EU Arctic Footprint and Policy Assessment

Final Report

Sandra Cavalieri, Ecologic Institute
Emily McGlynn, Ecologic Institute
Susanah Stoessel, Ecologic Institute
Franziska Stuke, Ecologic Institute
Martin Bruckner, SERI
Christine Polzin, SERI
Timo Koivurova, Arctic Centre
Nikolas Sellheim, Arctic Centre
Adam Stepien, Arctic Centre
Kamrul Hossain, Arctic Centre
Sébastien Duyck, Arctic Centre
Annika E. Nilsson, SEI

21 December 2010

Ecologic Institute, Berlin
www.ecologic.eu

About the Arctic Footprint and Policy Assessment

The study “Arctic Footprint and Policy Assessment” aims to improve the effectiveness of EU environmental policies with respect to the Arctic region. The study will undertake an assessment of the EU’s current footprint on the Arctic environment and evaluate how it could change over time. The effectiveness of the EU’s current environment-related policies will also be analysed, including how these policies relate to current and future footprint scenarios. Options for improving EU policy will also be developed. The “Arctic Footprint and Policy Assessment” is an initiative of the European Commission, DG Environment under contract EuropeAid/128561/C/SER/Multi. Ecologic Institute leads the project team, which includes three additional institutes: the Arctic Centre, SERI and Stockholm Environment Institute. The analysis and ideas put forward in this report are entirely the responsibility of the contractors and do not necessarily reflect the views of DG Environment.

Acknowledgments

The project team would like to thank the following experts for providing external reviews of various sections of this report: Ingela Andersson, Betsy Baker, Svante Bodie, Lawson Brigham, Alexey Gusev, Mark Hermanson, Henry Huntington, Pekka Iivari, Carina Keskitalo, Erik Molenaar, Jozef M. Pacyna, Dennis Thurston, Cynthia A. de Wit, and Kenneth Yalowitz.

About Ecologic Institute

The Ecologic Institute is a private not-for-profit think tank for applied environmental research, policy analysis and consultancy with offices in Berlin, Brussels, Vienna, and Washington DC. An independent, non-partisan body, the Ecologic Institute is dedicated to bringing fresh ideas to environmental policies and sustainable development. The Ecologic Institute's work programme focuses on obtaining practical results. It covers the entire spectrum of environmental issues, including the integration of environmental concerns into other policy fields. Founded in 1995, the Ecologic Institute is a partner in the network of Institutes for European Environmental Policy. The Ecologic Institute acts in the public interest; donations are tax-deductible.

Executive Summary

The European Union (EU) has a significant impact on the socio-economic and environmental aspects of the Arctic region. Three Member States – Denmark (/Greenland), Finland and Sweden - have territories in the Arctic. Two other Arctic states – Iceland and Norway– are members of the European Economic Area. At the same time, the EU is a relative newcomer to Arctic policy – and it may appear to have limited options for influencing non-EU Arctic policy. However, as underscored by the 2009 "Council conclusions on Arctic issues" and the findings of this report, EU participation in Arctic decision-making can occur through many policy pathways, including stronger EU environmental laws, increased cooperation through multilateral agreements and international leadership. The European Parliament's "A sustainability policy for the EU high north", which focuses on stronger EU coordination of Arctic research and information is expected in 2011.

Results from the EU Arctic Footprint and Policy Assessment (AFPA) project show a wide range of policy options for Europe to reduce its environmental footprint in the Arctic, while at the same time recognising the importance of the sustainable development of the region's natural resources for local and indigenous people. The analysis focuses specifically on the EU, and does not elaborate on the impacts of other Arctic or non-Arctic nations. Analysis was conducted within nine distinct policy issue areas: 1) biodiversity, 2) chemicals and transboundary pollution, 3) climate change, 4) energy, 5) fisheries, 6) forestry, 7) tourism, 8) transport and 9) Arctic indigenous and local livelihoods. Both qualitative and quantitative analysis of the EU's Arctic footprint point to key focal areas for EU action, and policy options are presented for each. Furthermore, three illustrative scenarios describing potential changes in the EU's Arctic footprint up to 2030 provide the context for a discussion of long-term policy considerations.

Key findings

ISSUE AREA	SUMMARY
Biodiversity	**Status:** Arctic biodiversity is threatened by both local and global drivers, including direct habitat disturbance and contamination from certain Arctic industries as well as changes in food availability and habitat ranges from climate change. Arctic terrestrial vertebrate populations have declined by 10% over the last 30 years, the majority of polar bear populations are decreasing in size, and the species composition in marine ecosystems is changing as certain bottom-dwelling and pelagic species move northward.
	EU's footprint (% of global impact): No flagship indicator.
	EU Policy Options 1. **Extend conservation networks** with a focus on Arctic regions and resolving conservation goals with local interests. 2. **Assist in improving international maritime governance** by fully implementing the UN Fish Stocks Agreement, including relevant provisions under the OSPAR Convention and supporting extension of the NAMMCO. 3. **Help reduce the spread of invasive species** by monitoring and managing native European species with the potential to invade the Arctic. 4. **Promote cooperation for conservation** by participating in and

ISSUE AREA	SUMMARY
	supporting, for example, the IPBES.
Chemicals and Transboundary Pollution	**Status:** Persistent organic pollutants (POPs) have become widely distributed in the Arctic and remain intact for many years. They can accumulate in the fatty tissue of organisms and are toxic to both humans and wildlife. Heavy metals reach and are re-distributed within the Arctic through the atmosphere, water, ice, and biotic transport mechanisms. They have also been associated with contamination and potential toxicity. Long-range transported air pollutants such as SO_2 and NO_x form Arctic haze and contribute to acidification. These air pollutants can also change the short and long wave radiation balance of the Arctic, affect visibility, and act as a pathway for additional contaminants into Arctic ecosystems. **EU's footprint (% of global impact):** *On average, from multiple indicators* – 35% **EU Policy Options** 1. **Support ongoing efforts to adopt international mercury agreement** that addresses increasing emissions in Asia as well as the use of mercury in developing countries. 2. **Develop integrated pollution control** of black carbon, mercury, POPs and CO_2 from coal combustion both domestically and abroad by expanding, for example the EU and China Partnership on Climate Change. 3. **Coordinate activities between REACH and the Arctic Council working groups,** using the examples of the Stockholm Convention and AMAP.
Climate change	**Status:** The main effects of climate change on the Arctic include the widespread melting of glaciers and sea ice and rising permafrost temperatures. This poses increasing challenges to Arctic wildlife and communities, which are potentially faced with increased flooding, compromised infrastructure, ecosystem changes and invasive species. There may also be economic benefits from reduced sea ice and higher air and water temperatures, including increased opportunities for fisheries, tourism, shipping, and hydrocarbon exploitation. Many of these benefits are highly dependent on infrastructure development. GHG emissions are causing climate change, with black carbon deposition increasing the rate of melting snow and ice. The EU is a major source of black carbon deposited in the Arctic. **EU's footprint (% of global impact):** *GHG emissions from the EU* – 16% *European continent's share of black carbon emissions to the Arctic* – 59% **EU Policy Options** 1. **Reduce domestic GHG emissions** and implement an unconditional 30% emissions reduction goal for 2020. 2. **Reduce black carbon emissions** through, for example, stricter emissions standards for diesel engines. 3. **Support reducing emissions from international shipping** through international agreement under the IMO or UNFCCC, or with a coalition of countries. 4. **Dedicate funding to Arctic adaptation needs** and research the adaptation needs of Arctic communities.

ISSUE AREA	SUMMARY
Energy	**Status:** The Arctic may become an important source of oil and gas in the future, containing an estimated 6.7% of the world's proven oil reserves and 26% of proven natural gas reserves. New infrastructure developments such as pipelines, roads, harbour facilities and other transport infrastructure for the exploration of the Arctic's large reserves of oil, gas and other minerals, are causing land fragmentation, threatening biodiversity, and heightening the risk of polluting land and water ecosystems. Oil contamination and large oil spills create clean-up challenges and can threaten Arctic livelihoods. The EU's increasing reliance on fossil fuel imports to meet energy needs, particularly from Russia and Norway, as well as its expanding renewable energy and energy efficiency policies are major drivers of its Arctic impacts. **EU's footprint (% of global impact):** *EU-27's final demand for products from the Arctic oil and gas industry* – 24% **EU Policy Options** 1. **Support a multilateral agreement on offshore oil and gas activities** which would account for the specific circumstances of the Arctic and require EIAs for any energy recovery activities. 2. **Cooperate with Russia** through an existing or new bilateral agreement on reducing the environmental footprint of hydrocarbon extraction. 3. **Strengthen the Northern Dimension policy** to encourage best practices and sustainable energy development in the Arctic.
Fisheries	**Status:** Reducing IUU fishing and sustainable development of Arctic fisheries are two challenges that must be addressed. Many Arctic and sub-Arctic fisheries are already over-exploited, and research is required to assess the state of fish stocks in certain Arctic areas. Over-fishing is a source of great concern for Arctic communities, and can reduce the viability of Arctic fisheries already threatened by climate change. Unclear or incomplete jurisdiction of RFMOs in Arctic areas will likely need to be clarified under the UN Fish Stocks Agreement. Though the EU only catches approximately 4% of all fish caught in the Arctic, the EU is one of the largest seafood markets in the world. **EU's footprint (% of global impact):** *EU-27's share in fish imports from Arctic countries* – 39% **EU Policy Options** 1. **Strengthen market-based instruments** to incentivise sustainable fishery expansion, such as environmental sourcing standards for imports. 2. **Enforce IUU fishing regulation** by continuing efforts to develop and strengthen bilateral and multilateral agreements with major fisheries products trade partners. 3. **Enact a moratorium on commercial fishing within certain Arctic areas**, like the US, until regulatory loopholes are closed.
Forestry	**Status:** Arctic forests represent only a small fraction of total boreal forested area and forestry has declined in the Arctic over the last century. However, forestry and wood-processing are major economic sectors in some Arctic regions. Arctic forests are threatened by oil and gas development, logging activities and climate change which may impact genetic diversity of tree populations. Climate change will likely have varying effects on the viability of various tree species. In general, the Arctic tree line has shifted northward.

