development in circumpolar areas also increases traffic and the risk of introducing invasive species (Figure 6).

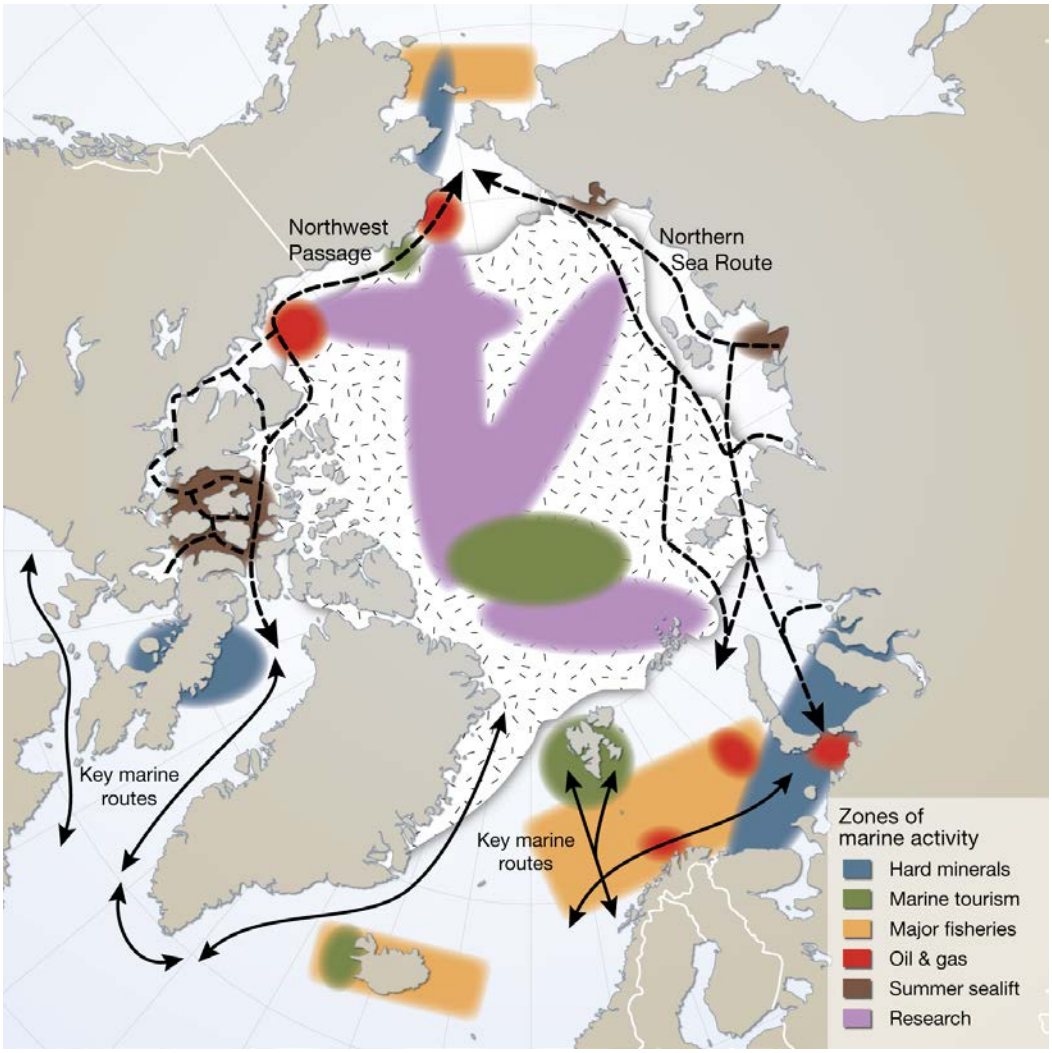

Figure 6. Current marine shipping uses in the Arctic. (Arctic Biodiversity Trends 2010 – Selected indicators of change. CAFF International Secretariat, Akureyri, Iceland. May 2010. Lassuy, D. and P.N. Lewis, Indicator #7 Invasive species (human-induced) p.47)

6.2 The Potential for Circumpolar Biodiversity to Resist Change

Arctic ecosystems face a range of stressors likely to have cumulative effects on northern biodiversity. The ability to cope with threats varies according to the characteristics of the species or ecosystem. E.g., Species heavily dependent on sea ice, such as ringed seals, narwhal and polar bears, are likely at greatest risk due to the decline in sea ice expected to continue over coming decades.

Responses are likely to be very different in other ecosystems. Biodiversity could increase in Arctic lakes as they warm. Retreating ice cover could make more habitat available, lengthen the growing season and allow the establishment of new substrates

such as aquatic mosses (Schindler and Smol, 2006). Alternatively, lake warming may not be positive for all species, e.g., temperatures may exceed tolerances for native species such as Arctic char.