ISSUE AREA	SUMMARY
	EU's footprint (% of global impact): *EU-27's final demand for products from the Arctic forestry industry* – data unavailable
	EU Policy Options 1. **Strengthen Sustainable Forest Management** by making it compulsory in the EU and endorsing existing certification schemes. 2. **Reduce pressure on boreal forests** by reducing demand for wood products such as pulp and paper and increasing recycling rates. Measures would also be needed to decrease demand for wood as an energy source.
Tourism	**Status:** Arctic tourism is on the rise, a significant percentage of which is patronised by EU tourists. Cruise ship impacts and ensuring that tourists do not disrupt delicate habitats are specific Arctic concerns. The increase in visitors, combined with changing conditions related to climate change, and introduction of invasive species to the Arctic may disturb wildlife.
	EU's footprint (% of global impact): *Share of EU tourists in the Arctic* – 27%
	EU Policy Options 1. **Form a European Arctic Tourism Association** to holistically manage Europe-based tourism to the Arctic. 2. **Increase the number of Arctic World Heritage Sites** under the UN World Heritage Convention. 3. **Link tourism and conservation** by encouraging tour operators and any tourism associations to facilitate close cooperation between tourism stakeholders and conservationists.
Transport	**Status:** Shipping is an important activity in the Arctic with growing and significant environmental impacts, especially with the prospect of new shipping routes through the Northern passages. Increased Arctic shipping would increase emissions of CO_2 and other air pollutants. Oil spills from tankers is also a concern given the difficult weather and ocean conditions in the Arctic.
	EU's footprint (% of global impact): *EU share of global shipping traffic in the Arctic* – data unavailable
	EU Policy Options 1. **Support development of the IMO Polar Code** by making it binding through existing international agreements and/or implementing its provisions in the EU. 2. **Support the designation of PSSAs in the Arctic** under the IMO (MARPOL). 3. **Support the development of Arctic shipping infrastructure** by promoting the multilateral Arctic Search and Rescue Instrument and exploring the possibility of an Arctic marine traffic awareness system.
Arctic Indigenous and Local Livelihoods	**Status:** Local and indigenous peoples' livelihoods are consistently impacted by environmental degradation. Smaller population numbers are projected due to outmigration; their traditions and resources are jeopardized both by direct climate change impacts and the increasing value of their resources for

ISSUE AREA	SUMMARY
	market purposes; and there is a lack of knowledge on what these communities will require under climate impact scenarios. Most economic activity in the region is devoted to the exploitation of natural resources, mostly non-renewables including minerals, gas, and oil, which has a significant environmental impact. Certain large sectors of the Arctic economy are low-income, such as fisheries and the reindeer- and fish-processing sectors. There is also a high dependency on transfer payments from federal governments.
	EU's footprint: *EU impact on employment/income on the Arctic* – data unavailable
	EU Policy Options 1. **Establish an Indigenous Peoples' Office in Brussels** to provide indigenous communities with continuous, stable financial and logistical support. 2. **Establish a Working Group on Indigenous Peoples** under the Northern Dimension Policy. 3. **Establish participatory mechanisms within the EU biodiversity policy**, thereby utilising traditional ecological knowledge and reducing land-use conflicts.

The EU Arctic footprint Future Scenarios (section 3) describe three different futures in 2030, utilising different assumptions on four key parameters: (1) the rate of climate change in the Arctic, (2) the efficacy of management of Arctic environmental pressures, (3) economic growth in the EU and (4) the efficiency of resource use by EU actors.

In the **Race for Resources scenario**, a high level of economic growth and a low level of resource efficiency in the EU interact with rapid climate change and a low level of effectiveness in management of Arctic pressures to result in a high impact EU footprint in the Arctic in 2030. Consumption patterns have been largely unaffected by environmental concerns and the EU falls short of several of its 2020 environmental goals.

In the **Business as Usual scenario**, moderate EU economic growth (approximately 2% annual increase in GDP) is essentially counterbalanced by a nearly comparable increase in resource efficiency. Europe 2020 targets have all been met. However, efforts at managing pressures in the Arctic are not quite able to hold the effects of climate change in check and environmental conditions in the Arctic continue to deteriorate. The balance struck between variables in this scenario is very delicate and slight shifts in any of them could tip the balance in one direction or the other.

In the **Eased by Efficiency scenario**, economic growth in the EU coupled with high resource efficiency creates low demand for resources and products, allowing for greater strides towards sustainable rates of consumption and reducing global greenhouse gas (GHG) emission levels. Though the momentum of climate change continues to create some pressures in the Arctic, these challenges are addressed through a high level of international cooperation on Arctic adaptation and ambitious regulation of black carbon and GHG emissions.

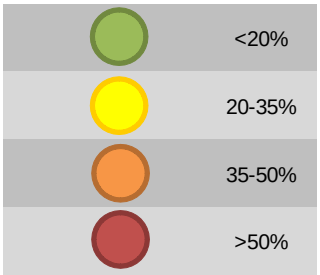
These scenarios highlight that the EU will face several key challenges across all three futures. These challenges include:

1. Utilising ecosystem-based management
2. Assisting in Arctic climate change adaptation efforts
3. Continuing climate change mitigation efforts within the EU and internationally
4. Continuing to increase resource efficiency
5. Reducing pollution from a wide variety of sources
6. Strengthening the policy process within the EU and among other international actors and improving cooperation

In conclusion, the results of the EU's Arctic footprint assessment, discussed within each issue in Section 2, are presented in the form of a scorecard (see Figure 1, below). The scorecard indicates the EU's share in each indicator as a percentage of the total global contribution to Arctic impacts. Lack of data prevented quantification of the EU's impact on forestry, transport and Arctic indigenous and local livelihoods. Further research is needed to address these information gaps.

Figure 1 EU Arctic footprint scorecard with flagship indicators

CATEGORY	FLAGSHIP INDICATOR	EU SHARE
Biodiversity	no flagship indicator	n.a.
Chemicals	PCB-153 emissions from Europe	57%
	Market demand for BFRs in Europe	17%
	EU-27's share of mercury emissions over the Arctic	24%
	EU-27's final demand for products from mercury-intensive Arctic industries	36%
	SO_2 emissions from the EU-27	42%
	EU-27's final demand for products from SO_2-intensive Arctic industries	38%
Climate change	GHG emissions from the EU	16%
	Europe's share of black carbon emissions to the Arctic	59%
Energy	EU-27's final demand for products from the Arctic oil and gas industry	24%
Fisheries	EU-27's share in fish imports from Arctic countries	39%
Forestry	EU-27's final demand for products from the Arctic forestry industry	n.a.
Tourism	Share of EU-27 tourists in the Arctic	27%
Transport	EU share of global shipping traffic in the Arctic	n.a.
Arctic livelihoods	EU impact on employment/income in the Arctic	n.a.



Source: Sustainable Environment Research Institute (SERI), 2010.

This study makes clear that the EU is currently addressing many of the potential impacts to the Arctic environment, and is aware of the potential for more severe effects in the future.

However, certain policy gaps must be addressed in order to decrease the EU's current and potential future Arctic impacts, particularly in order to account for future uncertainties indentified in many of the policy issue areas.

Table of Contents

List of acronyms

ACIA	Arctic Climate Impact Assessment
ABS	Access to genetic resources and Benefit Sharing (under CBD)
AFPA	Arctic Footprint and Policy Assessment
AMAP	Arctic Monitoring and Assessment Programme
AMSA	Arctic Marine Shipping Assessment
BC	Black Carbon
BFR	Brominated Flame Retardant
CAFF	Arctic Council Conservation of Arctic Flora and Fauna
CAP	EU Common Agricultural Policy
CBD	UN Convention on Biodiversity
Cd	Cadmium
CFP	EU Common Fisheries Policy
CH_4	Methane
CITES	UN Convention on International Trade in Endangered Species and Wild Fauna and Flora
CMS	UN Convention on the Conservation of Migratory Species of Wild Animals
CO	Carbon monoxide
CO_2	Carbon dioxide
EATA	European Arctic Tourism Association
ECJ	European Court of Justice
EEA	European Economic Area
EIA	Environmental Impact Assessment
EIDHR	European Instrument for Democracy and Human Rights
EMSA	European Maritime Safety Agency
ENPI	European Neighborhood and Partnership Instrument
ERDF	European Regional Development Fund
ETS	EU Emissions Trading System
FAO	UN Food and Agriculture Organization
FLEGT	Forest Law Enforcement, Governance and Trade
FMP	Fisheries Management Plan
FOC	Flag of Convenience
FSC	Forest Stewardship Council
GDP	Gross Domestic Product
GEO	Global Environment Outlook
GHG	Greenhouse Gas

HCB	Hexachlorobenzene
HFC	Hydrofluorocarbon
Hg	Mercury
IAATO	International Association of Antarctic Tour Operators
IATA	International Arctic Tourism Association
IBPP	Institution Building Partnership Programme
ICES	International Council for the Exploration of the Seas
ILO	International Labor Organization
IMO	International Maritime Organization
IPCC	Intergovernmental Panel on Climate Change
IUU	Illegal, Unregulated and Unreported fishing
LRTAP	UNECE Convention on Long-Range Transboundary Air Pollution
LULUCF	Land Use, Land-Use Change and Forestry
MEA	Multilateral Environmental Agreement
MEPC	Maritime Environment Protection Committee
N_2O	Nitrous oxide
NAMMCO	North Atlantic Marine Mammal Commission
ND	EU Northern Dimension
NMVOC	Non-methane volatile organic compounds
NO_x	Nitrogen oxides
NPP	EU Northern Periphery Programme
OC	Organic carbon
OECD	Organisation for Economic Co-operation and Development
OSPAR	Convention for the Protection of the Marine Environment of the North-East Atlantic
Pb	Lead
PBDE	Polybrominated diphenylether
PCB	Chlorinated Phenolic Compound
PCDD	polychlorinated dibenzo-p-dioxin
PCDF	polychlorinated dibenzofuran
PEBLDS	Pan-European Biological and Landscape Diversity Strategy
PEFC	Programme for the Enforcement of Forest Certification Schemes
PFC	Perfluorocarbon
PFOS	Perfluorooctane sulfonate
POP	Persistent organic pollutant
PSSA	Particularly Sensitive Sea Area
RE	Renewable Energy

RFMO	Regional Fisheries Management Organisations
SATA	Sustainable Arctic Tourism Association
SDS	EU Sustainable Development Strategy
SEA	Strategic Environmental Assessment
SF_6	Sulphur hexafluoride
SFM	Sustainable Forestry Management
SMART	Sustainable Model for Arctic Regional Tourism
SO_2	Sulfur dioxide
SOLAS	International Convention for the Safety of Life at Sea
TAC	Total Allowable Catch
TACIS	Technical Aid to the Commonwealth of Independent States
TEK	Traditional Ecological Knowledge
UNCLOS	United Nations Law of the Seas Convention
UNECE	United Nations Economic Commission for Europe
UNEP	United Nations Environment Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNFCCC	United Nations Framework Convention on Climate Change
UNFF	United Nations Forum on Forests
UNGA	United Nations General Assembly
USGS	United States Geological Survey
VPA	Voluntary Partnership Agreement
WGIP	UN Working Group on Indigenous Populations
γ-HCH	Lindane

List of figures

List of tables

1 Introduction

In response to recent environmental and geopolitical changes, the EU has a growing interest in taking a more active role in Arctic issues. In 2007, European Commission announced in its Integrated Maritime Policy a new focus on strategic issues relating to the Arctic Ocean.[1] A key turning point for Europe on the geopolitical stage was the subsequent release of its report from the European Commission and the High Representative in March 2008, which called for the development of an EU Arctic policy.[2] Following this report, in November 2008, the Commission's Communication, "The EU and the Arctic Region," set out proposals for a more structured and coordinated approach to Arctic matters as the first layer of an Arctic policy for the EU.[3] The Communication is the "first layer of an Arctic policy for the European Union" and intends to "open new cooperation perspectives with the Arctic states". It describes the EU's links to the region and outlines EU interests, posing three main objectives: 1) protecting and preserving the Arctic in unison with its population; 2) promoting sustainable use of resources; and 3) contributing to enhanced Arctic multilateral governance.

In 2009, the EU Council adopted "Council conclusions on Arctic issues", emphasising the need for gradual formulation of a policy on Arctic issues to address EU interests and responsibilities in the region.[4] According to the Council, the EU policy on Arctic issues should:

- effectively mitigate climate change to preserve the unique characteristics of the Arctic region;
- reinforce multilateral governance through effective implementation of international, regional, bi-lateral agreements, frameworks and arrangements;
- enhance measures of international conventions, such as UNCLOS and other relevant international instruments;
- formulate and implement EU actions and policy, taking into consideration the sensitivities of ecosystems as well as the needs and rights of Arctic residents; and
- maintain the Arctic as an area of peace and stability and highlight the need for responsible, sustainable and cautious actions, particularly in the area of resource extraction.[5]

Following the Communication and Council Conclusions, the European Parliament's Committee on Foreign Affairs is preparing a report on "A sustainable EU policy for the High North", expected in January 2011. The draft report includes specific action items for the Commission to further enhance coordination of Arctic information and research among the EU, its Member States, and at the circumpolar scale.[6]

[1] European Commission, 2007.
[2] High Representative and European Commission Paper on Climate Change and International Security, 2008.
[3] European Commission, 2008.
[4] EU Council, 2009.
[5] EU Council, 2009.
[6] European Parliament, 2010.

The Arctic is governed by a multitude of legal instruments, as well as institutions that are national, regional or global in scope. Most of these instruments and institutions are not specific to the Arctic but rather govern issues of global relevance that also apply to the Arctic.[7] Three Member States – Denmark (/Greenland), Finland and Sweden - have territories in the Arctic. Two other Arctic states – Iceland and Norway– are members of the European Economic Area. The EU has been engaged in sustainable development in the Arctic since the Northern Dimension policy was adopted in 1999. Although the EU is a relative newcomer to Arctic policy – and may appear to have limited options for influencing non-EU Arctic policy –as underscored in the Council conclusions and in this report, EU participation in Arctic decision-making can occur through many policy pathways, including stronger EU environmental laws, increased cooperation through multilateral agreements and international leadership.

Against this background, the EU Arctic Footprint and Policy Assessment (AFPA) project explores the wide range of policy options for Europe to reduce its environmental footprint in the Arctic, while at the same time recognising the importance of the sustainable development of the region's natural resources for local and indigenous people. 'The Arctic' is defined as the Arctic Ocean and all territory north of the Arctic Circle, and the project focuses on EU activities that take place both within the Arctic region as well as within Europe.[8] It is important to note that the analysis focuses specifically on the EU, and does not elaborate on the impacts of other Arctic or non-Arctic nations. Results from this analysis are intended to contribute to the EU's effort to improve its environmental and related sector-based polices, and could help showcase EU leadership in promoting international co-operation in the Arctic.

About the project

The AFPA project provides an assessment of Arctic environmental impacts from various activities that originate in the EU or are a result of the activities of EU citizens, and suggests areas where the EU can address this footprint today and in the future (up to 2030). The focus is on improving the environmental effectiveness of existing EU policies across nine distinct issue areas, including: 1) biodiversity, 2) chemicals and transboundary pollution, 3) climate change, 4) energy, 5) fisheries, 6) forestry, 7) tourism, 8) transport and 9) Arctic indigenous and local livelihoods. The report highlights existing and potential impacts that are driven, at least in part, by the EU. This focus is in line with the general goals and scope of the entire AFPA project, which seeks to identify policy strategies through which the EU can reduce its impact on the Arctic. This report is not intended to provide an exhaustive description of each issue, but rather to frame the discussion of the EU's options for reducing impact within the relevant policy area. Detailed policy options associated with each issue area are provided to inform a new Arctic Policy for the EU. The report includes the following sections:

- Section 2: *EU Arctic footprint and policy assessment*. This section evaluates each of the nine key issue areas according to 1) status, trends and pressures, 2) EU's footprint, 3) EU policies and multilateral agreements, 4) effectiveness of policy instruments, and 5) policy options. A detailed description of policies discussed in

[7] Best, et al., 2009, p. 1
[8] In some cases, specific reference is made to the Faroe Islands, which are south of the Arctic Circle.

each key issue area is provided in Annex C, followed by a policy summary matrix in Annex D.

- Section 3: *Future scenarios (up to 2030)*. This section outlines three potential scenarios for how the EU's Arctic footprint could change in the future. The scenarios are followed by a discussion of the long-term policy considerations in light of possible future changes.
- Section 4: *Conclusion*. This section presents the EU Arctic Footprint scorecard and report conclusions.

The methodology for this analysis is based on the framework from the Global Environment Outlook Resource Book, which focuses on a multi-step process beginning with understanding the problem, identifying environmental priorities and existing policies, then moving to analysis of gaps and development of a narrative review that highlights failures, successes and opportunities for improvement.[9] For each issue area, this assessment begins with a summary of the current status, followed by the EU's footprint in the Arctic, an analysis of the effectiveness of existing policies and a discussion of policy options. This assessment forms the basis for the three scenarios up to 2030, which are intended to assist policy makers and interested stakeholders in considering the short- and long-term policy options and implications for the future.

At the core of the AFPA is a novel assessment of one region's impacts on another. To develop the EU's footprint for each of the key issue areas, a set of indicators that measure Europe's impact across a range of environmental policy areas were analysed for both consumption and production activities. The results are presented within each section, as well as in the conclusion in the form of an Arctic Footprint scorecard. This scorecard indicates the EU's contribution as a percentage of the global contribution for each of the identified environmental indicators. It covers both production and consumption activities that occur within the EU, as well as those that occur within the Arctic and can be attributed to EU demand.

Based on the DPSIR (Driving forces, Pressures, States, Impacts, Responses) framework,[10] the methodology follows from the understanding that EU member states' activities can affect the Arctic environment mainly in two ways:

1) EU production and consumption

   Due to consumption and production activities within the EU territory, greenhouse gases (GHG) and other pollutants are released within and outside the EU that ultimately have a direct or indirect impact on the Arctic environment. Therefore, underlying driving forces and pressures originate in the EU.

2) Arctic production for EU consumption

   Production of goods within the Arctic that are imported by EU member states cause pollution on site. In this case, the driving forces originate in the EU (i.e. EU demand for Arctic products), while the resulting pressure originates within the Arctic.

[9] Pinter, et al., 2007.
[10] Smeets and Weterings, 1999.

The components of this framework are related systematically: the driving force causes the pressure, the pressure modifies the state of the system, this modified state has a certain impact on the system's characteristics, and the impact requires response in order to reduce either the driving force or the pressure. This analysis primarily uses pressure indicators (e.g. emissions of pollutants), but in cases where data on pressures is unavailable, driving force indicators (i.e. all activities and individual behaviours that cause pressures on the environment) are utilised. An example of a driving force indicator is the EU demand for oil, some of which may come from the Arctic, while the pressure could be the impacts of hydrocarbon extraction within the Arctic. In contrast to state or impact indicators (e.g. species loss), pressure and driver indicators allow for allocating regional shares of the respective pressure or driver and are therefore favourable for the purposes of this study. Further detail on the methodology for the Arctic footprint scorecard is available in Annex A.

Environmental assessments play a crucial role in adapting EU policies to the challenges in the Arctic. In particular, the Arctic Council has produced numerous assessments through the Arctic Monitoring and Assessment Programme (AMAP) such as the Arctic Climate Impact Assessment – Impacts of a Warming Arctic (ACIA) 2005, the Arctic Oil and Gas Assessment 2007, the Arctic Marine Shipping Assessment (AMSA) 2009 and the Arctic Biodiversity Trends - 2010: Selected Indicators of Change report. These reports serve as valuable tools for the EU to identify policies and measures to promote sustainable development in the Arctic region. As shown in the AFPA, a first step is to highlight the implications of these assessments for Europe, emphasising the environmental interconnectivity between the EU and the Arctic. Understanding this interconnectivity could contribute to a reduction of the EU's environmental footprint in the High North through a change in consumer and industry behaviour due to public recognition of environmental impacts originating at home.

The environmental policies of the EU are based on international and European legal instruments that rarely refer directly to the Arctic. An EU strategy for reducing its Arctic footprint would ideally consider the Arctic comprehensively, recognising the entire ecosystem, including all stewards and users, and rely on cooperation with Arctic states. By developing an environmental strategy specifically for the Arctic, using multilateral fora and discussions to reduce the environmental impacts from imported goods and services, and adapting its policies to international standards in Arctic management, the EU could effectively contribute to Arctic policy making and reduce its Arctic footprint.

2 EU Arctic Footprint and Policy Assessment

2.1 Biodiversity

Status, trends, and pressures

Biodiversity is ”the variability among living organisms from all sources including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part: this includes diversity within, between species and of ecosystems.”[11] Biodiversity is often portrayed with high-profile species, such as the polar bear, but its main importance lies in that it is the foundation for a range of ecosystem services. These include provisioning services (e.g. food, fibre, fuel), regulating services (e.g. climate regulation, water purification, flood regulation), cultural services (e.g. spiritual, recreational, educational) and supporting services (e.g. primary production, nutrient cycling, soil formation).[12] The Arctic is host to a range of ecosystems in both terrestrial and marine environments that are unique to the polar region. It is host to unique species, such as the polar bear, but also many globally significant animal populations, including half of the world’s shore bird species.[13] Changes in Arctic ecosystem services already affect the well-being of people living in the region and can also have large consequences for the rest of the world. A key example is the role of biodiversity in the cycling of carbon, with its potential feedbacks to climate change.[14]

The first circumpolar overview of biodiversity, published in 2001, stated that much of the Arctic was in its natural state and that the impacts of human activity were relatively minor. However, it also observed that individuals, species and ecosystems throughout the Arctic faced threats from many causes.[15] The pressures have become much more apparent and acute in recent years, partly due to accelerating climate change and partly due to exploitation of the region’s rich resources. The Arctic Biodiversity Trends 2010 assessment[16] included the following key findings about the current status of Arctic biodiversity:

- Unique Arctic habitats for flora and fauna, including sea ice, tundra, thermokarst ponds and lakes, and permafrost peatlands have been disappearing over recent decades.
- Although the majority of Arctic species examined are currently stable or increasing, some species of importance to Arctic people or species of global significance are declining.

The changes in species include a moderate 10% overall decline in terrestrial vertebrate populations over the past 34 years according to the Arctic Species Trend Index, partially reflecting declines in herbivores such as reindeer and lemmings. Also recorded are declines in 8 of 12 subpopulations of polar bears for which information on population numbers is available. Shore bird populations are declining globally, and populations of migratory species

[11] Convention on Biological Diversity. Article 2.
[12] Millennium Ecosystem Assessment, 2005.
[13] CAFF, 2010.
[14] ACIA, 2005, Chapin 2005.
[15] CAFF, 2001.
[16] CAFF, 2010, pp. 12-13.

such as the red knot indicate declines or suspected declines in several populations. Populations of some very abundant seabirds, such as common eiders appear healthy, while the majority of regional populations of murres have declined in recent years. In the low Arctic, there have been dramatic increases in some goose populations. Arctic char is an indicator species for freshwater environments and Arctic char populations in the north are generally healthier than further south. For marine fish species, there is a northward shift of both bottom-dwelling and pelagic species.