The precise ways in which Arctic species will respond to changing climate and other stressors remains uncertain. Prowse et al. (2009) state that:

> integrated, field-based monitoring and research programs, and the development of predictive models are required to allow for more detailed and comprehensive projections of change to be made, and to inform the development and implementation of appropriate adaptation, wildlife, and habitat conservation and protection strategies.

Nonetheless, traits that have allowed species to survive in harsh climates may limit their capacity to respond to rapid environmental change. For instance, compared to species living in temperate regions, species living year-round in the Arctic tend to be long-lived, slow-growing and have low reproduction rates (ACIA, 2004).

6.3 The Role of Conservation Strategies

Conservation biology is the scientific study of nature and biodiversity status with the aim of protecting species, habitats and ecosystems from excessive rates of extinction. Various strategies for protecting (conserving) biodiversity exist. Two of the most important are:

1. Documenting current levels of biodiversity and determining the level to which species or ecosystems are threatened; and
2. Setting aside areas of land and/or sea dedicated to protecting biological diversity.

The International Union for Conservation of Nature's (IUCN) Red List is the most comprehensive and scientifically rigorous information about the conservation status of species (Rodrigues et al., 2006). The IUCN has assigned categories to various types of protected areas formed to maintain biodiversity and natural and/or cultural heritage.

Table 1 displays Red List categories into which species are classified. Rodrigues et al. (2006) examined the value of the Red List in the conservation of species and concluded that in spite of several important limitations the Red List has "become an increasingly powerful tool for conservation planning, management, monitoring and decision making." One of the primary reasons for this is that, as well as classifying species by level of risk and prioritizing those species that require the most protection, a vast amount of data is collected to support species assessments, synthesized into reports and made available online for other researchers, decision-makers and interested parties. The Red List also provides data useful in determining the most suitable geographic regions to protect.

Learning Activity 5

Search the IUCN Red List for species in your region or a circumpolar region of your choice. Which species are at greatest risk? What are the biggest threats to local populations?

Table 1. IUCN Red List Categories

Extinct (EX)

A taxon (e.g., a genus or species) is Extinct when there is no reasonable doubt that the last individual has died. A taxon is presumed Extinct when exhaustive surveys in known and/or expected habitat at appropriate times (diurnal, seasonal, annual) throughout its historic range have failed to record an individual. Surveys should be over a time frame appropriate to the taxon's life cycle and life form.

Extinct in the Wild (EW)

A taxon is Extinct in the Wild when it is known only to survive in cultivation, in captivity or as a naturalized population (or populations) well outside the past range. A taxon is presumed Extinct in the Wild when exhaustive surveys in known and/or expected habitat at appropriate times (diurnal, seasonal, annual) throughout its historic range have failed to record an individual. Surveys should be over a time frame appropriate to the taxon's life cycle and life form.

Critically Endangered (CR)

A taxon is Critically Endangered when the best available evidence indicates that it meets any of the criteria A to E for Critically Endangered (Section V, IUCN 2001) and it is considered to be facing an extremely high risk of extinction in the wild.

Endangered (EN)

A taxon is Endangered when the best available evidence indicates that it meets any of the criteria A to E for Endangered (Section V) and it is considered to be facing a very high risk of extinction in the wild.

Vulnerable (VU)

A taxon is Vulnerable when the best available evidence indicates that it meets any of the criteria A to E for Vulnerable (Section V) and it is considered to facing a high risk of extinction in the wild.

Near Threatened (NT)

A taxon is Near Threatened when it has been evaluated against the criteria but does not now quality for Critically Endangered, Endangered or Vulnerable, but is close to qualifying for or is likely to qualify for a threatened category in the near future.

Least Concern (LC)

A taxon is Least Concern when it has been evaluated against the criteria and does not qualify for Critically Endangered, Endangered, Vulnerable or Near Threatened. Widespread and abundant taxa are included in this category.

Data Deficient (DD)

A taxon is Data Deficient when there is inadequate information to make a direct or indirect assessment of its risk of extinction based on its distribution and/or population status.

Not Evaluated (NE)

A taxon is Not Evaluated when it has not yet been evaluated against the criteria.

IUCN. 2001. IUCN Red List Categories and Criteria: Version 3.1. IUCN Species Survival Commission. IUCN, Gland, Switzerland and Cambridge, UK.

The Arctic's Biodiversity Monitoring Program

The role of monitoring and assessing biodiversity in the Arctic is undertaken by the Arctic Council's Conservation on Arctic Flora and Fauna (CAFF) Working Group, which coordinates the Circumpolar Biodiversity Monitoring Program (CBMP). The CBMP is an international forum of leading scientists and conservation experts from eight Arctic countries, Indigenous organizations of the Arctic Council and key global conservation organizations. The CBMP:

- Coordinates existing Arctic biodiversity monitoring programs,
- Addresses gaps in knowledge through identification of new programs,
- Gathers, integrates and analyzes data, and
- Communicates results.

The CBMP is strategically linked to other conservation programs, research and monitoring initiatives. The CBMP adopts an ecosystem-based approach primarily through the establishment of five integrated, cross-disciplinary expert monitoring groups representing the Arctic's major systems: marine, freshwater, coastal, terrestrial fauna and terrestrial vegetation.

The latest CBMP report, the Arctic Species Trend Index 2010: Tracking Trends in Arctic Wildlife, indicates High Arctic species have declined 26 percent in abundance between 1970 and 2004, while Low Arctic species have increased an average of 46 percent (McRae et al., 2010). Subarctic species have declined since the mid-1980s but show no overall change over the 34-year period. These trends are largely consistent with current predictions regarding the response of arctic wildlife to climate change, although some of the changes witnessed are affected by natural cycles influencing species abundance.

Within these overall trends there are success stories and worrisome declines. For example, populations of Alaskan bowhead whale are increasing in size following the removal of hunting pressure. Likewise, populations of Greenland cod that declined to a very low level in the early 1990s due to deterioration in environmental conditions and heavy fishing pressure are now increasing. However, the decline in the High Arctic index, where resource development and harvesting pressures are virtually non-existent, could be an early indication of the response of High Arctic vertebrate populations to a changing climate (McRae et al., 2010).

Data deriving Arctic indices is not consistent across ecosystems and taxonomic groups (McRae et al., 2010). Data behind the freshwater index are too sparse to give an accurate reflection of the circumpolar freshwater situation. The marine index covers a greater number of species and populations but is largely derived from data from the eastern Bering Sea. To increase the accuracy of the index so it becomes a more valuable tool for tracking changes in freshwater and marine environments, gaps and biases need to be addressed through additional monitoring.

The polar bear is the best known Arctic species listed as threatened on the IUCN's Red List. The polar bear was classified as Vulnerable in 2006 as the IUCN deemed its population would drop more than 30 percent in three generations (45 years) due to a decline in area of occupancy, extent of occurrence and habitat quality, primarily as a result of climate change. This predicted decline in population is because polar bears rely almost exclusively on the marine sea environment for survival. Figure 7 shows one model of the projected changes in polar bear habitat for 2001 – 2010 to 2041 – 2050.

There is an overall predicted decrease in habitat but a small amount of the Arctic basin area shows a predicted increase in habitat over this time period.