In spite of current efforts to assess Arctic biodiversity, there is not yet enough baseline information available to fully understand the status and trends of Arctic biodiversity.[17] The Arctic Biodiversity Assessment, carried out by the Arctic Council working group Conservation of Arctic Flora and Fauna (CAFF), will present its full assessment in 2013. Under its project "Streamlining European Biodiversity Indicators," the European Environment Agency has concluded that in Europe, the target of halting biodiversity loss by 2010 will not be achieved.[18] The context of biodiversity losses, ecosystem changes and the growing vulnerability of the Arctic environment will also be addressed in the EEA's next State and Outlook of the Environment Report (SOER2010) and in the European Ecosystem Assessment due in 2011.[19]

The pressures on Arctic biodiversity are varied, and range from global drivers, e.g. climate change, to local pressures from harvesting or habitat disturbance. Climate change is emerging as the most far reaching and significant stressor on Arctic biodiversity and has already had impacts on unique polar habitats such as sea ice and tundra landscapes.[20] These changes are likely to accelerate in the future, which has raised concerns that current strategies to conserve Arctic biodiversity have to be completely revamped to take the changing environment into account.[21] Some of the policy implications are discussed in more detail below.

In addition to stress from climate change, increased exploitation of natural resources in the Arctic has led to changes in the landscape and thus the habitats of flora and fauna. This includes infrastructure in connection with industrial development, with direct impacts as well as causing fragmentation of the landscape with implications for both current migrations and for the future use of migrations as an adaptive strategy when the climate is changing. It has been highlighted as a major challenge for reindeer husbandry.[22] The increasing interest in exploiting fossil and mineral reserves in the Arctic also increases the risk of local contamination, e.g. oil spills, in environments where it is expensive and sometimes impossible to restore the natural environment. The consequences for biodiversity are highly dependent on the location and timing of such spills, where worst case scenarios include spills that affect large colonies of seabirds, migratory marine mammals that gather at the ice edge, and shorebirds that gather in large numbers before their migrations.[23]

For some species (e.g. some marine fish species) over-exploitation remains a problem. Other pressures that are directly related to human use of natural resources include damage

[17] Barry, 2009.
[18] EEA, 2009, p. 7.
[19] McGlade, 2009.
[20] CAFF, 2010, pp. 12-13; ACIA, 2005.
[21] The Circle, 2009.
[22] Turi, 2009.
[23] AMAP, 2007, p. 35.

caused by certain harvest methods (e.g. by-catch of seabird and marine mammals) and reindeer overgrazing. Another issue is disturbance from species that have been introduced to the Arctic environment because of their potential commercial value (e.g. the red king crab in the Barents Sea region). With climate change and increased human activity, the risks associated from invasive species are becoming an increasing concern. Many invasive species have been recorded along road systems and other altered habitats. There is less information about marine ecosystems but they are believed to be at increasing risk from shipping and offshore developments.[24]

Pollution can pose a challenge to individual plants and animals and to local ecosystems. In some cases these concerns extend to wildlife populations.[25] Populations and ecosystems often experience several stressors simultaneously, which can increase their vulnerability.[26] Research on ecosystem change also highlights the risk for 'tipping points' or regime shifts, where gradual changes in the drivers can lead to sudden drastic changes in the organization of an ecosystem. Such changes are difficult to foresee and may not always be reversible.[27]

EU's Footprint

No formal footprint has been calculated for biodiversity because its loss is the result of a range of pressures (such as climate change and long-range transport of contaminants), which have been assessed in other sections of this report. Including these indicators would therefore result in double counting. The EU countries and citizens can impact Arctic biodiversity through activities ranging from infrastructure development and exploitation of resources to tourism and shipping in sensitive habitats. In addition, there is an indirect influence from activities outside the Arctic that emit long-range pollutants, contributing to global climate change and influencing ecosystem health in the Arctic. Legislation relevant to such activities is discussed in the following sections.

EU policies and multilateral agreements

General policy trends

Historically, the protection of biodiversity has focused primarily on individual species and especially valuable habitats. Policy measures include specific resource management regimes, creating nature reserves, and regulating the trade of threatened species. A more recent trend is a move towards protecting ecosystems as a whole rather than focusing only on their individual components. The ecosystem approach is a strategy for integrated management of land, water, and living resources that promotes conservation and sustainable use in an equitable way.[28] It can be implemented as integrated ecosystem management, which is a continuous process that considers a multitude of uses of the ecosystem and a range of stakeholders. The knowledge used for managing biodiversity has often been based in western science but there is increasing recognition of traditional knowledge in both local

[24] CAFF, 2010, p. 19.
[25] AMAP, 2009, pp. 30-32; AMAP, 2002, p. 36.
[26] AMAP, 2009, pp. 30-32.
[27] Fagre, 2009.
[28] Convention on Biological Diversity, Ecosystem Approach, online.

and international contexts. The Arctic provides many examples of management regimes that aim to integrate different knowledge traditions.[29]

EU policies

On 15 March 2010, the European Environment Council agreed a new long-term vision and mid-term headline target for biodiversity in the EU for the period beyond 2010, when the current target expires. The new target is "to halt the loss of biodiversity and the degradation of ecosystem services in the EU by 2020, restore them in so far as feasible, while stepping up the EU contribution to averting global biodiversity loss."

The European Environment Council also further developed the EU position for the international negotiations on biodiversity under the United Nations Convention on Biological Diversity (CBD), building on earlier conclusions that stress, inter alia, that the global post-2010 targets agreed at the 10th Conference of the Parties to the CBD in Nagoya, Japan in October 2010 must be recognised and embraced by stakeholders in the key sectors concerned, and that they should be endorsed at the highest political level. On Access to genetic resources and Benefit Sharing (ABS), the conclusions for the first time explicitly called for the adoption of a Protocol to the CBD, with binding and non-binding provisions, which was ultimately adopted in Nagoya.[30]

In its conclusions of 26 March, 2010, the European Council committed to the EU post-2010 vision and target for biodiversity and underscored the urgent need to reverse continuing trends of biodiversity loss and ecosystem degradation.[31]

The Commission has set out possible future options for biodiversity policy in the EU for the period after 2010. The Communication proposes a long-term (2050) vision for biodiversity, with four options for a mid-term (2020) target – an essential step along the way towards reaching the vision. In this vision, biodiversity and the ecosystem services we get for free from nature are preserved, valued and, insofar as possible, restored for their intrinsic value, enabling them to support economic prosperity and human well-being, and averting any catastrophic changes linked to biodiversity loss.

The background to these recent policy developments is that the EU already in 2001 set up a target to halt biodiversity loss by 2010. In 2002, it signed up for a similar global target. In 2006, a Biodiversity Communication and a detailed Action Plan set out an agenda for action to halt the loss of biodiversity, with priority objectives addressing most important habitats and species; actions in the wider countryside and marine environment; making regional development more compatible with nature; reducing impacts of invasive alien species; effective international governance; support to biodiversity in international development; reducing negative impacts of international trade; adaptation to climate change; and strengthening the knowledge base. The Communication also recognised the need for four supporting measures relating to adequate financing, strengthening EU decision-making, building partnerships and promoting public education, awareness and participation. Despite these efforts, there are clear indications that the EU will not achieve its targets.[32] In March

[29] See e.g. CAFF, 2010; Chapin, 2009; McLennan, 2009.
[30] European Commission, EU Biodiversity Policy Development , online.
[31] European Council, 2010.
[32] EEA, 2009.

2009, the Council called for a new EU vision and target, which started a consultative process, which underlined the need for a post-2010 target.[33]

Existing EU legislation includes the Habitat Directive and the Bird Directive, which form the cornerstone of Europe's nature conservation policy. The Habitat Directive is built around a strict system of species protection and the Natura 2000 network of protected areas. EU legislation is described in further detail in Annex C.

Multilateral agreements

Protection of biodiversity is mainly a national responsibility but there are also a number of international agreements that commit countries to protecting biodiversity, set the framework for national legislation, and that regulate certain transnational issues. At the global level, the most important regimes specifically addressing biodiversity are the Convention on Biological Diversity (CBD), the Convention on International Trade in Endangered Species and Wild Fauna and Flora (CITES), the Convention on Wetlands of International Importance (RAMSAR)[34]; and the Convention on the Conservation of Migratory Species of Wild Animals (CMS). The overarching goals of these multilateral agreements are listed in the policy table in Annex C. In addition, the United Nations Convention on the Law of the Sea (UNCLOS) includes conventions on conservation of living resources of the high seas and regarding straddling fish stocks. The UN Fish Stock Agreement and regional fisheries management organisations (RFMOs) can contribute to marine biodiversity protection. In addition there are several multilateral regimes that are relevant for the Arctic, including the Convention for the Protection of the Marine Environment of the North-East Atlantic (OSPAR), the North Atlantic Marine Mammal Commission (NAMMCO) and the Agreement on the Conservation of Polar Bears.

Effectiveness of policy instruments

The European Environment Agency coordinates the project 'Streamlining European Biodiversity Indicators,' many of which are relevant also for the Arctic. Its first progress report does not specifically discuss polar regions, but for Europe it concludes that the target of halting biodiversity loss by 2010 will not be achieved. Moreover, biodiversity continues to be under serious pressure and the policy response, although successful in some areas, is not yet adequate to halt the general decline.[35] Much hope has been generated by successes of the negotiations under the CBD in Nagoya in 2010, where Parties adopted a new protocol on access and benefit sharing of genetic resources as well as an agreement on a new 10-year plan for reducing biodiversity loss. The effectiveness of these new developments remains to be seen.

Policy options

The protection of biodiversity in the Arctic is closely connected to numerous other fields of environmental governance, such as climate change, fisheries, chemicals, forestry and

[33] European Commission, EU Biodiversity Policy Development, online.
[34] The EU is not party to these conventions, their only representation is through EU member states.
[35] EEA, 2009, p. 7.

tourism. With respect to local and regional pressures on biodiversity, integrated ecosystem management is a relevant approach as it creates structures for addressing competing needs of stakeholders. International biodiversity-related agreements such as the CBD or RAMSAR are important tools for knowledge sharing and creating policy contexts for such local/regional approaches. To address global stressors that originate outside the context of integrated ecosystem management, e.g. climate change, international agreements are essential.

EU options

Arctic biodiversity is under threat from a diverse set of pressures, some of which originate in Europe. Current strategies of biodiversity conservation are not adequate for addressing the mounting challenges of climate change and land-use-change in the Arctic. The following presents two key focus areas for policy development in the EU.

Extend conservation networks

The Natura 2000 network is of key importance for the protection of Arctic biodiversity within the EU. Several sites in the European Arctic, i.e. northern Sweden and Finland, are protected under the Bird and Habitat Directives. The European Union should focus on the European Arctic through Natura 2000. These efforts should be combined with the Arctic Council's strategies for Arctic biodiversity protection through its CAFF working group. Specific attention should be paid to resolving conservation goals with local issues (e.g. reindeer herding). There is a necessary balancing act between local, national and global actors in implementing measures, and local buy-in is critical to extending conservation networks.

Create a conservation think tank

Climate change poses a special threat to the current policy focus on conservation and protected areas, as many species are likely to change their geographical range. Several experts have pointed out that conservation strategies may have to be radically rethought and based more on building resilience and capacity for adaptation. Issues such as mobile protected areas and the need to ensure migratory corridors have also been raised. The EU could take a leading role in supporting this rethinking by bringing together scientists and conservation practitioners to focus on research, policy and practice that aim to tackle this challenge.

Multilateral options

These policy options are based on multilateral agreements, some of which do not have a specific Arctic focus (with the exception of the Stockholm Convention on Persistent Organic Pollutants), but that nevertheless are relevant: a key policy strategy can be including Arctic provisions in existing international regimes. While the options presented here are not exhaustive, they can contribute to larger and more comprehensive policy initiatives.

Assist in improving international maritime governance

The EU should focus on the following measures to reduce the loss of marine biodiversity: fully implement the UN Fish Stocks Agreement; regularly re-evaluate fish stocks' maximum sustainable yields; prohibit bottom trawling; and implement new transport regulations. By including provisions under the OSPAR Convention as well as supporting an extension of the NAMMCO area, the potential for protecting Arctic biodiversity could increase. OSPAR itself

has identified greater cooperation with the Arctic Council working groups CAFF, PAME and AMAP as an important strategy for increasing the efficacy of biodiversity protection efforts.[36]

Help reduce the spread of invasive species

Invasive species have the potential to significantly alter Arctic ecosystems. To prevent a drastic change in Arctic biodiversity, the EU could develop policies that aim to monitor and manage species originating in Europe, such as the European Green Crab, which have the potential to invade the Arctic.[37] Source detection, targeting of highest-risk pathways and policies for effective prevention of spreading from within the EU/EEA to the Arctic could mitigate the dangers stemming from invasive species.

Promote cooperation for conservation

Conservation efforts have been seen as mainly a national responsibility, but the new situation will call for more international cooperation in order to avoid sub-optimal solutions in selecting protected areas. However, successful conservation efforts require trust and dialogue with local stakeholders and it will be a challenge to maintain or establish such dialogues when a larger range of actors become involved. New bridging mechanisms between conservation bodies at different levels of governance are likely to become important, as will networks for knowledge sharing and learning. The EU should participate in – and support – the newly formed Intergovernmental Science Policy Platform on Biodiversity and Ecosystem Services (IPBES), which aims to mirror the Intergovernmental Panel on Climate Change (IPCC) in bridging the gap between science and policy to halt the loss of biodiversity.[38]

2.2 Chemicals and transboundary pollution

Status, trends, and pressures

POPs and heavy metals

Persistent organic pollutants (POPs) and heavy metals include a range of anthropogenic and natural substances that are potentially toxic to people and wildlife. The levels of POPs and several heavy metals in the Arctic environment are higher than would be expected in environments without local sources of pollution. For some compounds, such as PCBs and mercury, the levels in some groups of people and some wildlife populations are high enough to cause concern about health effects.

The main source of persistent organic contaminants in the Arctic is long-range transport from outside the region. These contaminants accumulate and biomagnify in the food web and human and wildlife exposure is mainly via diet.

Many POPs and mercury can travel over long distances in the gas phase, only to condense in the Arctic and not volatilise again because of cold temperatures. Some POPs that are not volatile, including the brominated flame retardants (BFRs), travel through the atmosphere on

[36] OSPAR, 2010.
[37] CAFF, 2010, p. 46.
[38] Intergovernmental Science Policy Platform on Biodiversity and Ecosystem Services (IPBES), online.

particles and thus rely on a particle transport processes to reach the Arctic (see Box 1, below). The high levels of contaminants in parts of the Arctic that would otherwise be pristine travel there via several pathways:

- Prevailing wind patterns: Meteorological conditions in the winter tend to favour transport of air masses from polluted regions in Europe and Asia to the Arctic. This provides a fast pathway for volatile contaminants and for contaminants that attach to particles.

- Ocean currents: Vast water masses are transported to the Arctic with ocean currents. Without ice cover, there is recurring exchange between the surface water and the atmosphere but with ice cover, contaminants that are partly soluble in water can become trapped under the ice. Declining ice cover that is expected with a warmer climate is likely to cause the Arctic Ocean to emit some of the trapped contaminants back to the atmosphere. This is already occurring for alpha-HCH, a component of technical HCH.

- Biological factors: Fat plays a key role as an energy source for living organisms in the Arctic. Most POPs accumulate preferentially in fatty tissues creating conditions for bioaccumulation. The substance biomagnifies for each step in the food web, which can lead to very high concentrations in top level predators, including humans. The fact that the Arctic also has long food webs, with third level predators, and that many Arctic animals are long-lived accentuates the potential for accumulating high levels of contaminants.[39]

Many POPs have been deliberately produced for technical applications (e.g. PCBs, BFRs, organic pesticides, PFOS) or are created when the technical products break down (e.g. DDE from DDT; PFOS from perfluorooctanesulfonamides and perfluorooctanesulfonamide ethanols). Some POPs are created as by-products in production of technical products or in various combustion processes (e.g. dioxins and furans). In the Arctic, levels in the environment often reflect proximity to source regions and time trends often reflect changes in production and use volumes. For some of the newer POPs (e.g. BFRs and fluorinated compounds), consumer products that contain these chemicals have shown to be a source to the environment. Products containing POPs can be a source to the environment long after production has ceased.[40]

Mercury and other heavy metals are released into the environment via mining and metal processing or through the products in which the metals are used. Mercury is also mobilized through coal combustion, which is a major source of GHG emissions, while phosphorous fertiliser is a major source of cadmium. For mercury, natural emissions (geothermal sources) are a major source to the environment. Re-emissions are also important, accounting for about one third of emissions to the atmosphere.[41] It is difficult to distinguish natural sources and re-emissions, e.g. mercury released in forest fires.[42]

[39] Summary based on AMAP, 1997, 2002, 2009.
[40] AMAP, 2009, pp. 7, 16.
[41] Selin, 2009.
[42] AMAP, 2002, p. 39.

Climate change is likely to affect both sources and pathways of POPs and mercury through changes in wind patterns or ocean currents and precipitation. Permafrost and glacier melt may also result in higher re-emissions of mercury and other contaminants. However, it is difficult to predict whether long-term climate change will lead to generally increased or decreased loads, as there are processes working in both directions. In terms of affecting long-term levels of and impacts from contaminants in the Arctic, anthropogenic emissions of greenhouse gases may become as important as emissions of the contaminants themselves.[43]

Arctic haze and acidification

Other forms of transboundary air pollution contribute to Arctic haze, a reddish-brown fog in the lower atmosphere at high northern latitudes. It is caused by a mixture of sulfate, black carbon, nitrogen oxides (NO_x), sulphur dioxide (SO_2) and other contaminants. These aerosol particles provide a transport pathway for pollution into the Arctic and can also contribute to climate change.[44] Black carbon (BC), for example, reduces the albedo of Arctic snow and ice and accelerates warming (black carbon is discussed more extensively in Section 2.3 on climate change.

Contamination released into the atmosphere from Europe can reach the Arctic in a few days with the prevailing northerly winds of the Atlantic storm track (see Box 1, below). Up to two-thirds of air pollution associated with some heavy metals and acidifying gases in the Arctic has been attributed to European emissions.[45] Transport is directly responsible for at least 17% of EU-27 air pollutant emissions (not including CO_2).[46] Shipping is a large source of SO_2 and NO_x pollution and one of the largest sources of acid fallout in much of Europe, contributing to water acidification in the Arctic.[47] Climate change is expected to shift the Atlantic storm track further northeast, which would result in the Arctic receiving more European air pollution.[48]

Industry in and around the Arctic also contributes significantly to acidification and contamination, especially locally. This includes severely contaminated areas with major forest damage around the copper-nickel smelters on the Kola Peninsula and at Norilsk in Siberia.[49] Highly acidified soils are not able to support plants.

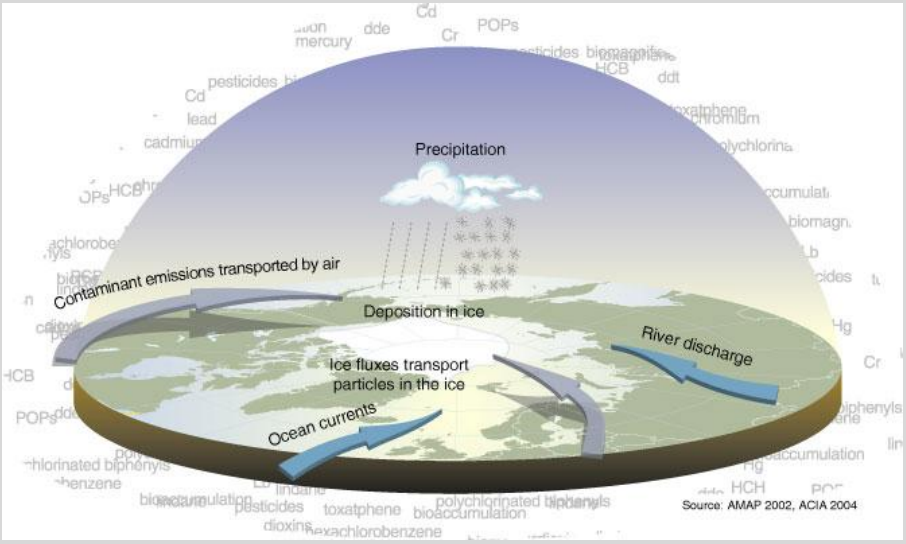
[43] AMAP 2002, p. 111.
[44] ACIA, 2005, p. 1.
[45] EEA, 2004, p. 33.
[46] EEA, 2009, p. 7. This is an underestimate, since certain forms of transportation (international maritime transport, international aviation cruise travel) are not included in the total calculations.
[47] EP, 2003, p. 10.
[48] UNECE, 2007, pp. 20-21.
[49] EEA, 2004.

There is little data on the effect of acidifying compounds on Arctic freshwater and its biota. It does appear that certain Arctic lakes are recovering from acidification due to long-range transboundary SO_2 deposition.[50]

Box 1: Long-range atmospheric transport of pollutants and transboundary air pollution in the Arctic

Contaminants reach the Arctic from other regions through wind, air and water currents (see Figure 2). Rivers and ocean currents are important pathways for water-soluble contaminants and those that are attached to particles in the water. Contaminants from industrial areas are transported to the Arctic through winds, especially in winter.

Figure 2 Pathways of contaminants to the Arctic



Due to the extreme dryness of the Arctic troposphere, wet deposition is minimised and aerosols stay for a long time in the Arctic in winter. Surfaces of constant potential temperature form closed domes over the Arctic, with minimum values in the Arctic boundary layer. They isolate the lower troposphere from the rest of the atmosphere by a transport barrier, known as the "Arctic Front" (AMAP, 2006, p. 7).

The "Arctic Front" hinders low-level transport from relatively warm and humid regions such as North America and East Asia into the Arctic during the cold months. At the same time, it allows such transport at higher altitudes from those regions and at low altitudes from Eurasia (Law and Stohl, 2007; Klonecki et al., 2003; Stohl, 2006; cited in Shindell et al. 2008). Therefore, Arctic haze mainly arises due to pollution from Northern Eurasia, especially in winter. During summer, when the "Arctic Front" is furthest north, emissions from Europe, East Asia, South Asia and North America have a comparable influence on the Arctic surface (per unit emission), with a slightly larger contribution from Europe (Shindell et al., 2008, p. 5356).

Other pathways to the Arctic include ocean currents, which are slow pathways that are now recognized as more important than previously thought, especially for contaminants that are partially water-soluble. Rivers can carry contaminants and process them through sedimentation and re-suspension of particles.