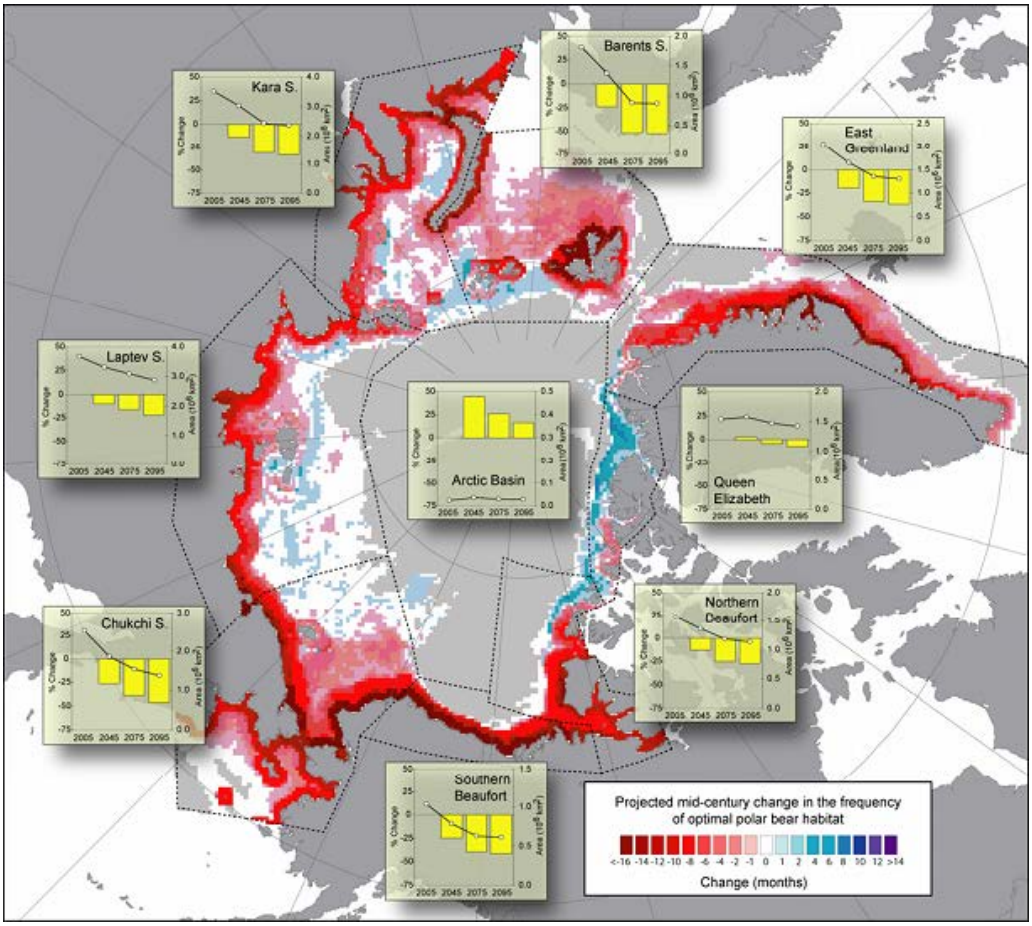

Figure 7. Projected changes in the spatial distribution and integrated annual area of optimal polar bear habitat. Base map shows the cumulative number of months per decade where optimal polar bear habitat was either lost (red) or gained (blue) from 2001-2010 to 2041-2050. Offshore gray shading denotes areas where optimal habitat was absent in both periods. Insets show the average annual cumulative area of optimal habitat (right y-axis, line plot) for four 10-year periods in the 21st century (x-axis midpoints), and their associated percent change in area (left y axis, histograms) relative to the first decade (2001-2010). (Source: USGS.http://www.usgs.gov/newsroom/special/polar_bears/docs/USGS_PolarBear_Durner.Habitat_highres.pdf)

Some conservationists believe Arctic seals should be afforded the same level of protection as polar bears given the expected changes in their environment resulting from climate change (Brahic, 2008). Ringed seals (Figure 8) are likely to be the most affected seal species as their life-history and distribution are intricately linked to sea ice. These seals are currently listed as 'Least Concern' on the IUCN Red List given their large population size and broad distribution. The potential for rapid change is acknowledged, however, with a reassessment planned for 2018 given the risks posed by climate change.

Figure 8. A ringed seal surfaces amid sea-ice.
Source: P. Nicklen, National Geographic.
http://animals.nationalgeographic.com/animals/printable/ringed-seal.html

6.4 Protected Circumpolar Areas

Throughout the world a key biodiversity conservation strategy has been the establishment of **protected areas**. The concept of a protected area is implemented differently in different regions.

Learning Activity 6

Search the protected areas website

http://www.wdpa.org/Default.aspx

to locate protected areas in your area or a circumpolar region of your choice. How large are these protected areas? What is their purpose?

Table 2. IUCN Protected Area Management Categories

Category Ia: Strict Nature Reserve – Protected area managed mainly for science.

Area of land and/or sea possessing some outstanding or representative ecosystems, geological or physiological features and/or species available primarily for scientific research and/or environmental monitoring.

Category Ib: Wilderness Area – Protected area managed mainly for wilderness protection.

Large area of unmodified or slightly modified land and/or sea retaining its natural character and influence without permanent or significant habitation, which is protected and managed to preserve its natural condition.

Category II: National Park – Protected area managed mainly for ecosystem protection and recreation.

Natural area of land and/or sea designated to (a) protect the ecological integrity of one or more ecosystems for present and future generations; (b) exclude exploitation or occupation harmful to the purposes of the designation of the area; and (c) provide a foundation for spiritual, scientific, educational, recreational and visitor opportunities all of which must be environmentally and culturally compatible.

Category III: Natural Monument – Protected area managed mainly for conservation of specific natural features.

Area containing one or more specific natural or natural/cultural features of outstanding or unique value because of its inherent rarity, representative or aesthetic qualities or cultural significance.

Category IV: Habitat/Species Management Area – Protected area managed mainly for conservation through management intervention.

Area of land and/or sea subject to active intervention for management purposes to ensure the maintenance of habitats and/or meet the requirements of specific species.

Category V: Protected Landscape/Seascape – Protected area managed mainly for landscape/seascape conservation and recreation.

Area of land with coast and sea where the interaction of people and nature over time has produced an area of distinct character with significant aesthetic, ecological and/or cultural value and often with high biological diversity. Safeguarding the integrity of this traditional interaction is vital to the protection, maintenance and evolution of such an area.

Category VI: Managed Resource Protected Area – Protected area managed mainly for the sustainable use of natural ecosystems.

Area containing predominantly unmodified natural systems managed to ensure long term protection and maintenance of biological diversity while providing a sustainable flow of natural products and services to meet community needs.

IUCN (1994). Guidelines for Protected Areas Management Categories. IUCN, Cambridge, UK and Gland, Switzerland. 261 pp.

In the Arctic there are currently 405 protected areas covering approximately 2.5 million km^2 or 17 percent of the land area covered by the Conservation of Arctic Flora and Fauna (CAFF) Program (CAFF, 2001). Some of the largest terrestrial and freshwater protected area environments in the world are in the Arctic, although few studies have examined whether these areas are achieving their stated aims (ACIA, 2004). There is an uneven distribution of protected areas across countries and biogeographic zones. The percentage of land protected in IUCN categories I-V ranges from less than 10 percent in Canada and Russia to more than 40 percent in Greenland and the United States (CAFF, 2001) (Figure 9). There is a need for greater protection of the Arctic marine environment with only 1.7 percent protected (CAFF, 2001). Figure 10 shows existing and proposed coastal and marine protected areas in the Arctic.

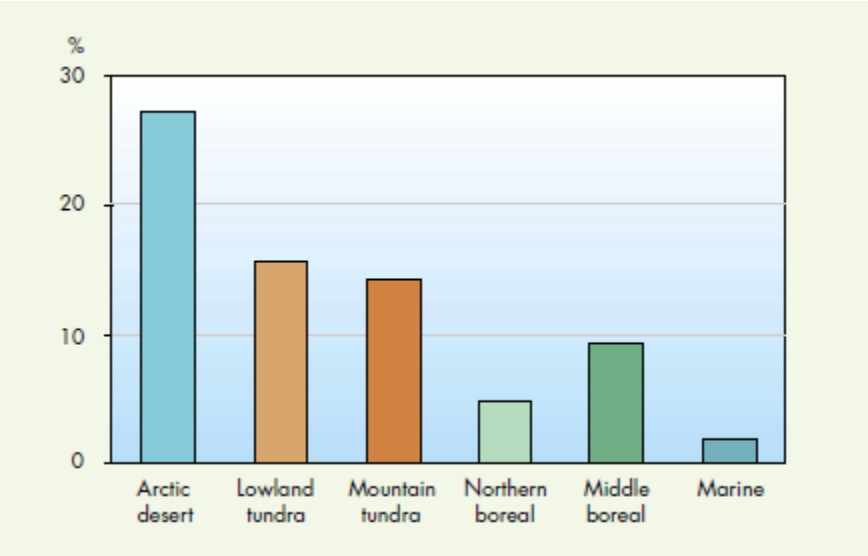

Figure 9. Percentage of territory of Arctic biomes protected in 2000 (Source: CAFF, 2001).

Learning Highlight 3

Only 1.7 percent of the Arctic marine environment is currently considered as protected area (CAFF, 2001).

Figure 10. Existing and proposed coastal and marine protected areas in circumpolar regions.

Alongside concerns over whether existing protected areas are large enough and serving their purpose is the fear that the areas will not be effective given landscape-level shifts in ecosystem distribution and structure likely to result from changing climate. Lemieux and Scott (2005) used global vegetation and climate models to project changes to terrestrial conservation lands. They predicted over 50 percent declines in conservation lands from each of the three northern **biomes** (a major biotic community characterized by dominant plant life forms and prevailing climate): tundra, taiga-tundra and boreal. These projections raise concerns about the adequacy of existing plans to protect representative samples of Arctic ecosystems and, ultimately, Arctic biodiversity (Prowse et al., 2009).

Unease over the effectiveness of protected areas in the face of climate change prompted the ACIA (2004) to recommend the following steps be taken to establish a Circumpolar Protected Areas Network (CPAN):

1. The CPAN needs to be completed and reviewed to ensure it covers the full range of the Arctic's present biodiversity;
2. An assessment must be made for each protected area of the likely affects of climate change with corresponding reviews of management methods and area boundary revisions;
3. Integrated management forms incorporating biodiversity conservation requirements must be explored for all uses of land, freshwater and sea in the Arctic; and