The major transport mechanisms for pollutants vary depending on their chemical and physical properties. Contaminants that bind to air-borne particles are likely to follow the relatively direct routes of wind currents. Semi-volatile compounds, which include most POPs and mercury, also have the ability to revolatilise after they have been deposited. Through the so-called grass-hopper effect (recurring depositions and revolatilisation), these compounds can reach the Arctic from a global pool of contaminants.

[50]AMAP, 2006, p. 96.

Another area of recent concern is ocean acidification in the Arctic Ocean, which may occur sooner and more rapidly in the Arctic than elsewhere. This is primarily a result of increasing levels of atmospheric CO_2 dissolving into seawater (discussed further in Section 2.3 on climate change).

EU's Footprint: POPs and heavy metals

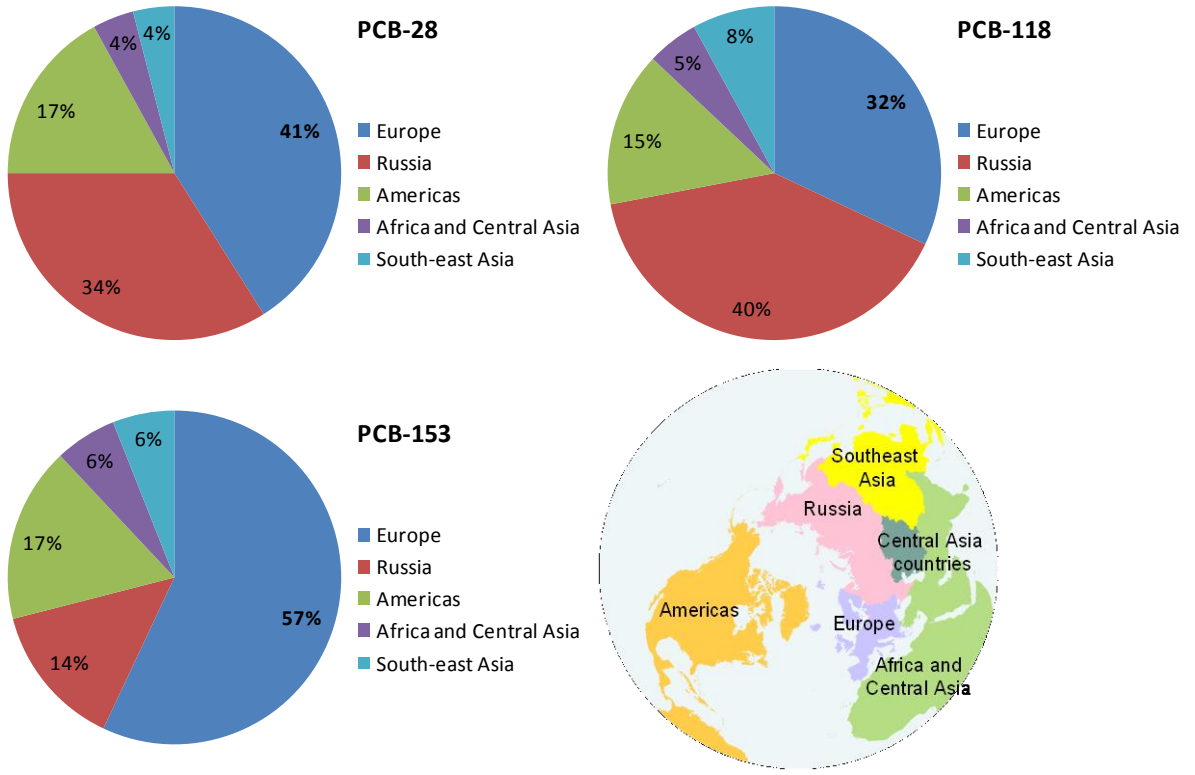
POPs from Europe still pose a significant risk to the Arctic. The use of legacy POPs is forbidden in the EU. However, new and potential POPs are still in use, and legacy POPs continue to be emitted from soil, landfill sites, and POP-containing products. The following POPs were selected due to data availability. The report covers some well known legacy POPs, some substances which are only recently recognised as POPs under the Stockholm Convention (new POPs), or which still are discussed to be POPs (potential POPs).

Polychlorinated biphenyls (PCBs)

PCBs have been produced as an industrial chemical, but are also known to be unintentionally formed in various combustion processes[51]. Although PCB use was banned by some countries in the late 1970s and by the Stockholm Convention on Persistent Organic Pollutants in 2004, they are still present in the soil in many places in Eastern Europe and North America and in PCB-containing products (see Figure 3). PCB emissions from Europe likely originate from PCB-containing products (e.g. transformers, condensers, synthetic materials, wall paint, adhesives, caulking) and from landfill sites and deposits in nature.

[51] Breivik et al., 2004, p.4.

Figure 3 Contributions of selected groups of emission sources of PCB-28, PCB-118, and PCB-153 (POPs) to deposition over the Arctic region in 2005



Note: *Map shows how the geographic areas are defined in the associated pie charts.*

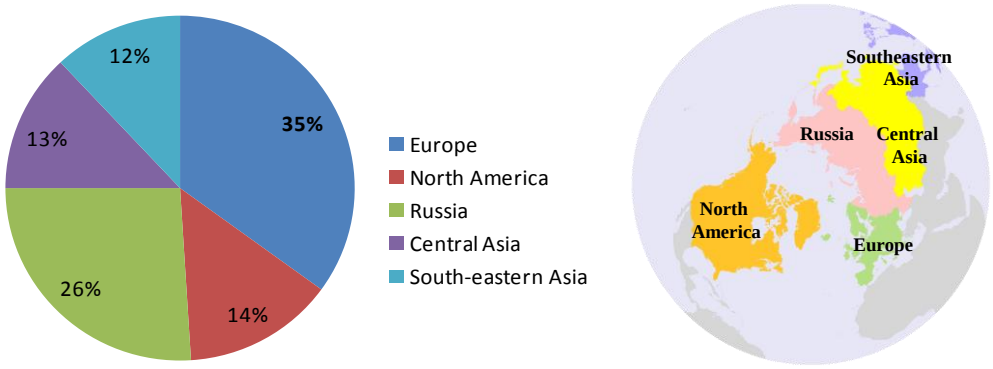
Source: Gusev et al., 2007, p.52.52

Hexachlorobenzene (HCB)

Hexachlorobenzene (HCB) is mainly an industrial by-product (from production of chlorine gas and chlorinated compounds). Figure 4 presents the contributions to total annual depositions of HCB over the Arctic region emitted by selected groups of emission sources for 2005. Depositions of HCB in the Arctic mainly originate from Europe (35%), followed by Russia (26%), North America (14%), Central Asia (13%) and South-east Asia (12%). Europe's share in global HCB emissions, by contrast, is only 16%. HCB is included in Annex C of the Stockholm Convention, which requires Parties to take measures to reduce the unintentional releases with the goal of continuing minimization and, where feasible, ultimate elimination.

[52] Calculations are based on the MSCE-POP model.

Figure 4 Contributions of selected groups of emission sources of HCB (POP) to depositions over the Arctic region in 2005



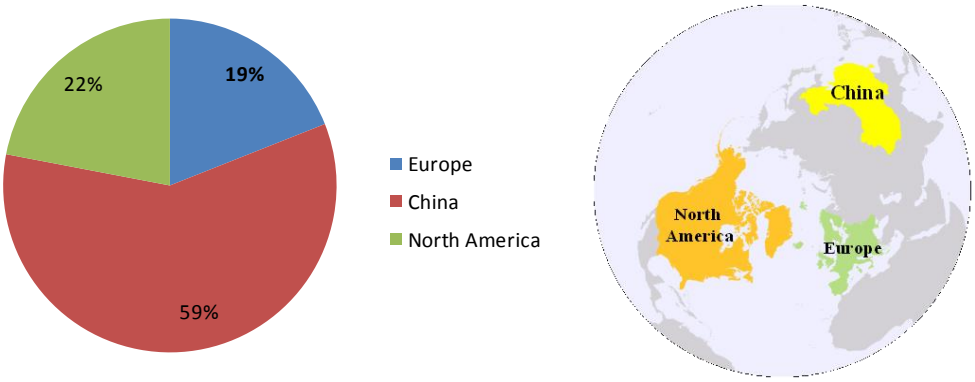
Note: *Map shows how the geographic areas are defined in the associated pie charts.*

Source: Gusev et al., 2007, pg.17 and 59

Lindane (γ-HCH)

Although recognized as a POP under annex A of the Stockholm Convention, lindane (γ-HCH) is still used as an insecticide and is allowed in restricted uses in the EU under the POPs protocol of the Convention on Long Range Transboundary Air Pollution. The production of lindane has decreased rapidly in the last few years and only few countries are still known to produce lindane. Figure 5 shows the contributions of selected groups of emission sources of lindane to depositions over the Arctic region for the year 2005. In sea water, levels are higher north of North America than north of Eurasia, indicating Asia as a major source region.

Figure 5 Contributions of selected groups of emission sources of γ-HCH (POP) to depositions over the Arctic region in 2005



Note: *Map shows how the geographic areas are defined in the associated pie charts.*

Source: Gusev et al., 2007, p.19 and 56.

Brominated flame retardants (BFRs)

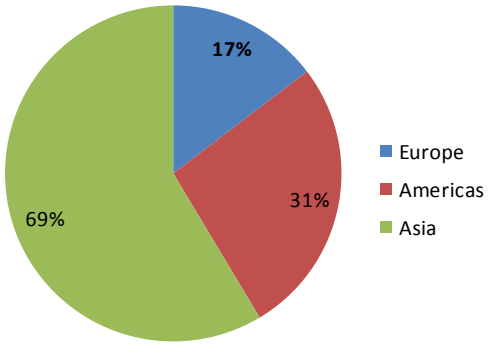
BFRs are brominated organic compounds used in a number of applications including in electrical and electronic equipment, hard plastics, polyurethane foams for furniture and in textiles to prevent them from catching on fire. Some BFRs have been recognized as POPs

under the Stockholm Convention whereas others are under consideration (see further detail in Annex C, Table 7).

Figure 6 shows the estimated annual worldwide market demand for selected BFRs, namely PentaBDE, OctaBDE, DecaBDE, TBBPA and HBCD, in 2001 by three main regions. Asia clearly has the largest demand (59%), followed by the Americas (27%) and Europe (14.6%).[53]

Just as for mercury, Europe affects BFR deposition over the Arctic by demanding goods from BFR intensive industries, particularly from Asia, where many electronic products are manufactured. Therefore a portion of Asia's BFR emissions can be attributable to EU demand.

Figure 6 Estimated annual worldwide market demand for selected BFRs (POP) in 2001 by region



Source: AMAP, 2009, p. 8.

Heavy metals

Heavy metals include both metals and semimetals (metalloids), such as arsenic, cadmium, chromium, copper, lead, mercury, nickel and zinc, which have been associated with contamination and potential toxicity.[54] The main activities that contribute to heavy metal contamination include burning coal, waste incineration, urban and agricultural run-off, industrial discharges, small-scale industrial activities, mining, and landfill leakages.[55] Heavy metals travel to and are re-distributed within the Arctic region via atmospheric, freshwater, oceanic, ice, sediment, and biotic transport mechanisms. Three key heavy metals in the Arctic are mercury, lead, and cadmium. Due to data constraints, only numbers for mercury are included in this report.