4. Biodiversity conservation must be incorporated into regional, national or circumpolar policy development.

6.5 Circumpolar Resource Management

Arctic regions of Alaska (USA), Canada, Greenland (Danish territory), Norway, Finland, Iceland, Sweden and Russia have been home to Indigenous peoples for centuries. Co-management of natural resources and the participation and consultation of Indigenous peoples in the North varies between territories and countries. In Canada, the Inuit and Inuvialuit are closely related branches of the same Aboriginal family, sharing many cultural characteristics and speaking close variants of the same language. The Inuvialuit Settlement Region (ISR) was established when the Inuvialuit land claim was settled in 1984. The Inuit of Nunavut settled their claim in 1993 with the establishment of Nunavut as a distinct Canadian territory in 1999. White (2009) describes that while there are similarities in governance, there are key differences in the two land claims agreements, the scale of the lands covered by the agreements (Nunavut is several times larger than the ISR) and the implications of autonomy (Nunavut is an autonomous territory within Canada, while the ISR is one of several regions within the Northwest Territories). Both agreements guaranteed participation in a series of co-management boards with jurisdiction over wildlife and the environment.

Learning Highlight 4

Co-management of natural resources requires the participation and consultation of Indigenous peoples, but its implementation varies between territories and countries.

The Canadian Inuvialuit Final Agreement (IFA) dated June 5, 1984, represents a land claim settlement under Canada's Constitution Act (1982) and is affirmed as an existing Aboriginal right. The terms of the Agreement are given preferred status over other federal and territorial laws within the defined ISR (Kavik-Axys, 2002). The Inuvialuit negotiated the Agreement partly to avoid the 1970's experience they had when they felt sidelined by proponents of development in the Mackenzie Delta. Development proposals in the ISR are reviewed by the Environmental Impact Screening Committee and the Environmental Impact Review Board established by the IFA to pursue the following goals:

- To preserve Inuvialuit cultural identity and values within a changing northern society;
- To enable Inuvialuit to be equal and meaningful participants in the northern and national economy and society; and
- To protect and preserve the Arctic wildlife, environment and biological productivity.

The Inuvialuit participate in development through project description reviews and fish and wildlife co-management. The Inuvialuit are interested in proceeding with resource

development as described in guidance documents on conducting cumulative effects assessments in the ISR. They are determined to ensure “development will not occur at a long-term cost to the land that has sustained their well-being for generations. Wise **stewardship** of the land is central to the vision that Inuvialuit have for the future landscapes of the Inuvialuit Settlement Region” (Kavik-Axys, 2002). Stewardship is an ethic that embodies cooperative planning and environmental resource management with organizations and communities to actively prevent habitat loss and facilitate its long-term sustainable recovery. Participatory rights of the Inuvialuit are guaranteed through a land claims agreement that grants them the opportunity to play a role in the sustainable development of their lands and resources.

Circumpolar Indigenous peoples work within the eight Arctic countries to protect the rights of local resource users. The VI Congress of Indigenous Peoples of the North, Siberia and the Russian Far East held in Moscow on April 23 – 24, 2009, recommended the Federal Assembly of the Russian Federation introduce amendments to the federal law “on fisheries and conservation of aquatic biological resources” to grant priority access rights to Indigenous peoples for fishing and aquatic biological resources. These amendments were to include exemption mechanisms for the timing and areas for harvesting aquatic biological resources, sex and age ratios, total amounts of resources to be harvested, and allocation of exclusive rights for harvesting certain types of aquatic biological resources (Russian Association of Indigenous Peoples of the North (RAIPON), 2010a).

Congress delegates were concerned with how fishing sites in Kamchatka, in which Indigenous peoples fished for centuries using traditional methods, were assigned to commercial fishing entities. Sites assigned to Indigenous peoples were located far from traditional residential areas and unsuitable for fishing using traditional methods. Concerns were raised over production limits set for commercial fishers and the potential for fish stock depletion upon which Indigenous peoples depended. The Congress argued federal laws and international principles granting preferential access to biological resources and traditional foods had been breached and the federal government had to act to meet its obligations under the Concept of Sustainable Development of Indigenous Peoples of the North, Siberia and the Far East (RAIPON, 2010b).

In addition to the role Indigenous peoples play in natural resource management within countries, they also play an important regional role in the Arctic Council. The Arctic Council was formed in 1996 to promote cooperation, coordination and interaction among Arctic states, Indigenous communities and inhabitants, particularly related to maintaining the culture of Arctic Indigenous peoples, sustainable development and environmental protection.

Learning Activity 7

How are Indigenous peoples involved in the management of natural resources in your region or another circumpolar region of your choice?

Along with eight member states that make up the Arctic Council, there are six Permanent Participants whose involvement ensures active participation and full consultation with representatives of Arctic Indigenous peoples (Table 3). Six expert working groups mandated by Arctic Council Ministers carry out the Arctic Council's scientific work. These working groups focus on issues such as monitoring, assessing and preventing pollution in the Arctic, climate change, biodiversity conservation and sustainable use, emergency preparedness and prevention, and living conditions of Arctic residents.

- Arctic Contaminants Action Program (ACAP)
- Arctic Monitoring and Assessment Program (AMAP)
- Conservation of Arctic Fauna and Flora (CAFF)
- Emergency Prevention, Preparedness and Response (EPPR)
- Protection of the Arctic Marine Environment (PAME)
- Sustainable Development Working Group (SDWG)

Further details on the mandates of these working groups are available on the Arctic Council website: http://arctic-council.org/section/working_groups.

Table 3. Member States and Permanent Participants in the Arctic Council

Member States	Permanent Participants
Canada	The Sami Council
Denmark (including Greenland and the Faroe Islands)	Russian Association of Indigenous Peoples of the North (RAIPON)
Finland	Gwich'in Council International
Iceland	Inuit Circumpolar Council
Norway	Aleut International Association
The Russian Federation	Arctic Athabaskan Council
Sweden	
United States of America	

6.6 Strategies for Long-Term Circumpolar Environmental and Resource Stewardship

Legally binding international agreements applicable on a global scale extending to the Arctic include:

- The United Nations Convention on the Law of the Sea (1994),
- The Convention on Biological Diversity (1992),

- The Convention on the Prevention of Marine Pollution by Dumping of Waste and Other Matter (1972), and
- The International Convention for the Prevention of Pollution from Ships (MARPOL; 1973).

The Convention on Long Range Transboundary Air Pollution (1979) also applies within Europe and North America. All land areas in the Arctic fall under the uncontested sovereignty of one of the eight Arctic states, therefore environmental protection in terrestrial and freshwater ecosystems are primarily controlled by national domestic laws (Nowlan, 2001). The UN Convention on the Law of the Sea covers the marine environment to the limit of 200 nautical mile exclusive economic zones (EEZ).

Regardless, there are gaps in the Arctic environmental legal regime such as inadequate control of environmental impacts associated with mining, management of hazardous substances, control of vessel traffic in Arctic seas, incomplete biodiversity protection, lack of full integration of Indigenous peoples into the legal regime of most Arctic states (despite Indigenous rights and land claims), and inadequate sharing of benefits from resource activities with Indigenous and local populations (Nowlan, 2001). These issues are covered by a "soft law", i.e., one that is not legally binding, approach that began with the Declaration on Protection of the Arctic Environment and the Arctic Environmental Protection Strategy (1991) and culminated with the creation of the Arctic Council in 1996.

Learning Highlight 5

The Arctic Council was formed in 1996 to provide a way to promote cooperation, coordination and interaction among the Arctic states, Arctic Indigenous communities and other Arctic inhabitants. Particular issues include maintaining the culture of Arctic Indigenous peoples, sustainable development and environmental protection.

The Arctic Council's Working Groups have produced useful guidelines including the Arctic EIA Guidelines, the Arctic Guide for Emergency Prevention, Preparedness and Response, and the Arctic Offshore Oil and Gas Guidelines. There is uncertainty whether environmental protection provisions implemented by the eight nations and coordinated activities of the Arctic Council are sufficient to protect the Arctic. Increasing levels of some pollutants in Arctic ecosystems and wildlife, climate change impacts and declines in some species of the High Arctic suggest the Arctic is not adequately protected (Nowlan, 2001). Many urgent environmental issues facing the Arctic require global multilateral approaches.

Nowlan (2001) identified the following strategies put forward for long-term Arctic environmental protection:

- A single comprehensive environmental agreement addressing land and vessel based pollution, contingency planning and biodiversity protection;
- A convention on Arctic land based sources of pollution;

- A broader sustainable development and environmental protection convention covering marine and terrestrial areas;
- A protocol to other conventions, i.e. an Arctic Protocol under the Biodiversity Convention; and
- An Arctic Ocean Regional Sea regime under the United Nations Environment Program's (UNEP) Regional Seas Programme. UNEP has taken preliminary steps to establish a Regional Action Plan for Protecting the Arctic Marine Environment with the eight Arctic states. An Action Plan may be more feasible than a full-fledged agreement and could stimulate activities by Arctic states to more efficiently protect the environment.

Nowlan (2001) argues for a new binding treaty encompassing the sustainable development focus of the Arctic Council, while enshrining innovative legal approaches such as the unique role of Indigenous peoples. Many conservation organizations, scientists, government representatives and academic experts favour a binding environmental agreement. This could occur by converting the Arctic Council agreement into a more comprehensive treaty and formalizing the mandates of the Working Groups. Others argue the burden of negotiating a full treaty may not be required if the current soft law approach is given more time. Also, states may be more innovative and willing to make substantive commitments if the end result is not legally binding.