Despite substantial mercury emission reductions in North America and Western Europe during the 1980s, global mercury emissions may, in fact, be increasing. Mercury emissions from waste incineration are likely underestimated. The burning of coal in small-scale power plants and residential heaters, principally in Asia, are major sources of current mercury

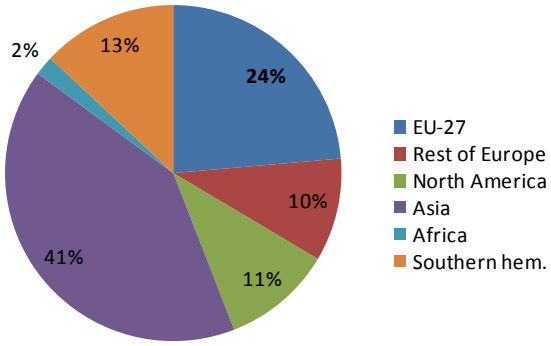
[53] Geographical regions are not further specified in the source literature.
[54] UNEP, 2008, p. 520.
[55] UNEP, 2008.

emissions. These emissions are likely to increase significantly due to economic and population growth in this region.[56]

There is strong evidence that mercury levels in marine birds and mammals in the Canadian Arctic are increasing. Some indications also point to increases in West Greenland. The effects of these levels are not well understood. However, there are also examples of stable or decreasing levels in other regions, which may indicate the importance of local or regional processes. The health risks of current mercury exposures to some people and animals in the Arctic mainly include subtle neurobehavioral effects.

Mercury is emitted to the atmosphere from sources around the world. The EU's share in global mercury emissions is about 5.5%. The largest share of global mercury emissions originates from Asia (67%). Following the results of the hemispheric MSCE-Hg-Hem model, Europe's share of global mercury emissions reaching the Arctic is 34%. The EU-27 accounts for 70.4% of total European mercury emissions. Under the assumption that Arctic sensitivities to emissions from EU-27 are generally similar to that of other European countries – given the similarity in proximity and meteorological conditions – the share of EU emissions of mercury in the Arctic is 24% (see Figure 7).[57]

Figure 7 Source regions of mercury emissions reaching the Arctic, 2005



Sources: Travnikov, O., 2005.

Imports from mercury intensive industries

The EU-27 countries not only affect mercury depositions over the Arctic by emitting mercury, but also by demanding goods from mercury intensive industries all over the world. The EU's share in the final demand of output from these sectors is a first approximation to an evaluation of this responsibility.

The most important anthropogenic sources of mercury are fossil fuel combustion (45.6%), gold production (24%), and metal production excluding gold (10.4%).[58] The share of these industries' output which is consumed domestically is extracted from the OECD's input-output tables for 2005.[59] According to bilateral trade data from the OECD[60] and estimates of the

[56] AMAP, 2005, p. XIII.
[57] Geographical regions are not further specified in the source literature.
[58] AMAP/UNEP, 2008, p. 39.
[59] OECD, 2009, Input-Output tables (edition 2009): 1995–2005.
[60] OECD, 2006, STAN Bilateral Trade Data (2006 edition).

Arctic gross product as a percentage of national GDPs[61], the EU-27's share in the final demand for the output of these industries was estimated. It represents 36% of total output of mercury intensive sectors. This preliminary number, however, does not consider differences in emission intensities between countries and regions.

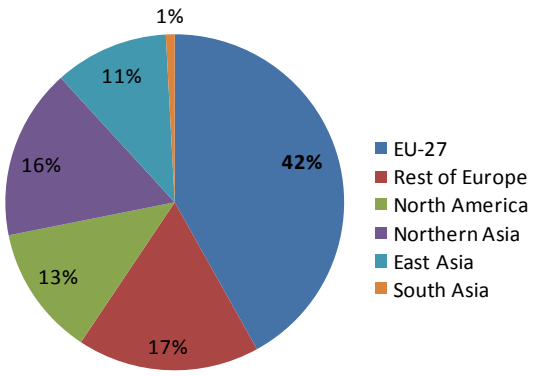
EU's Footprint: Acidifying pollutants

Sulphur is the most important substance contributing to acidification in the Arctic, with nitrogen of secondary importance.

Sulphur dioxide (SO_2) emissions

As shown in Figure 8, sulphur dioxide emissions from the EU-27 have the largest influence on the Arctic (42%), followed by the rest of Europe (17%), Northern Asia (16%), North America (13%), and East Asia (11%). A small amount (1%) of all sulphur dioxide emissions in the Arctic comes from South Asia.

Figure 8 Shares of SO_2 emissions to the Arctic from selected source regions, 2001



***Note**: The geographical regions are defined as follows: Europe 10W–50E, 25N–65N (which also includes North Africa), North America 125W–60W, 15N–55N, East Asia 95E–160E, 15N–50N, and South Asia 50E–95E, 5N–35N.*

In order to separate the EU-27 from the Europe region we assumed that emissions from North Africa and the Middle East have only half the potential to reach the Arctic than European emissions. The calculation of the share of Northern Asia is based on Shindell et al. (2008). We assume that Arctic sensitivities to emissions from Northern Asia are generally similar to their European counterparts given the similarity in proximity and meteorological conditions.

Source: Shindell et al., 2008; EDGAR FT; and calculations by SERI.

Imports from SO_2-intensive industries

Not only the EU's direct emissions but also EU demand for goods produced by SO_2 intensive industries in third countries is responsible for the global emissions of SO_2. The EU's share in the final demand of output from these sectors is a first approximation to an evaluation of this responsibility.

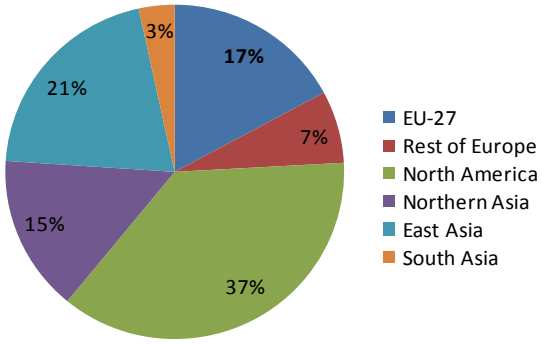
[61] Durhaime et al., 2004, p.77.

The most important anthropogenic sources of sulphur dioxide emissions are metallurgy, power plants, and oil and gas activities.[62] The share of these industries' output, which is consumed domestically, is extracted from the OECD's input-output tables for 2005.[63] The foreign final demand for these products is estimated according to bilateral trade data from the OECD.[64] The EU-27's share in final demand for the output of these industries represents 38% of total output of SO_2 intensive sectors of the Arctic economy. This preliminary number, however, does not consider differences in emission intensities between countries and regions.

Nitrogen oxide (NO_x) emissions

In contrast to its responsibility for other pollutants in the Arctic, Europe does not contribute a disproportionately high share of nitrogen oxides (NO_x). At 17%, the EU-27's share in Arctic NO_x pollution is smaller than that of North America (37%) and East Asia (21%), but still larger than that of Northern Asia (15%), the rest of Europe (7%) and South Asia (3%) (see Figure 9). Europe's share in NO_x emissions does, however, increase by about one third in higher atmospheric layers.

Figure 9 Shares of NO_x emissions to the Arctic from selected source regions, 2001



***Note**: The geographical regions are defined as follows: Europe 10W–50E, 25N–65N (which also includes North Africa), North America 125W–60W, 15N–55N, East Asia 95E–160E, 15N–50N, and South Asia 50E–95E, 5N–35N.*

In order to separate the EU-27 from the Europe region we assumed that emissions from North Africa and the Middle East have only half the potential to reach the Arctic than European emissions.

Source: Shindell et al., 2008, and calculations by SERI.

The data for these calculations are based on a paper by Shindell et al.[65] Note that the authors did not include Northern Asia as a source region as 'its total emissions of most pollutants are comparatively small (at least for anthropogenic sources)'.[66] However, given that emissions from this area can contribute substantially to Arctic pollution due to their proximity to the Arctic, we included Northern Asia in our calculations and assumed that Arctic sensitivities to emissions from Northern Asia are generally similar to their European counterparts given the similarity in proximity and meteorological conditions.

[62] AMAP, 2006, pp. 2-5.
[63] OECD, 2009, Input-Output tables (edition 2009): 1995–2005.
[64] OECD, 2006, STAN Bilateral Trade Data (2006 edition).
[65] Shindell et al., 2008.
[66] Shindell et al., 2008, p. 5354.

Impacts of persistent contaminants and air pollution on the Arctic

The environmental impacts of persistent contaminants depend on exposure and toxicity of the compounds. Several legacy POPs are known to be toxic with impacts on the immune system, the nervous system as well as hormones and reproduction also at relatively low levels. Regarding human health, AMAP has concluded that toxicological studies show that contaminants, at the levels found in some parts of the Arctic, have the potential for adverse health effects in people.[67] Similarly, levels of some compounds are close to or above known effect levels in some wildlife species (e.g. polar bear, Arctic fox, some species of seals and toothed whales, some sea birds and some predatory birds).[68] Assessments of biological impacts have mainly been based on single compounds, but in reality the exposure is to a mixture of chemicals as well as other environmental stressors. Effects that have been observed in wildlife or in epidemiological studies of human health can therefore be difficult to attribute a single cause. Nevertheless, the most recent AMAP assessments of pollution in the Arctic has concluded that "recent studies of biological effects of POPs have been able to confirm the causal link between POPs and observations of adverse health effects in Arctic top predators. They include effects on hormone, immune and reproductive systems".[69] For people, "epidemiological studies, looking at Arctic residents directly provide evidence for subtle immunological, cardiovascular, and reproductive effects due to contaminants in some Arctic populations. These results indicate that POPs, mercury, and lead can affect health of people and especially children at lower levels of exposure than previously thought."[70]

EU policies and multilateral agreements

Use and emission of POPs are regulated at the global level by the Stockholm Convention on Persistent Organic Pollutants, which entered into force in 2004. The European Council approved the POPs convention in 2004.[71] Further detail on international and EU policies and regulation POPs, chemicals and mercury is provided in Annex C.

In addition, the POPs Protocol of the UN-ECE Convention on Long-Range Transboundary Air Pollution provides regulation within the UN-ECE sphere.[72]

Mercury, cadmium and lead are included in the UN-ECE Convention on Long-Range Transboundary Air Pollution Aarhus Protocol on Heavy Metals that targets cadmium, lead and mercury from 1998. The protocol was approved by the European Community in 2001.[73]

UNEP is currently addressing the mercury problem through negotiations for a globally binding treaty that started in 2010. The aim is to address atmospheric emissions as well as the use of mercury in products, processes, wastes, and international trade.[74] Mercury is also subject to discussion in the Basel Convention (management of mercury wastes) and the Rotterdam Convention (prior informed consent in international trade).

[67] AMAP, 2009, p. vii.
[68] AMAP, 2009, p. vii.
[68] AMAP, 2009, p. vi; AMAP 2002, pp. 25-36.
[69] AMAP, 2009, p. vii.
[70] AMAP, 2009, p. vii.
[71] Stockholm Convention on Persistent Organic Pollutants , Status of Ratification, online.
[72] For a list of substances and their regulatory status, see AMAP, 2009, pp. 34-35.
[73] Convention on Transboundary Air Pollution, UN-ECE , Protocol on Heavy Metals, online.
[74] Selin, 2009; UNEP GC decision 25/5 III Chemicals management, including mercury.