Learning Activity 8

Identify actions that you can take to engage in long-term circumpolar environment and resource stewardship.

Conclusion

The Arctic is under significant pressure from multiple threats likely to act cumulatively and in ways not yet fully understood. Positive feedback mechanisms may occur to exacerbate issues threatening Arctic biodiversity and northern peoples. Traditional conservation mechanisms such as the IUCN Red List and Protected Areas may need to be adapted to cope with rapid landscape-level shifts in ecosystem distribution and structure that may occur as a result of climate change. The Arctic governance regime is unique, although concerns remain regarding whether there is adequate protection for Arctic ecosystems given the nature and magnitude of the risks.

Discussion Questions

1. How should the conservation of Arctic wildlife be reconciled with traditional and non-traditional consumptive use of species?
2. Given the potential for rapid resource development and ecosystem changes resulting from climate change, what priority steps should be taken to protect the Arctic?
3. Is a legally binding treaty governing all Arctic nations required to provide adequate protection of Arctic ecosystems? Explain.

Study Questions and Answers

1. What major Arctic resources are companies interested in exploiting?

   Oil and gas, gold, silver, uranium, base metals, diamonds, forests and hydropower.

2. What marine mammal species is most threatened by changes in sea-ice distribution as a result of climate change?

   Ringed seal

3. Which two Arctic biomes are underrepresented protected areas in the North?

   Northern boreal and marine

4. What Indigenous groups act as Permanent Participants on the Arctic Council?

   Sami Council, Russian Association of Indigenous Peoples of the North, Gwich'in Council International, Inuit Circumpolar Council, Aleut International Association, Arctic Athabaskan Council

5. Which international law give coastal states the sovereign right to exploit, conserve and manage natural resources of its waters within 200 nautical miles of the coast?

   The 1994 United Nations Convention on the Law of the Sea

Glossary of Terms

Abbreviations

ACAP – Arctic Contaminants Action Program

ACIA – Arctic Climate Impact Assessment

AMAP – Arctic Monitoring and Assessment Program

CAFF – Conservation of Arctic Flora and Fauna

CBMP – Circumpolar Biodiversity Monitoring Program

CPAN – Circumpolar Protected Areas Network

EEZ – exclusive economic zone

EIA – Environmental Impact Assessment

EPPR – Emergency Prevention, Preparedness and Response

IFA - - Inuvialuit Final Agreement

ISR - Inuvialuit Settlement Region

IUCN – World Conservation Union

PAME – Protection of the Arctic Marine Environment

PCB – polychlorinated biphenyls

POP – persistent organic pollutant

SDWG – Sustainable Development Working Group

SWE – snow water equivalent

UNEP – United Nation's Environment Program

Terms

Arctic Greening: increase in vegetative productivity and in the length of the growing season over the Arctic.

Bioaccumulation: accumulation of substances that increase in concentration in an organism as the organism takes in the toxic substance from contaminated air, water or food at a rate greater than it is lost.

Biodiversity: variability among living organisms from all sources including terrestrial, marine and aquatic ecosystems and the ecological complexes of which they are a part; includes diversity within species, between species and of ecosystems (CBD, 1992).

Biomagnification: increase in concentration of a substance that occurs in a food chain as a consequence of food chain energetics.

Biome: major biotic community characterized by dominant forms of plant life and the prevailing climate.

Climate Change: change in climate caused by human activity and defined by the United Nations Framework Convention on Climate Change as "a change of climate attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods" (UNFCCC, 1994).

Co-management: "the sharing of power and responsibility between government and local resource users" (Berkes et al., 1991).

Conservation Biology: scientific study of nature and the status of biodiversity with the aim of protecting species, habitats and ecosystems from excessive rates of extinction.

Environmental Stewardship: responsibility for environmental quality shared by all whose actions affect the environment (United States Environmental Protection Agency).

Invasive Species: non-native species introduced or entered into an environment that has become a nuisance through rapid spread often to the detriment of native species.

Phenology: study of periodic plant and animal life cycle events and how these are influenced by seasonal and inter-annual climate variations.

Protected Area: area of land and/or sea dedicated to the protection and maintenance of biological diversity, and natural and associated cultural resources, and managed through legal or other effective means (IUCN, 1994).

Stewardship: ethic that embodies cooperative planning and management of environmental resources with organizations and communities to actively engage in the prevention of habitat loss and facilitate its long-term sustainable recovery.

Sustainable Development: process that "meets the needs of the present without compromising the ability of future generations to meet their own needs" (The Brundtland Commission, 1987).

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