Chemicals

EU chemicals policy has been extensively reshaped in recent years with the agreement on a European Community Regulation on chemicals and their safe use (EC 1907/2006) (REACH).[75] It entered into force on 1 June 2007. REACH covers both "existing" and "new" chemicals. It requires manufacturers and importers to gather information on the properties of their chemical substances provided that certain volumes of the substances are placed on the EU market. The assessments made by industry are used to provide information in the supply chain and can be used to prepare proposals for restriction and authorization. REACH provisions will be phased-in over 11 years. Other relevant EU legislation is the restriction of certain hazardous substances in electrical and electronic equipment (RoHS;2002/95/EC), legislation on waste electrical and electronic equipment (WEEE;2002/96/EC), and the regulation on classification, labelling and packaging of substances and mixtures (CLP; No 1272/2008).

Mercury

Mercury is addressed in the EU Mercury Strategy, which is currently under revision. The current strategy proposes an international initiative to reduce mercury supply. Within the EU, the strategy calls for a phase-out of mercury exports from the EU by 2011, reducing EU's demand by prohibiting certain uses of mercury, ensuring safe storage of surpluses, reducing mercury emissions, and protecting against mercury exposure.[76] The EU mercury strategy has led to several specific policy measures.[77] They include that emissions of mercury from major industrial sources are now subject to the EU Directive (96/61/EC) on Integrated Pollution Prevention and Control (IPPC) as well as sector-specific EU directives dealing with large combustion plants and waste incineration. EU legislation also prohibits, or severely restricts, the use of mercury in a range of applications. Other areas of EU legislation set requirements for the management of waste that contains mercury.

Effectiveness of policy instruments

POPs

As a consequence of past bans and restrictions on uses and emissions, levels of many POPs are declining in the Arctic environment. The rates of decline vary between compounds and where the measurements are taken. 'Legacy' POPs (covered by current bans) that show declining levels include PCBs and DDTs. Several other legacy POPs also show signs of declining levels but the lack of data make it difficult to draw firm conclusions (e.g. HCH, dioxins/furans, chlordane, dieldrin, toxaphene). There are some indications that temporal trends may be affected by impacts of climate change, e.g. the declining ice cover leading to increased levels in air. Climate change is also likely to affect transport pathways, which may in turn affect levels in the environment.[78]

For legacy POPs a major concern is that not all countries have ratified the Stockholm Convention (e.g. Russia) and may still be using these substances, with the risk of further

[75] European Commission REACH, online.
[76] European Commission ,Mercury, online.
[77] As listed by MEMO/08/808 Questions and Answers on the EU Mercury Strategy.
[78] AMAP, 2009, pp. 28-29.

emissions to the environment. There is also a continued need to take care of old contaminated sites that can serve as continuous sources to the Arctic environment.

Several POPs that were not included in the original Stockholm Convention and The Convention on Long-Range Transboundary Air Pollution (LRTAP) POPs Protocol but still have some POP characteristics (persistence, ability to transport over long distances, toxicity) have been detected in the Arctic. They include BFRs, fluorinated compounds, and some current use pesticides, and have more recently become regulated or subject to policy review. These developments illustrate that new information about risks to the Arctic environment effectively influences existing international treaties. Moreover, the case of BFRs illustrates that the EU can serve as a forerunner in international chemicals policy in ways that are highly relevant to the Arctic.

EU chemicals policy has recently gone through a major overhaul and it is too early to assess its effectiveness in relation to levels of POPs in the Arctic environment. The effectiveness of the REACH system in preventing emissions of harmful chemicals to the environment will depend on the quality of the assessments as well as on the underlying scientific understanding of toxic mechanisms and properties in the environment. Knowledge about the properties that make chemicals problematic for the Arctic environment has increased in the past 30 years and models have been developed to predict potential for long-range transport and bioaccumulation. One report identified 120 high-production volume organic chemicals that have the potential to undergo long-range transport to the Arctic, of which 65 were predicted to have the ability to biomagnify.[79] Although methods for large-scale screening are being developed, they are not likely to capture substances that become problematic based on different physicochemical or biological mechanisms. Other concerns include the fact that REACH regulates the use and manufacture by individual companies rather than total use and manufacture. Moreover, assessments are focused on single compounds while environmental impacts are likely to be affected by mixtures of a range of compounds and combined stresses, including potential additive effects.

Heavy metals

As a result of the EU's mercury strategy and certain other factors (e.g. switching from coal burning to oil), European emissions of mercury have been cut by about 60% between 1990 and 2000. However, levels of mercury in the Arctic do not seem to be dropping as would be expected from regional emission reductions in Europe and North America. Time trends for biota are scarce but some evidence points to increasing trends recently in the Canadian Arctic and Greenland, whereas levels in lower-level European biota are stable. Levels of mercury in some populations are high enough to affect children's cognitive development, which has led to dietary recommendations as a way to reduce exposure.[80]

A comparison conducted between 1990 and 1996 shows that global mercury consumption has decreased substantially.[81] However, such accounted consumption is only part of the problem. Remaining challenges include artisan use in developing countries and emissions from coal combustion. Reduction in emissions in Europe and North America have been offset by increases from Asia, which now produces half the world's mercury emissions. There are

[79] AMAP, 2009, p. 22.
[80] AMAP, 2002.
[81] UNEP Chemicals, 2002.

indications that these emissions are increasing, mainly due to coal combustion.[82] Mercury is globally distributed, and EU policies on mercury that are only directed toward the use and emissions in the EU can therefore only be partially effective. The potential benefits of reducing mercury emissions are large. A scenario exercise over the period 2005-2020 suggests that global use of available technologies to reduce emission of mercury from coal combustion could save on the order of US$2 billion per year by avoiding damages to children's cognitive development.[83]

A review of global cycling of mercury highlights that mercury policies have generally focused on controlling direct anthropogenic emissions, but that these fluxes represent about one third of present emissions and deposition. Of similar importance is the legacy of historical emissions that continue to circulate in the environment.[84]

Cadmium levels also vary across the Arctic, with no clear overall time trend. Levels of lead have dropped after most countries in the source regions stopped using leaded gasoline.[85]

Acidifying pollutants

Under the LRTAP Convention and various EU-wide directives, the EU has been able to make significant progress in reducing air pollution. The EU has reduced SO_2 emissions by 72% from 1990 to 2007, NOx emissions by 36%, NMVOCs by 47% and particulate emissions by 11% from 2000-2007.[86]

Under LRTAP, emissions from domestic and international aviation during cruising and international maritime navigation are not included in the calculation totals.[87] Including all maritime-related emissions would allow for greater understanding of EU shipping emissions impact on the Arctic.

Policy options

Support ongoing efforts to adopt international mercury agreement

Mercury is globally distributed, and EU policies on mercury that are only directed toward the use and emissions in the EU can only be partially effective. A major priority is therefore to support ongoing efforts towards a global mercury agreement that is also able to address increasing emissions in Asia as well as the use of mercury in developing countries.

Mercury, although a natural element deriving from e.g. volcanic eruptions, is found in rising amounts in Arctic ecosystems as a by-product of the combustion of coal. China is the largest consumer of energy generated from the burning of coal in the world and thus emits the most mercury from coal combustion.[88] Moreover, the global demand for products linked to mercury use, such as medical products, cosmetics or PVC, increasingly demands for more production of mercury.

[82] AMAP, 2002, p. 39.
[83] Sundseth et al., 2010.
[84] Selin, 2009.
[85] AMAP, 2002, p. 39-58.
[86] EEA, 2009, p. 5.
[87] EEA, 2009, p. 10.
[88] USGS, 2010.

China is likely to experience a shortage of mercury from mining by 2013. In order to cover the shortage, 'informal' sources such as illegal mining or imports of mercury could cover those gaps.[89] The EU could support China by providing expertise in reducing illegal mines to make them 'formal' and to develop policies and strategies for the reduction of mercury demand in Europe as well as in China. Moreover, European companies and scientists could be encouraged to share their expertise and technology to enhance Chinese plant performance and to improve coal treatment to reduce mercury emissions.

Implement integrated approach to pollution control

In absence of an international agreement to tackle the transboundary problem of mercury and to mitigate rising mercury and other pollution levels in the Arctic, the EU could utilise an integrated approach.

Coal combustion is major source of mercury emissions, as well as black carbon, acidifying compounds and CO_2. Mercury and black carbon emissions can be better controlled by policies that promote best available technologies, not only within the EU but globally. More efficient coal combustion also reduces the emission of CO_2 per unit of energy. An integrated assessment of the long-term benefits of phasing out coal combustion would be quite illustrative, i.e. an assessment that takes into account the impacts of mercury emissions, local black carbon emissions, transboundary pollution, greenhouse gas emissions, and coal mining on human health, air quality, ecosystems and the climate. The EU could spearhead developing standard methodologies for such an assessment that could be used within the EU as well as in other contexts.

As a basis for an integrated pollution control, both domestic and international companies could be encouraged to introduce control systems for pollutants such as soot, POPs and CO_2. The EU could continue and expand its cooperation with China under the EU and China Partnership on Climate Change, initiated in 2005, on issues such as flue gas cleaning technologies or activated carbon filters, in tandem with the carbon capture and storage (CCS) goal.[90] This would allow the EU to reinforce its commitment not only to mitigating climate change internationally but to controlling pollutants that can exacerbate the impacts of climate change on wildlife and ecosystems, especially in the Arctic. Given that Asia is a large source of mercury, POPs and other air pollutants, an EU commitment to assisting in the reduction of all of these emissions in this part of the world, not only GHGs, could help to reduce the impact of both climate change and pollutants on the Arctic.

Cooperate through REACH

REACH, as one of the regulatory frameworks to control chemicals in the European Union, could initiate cooperation with existing working groups in the Arctic, such as AMAP or CAFF. The need to link already existing branches is a necessary step to control, regulate and monitor POPs and other pollutants in the Arctic. Various memorandums of understanding could serve as templates for connecting AMAP and REACH, such as the exiting agreement between the CBD and CAFF or the expected agreement between the Stockholm Convention and AMAP, which is in preparation.[91,92]

[89] UNEP, 2009, p. 18.
[90] EU@UN, 2005.
[91] Resolution of Cooperation, 2009.

A major concern is that legislation will always be behind compared to the production of new POPs. By the time a compound has been detected in the Arctic environment, it is likely to remain there for a long time. Although the concentration of each substance may be low in relation to toxic levels, impacts on people and wildlife will depend on the combined effects of all substances in the environment, potentially in synergy with other stresses.

In the European Arctic, the EU could support and foster health studies for Arctic communities, as done in the 2005 AMAP Human Health Study for Finnish Lapland. REACH could be extended to include the entire European Arctic (including EEA nations) and the Arctic as a whole, by not only giving more responsibility to industry, but by fostering a close cooperation between industry and local populations before implementing new industrial projects. This would entail an inclusion of local knowledge into the assessment procedure, thus enabling REACH to fill important gaps in knowledge about land use, dietary behaviour or health issues of the local population.

2.3 Climate change

Status, trends, and pressures

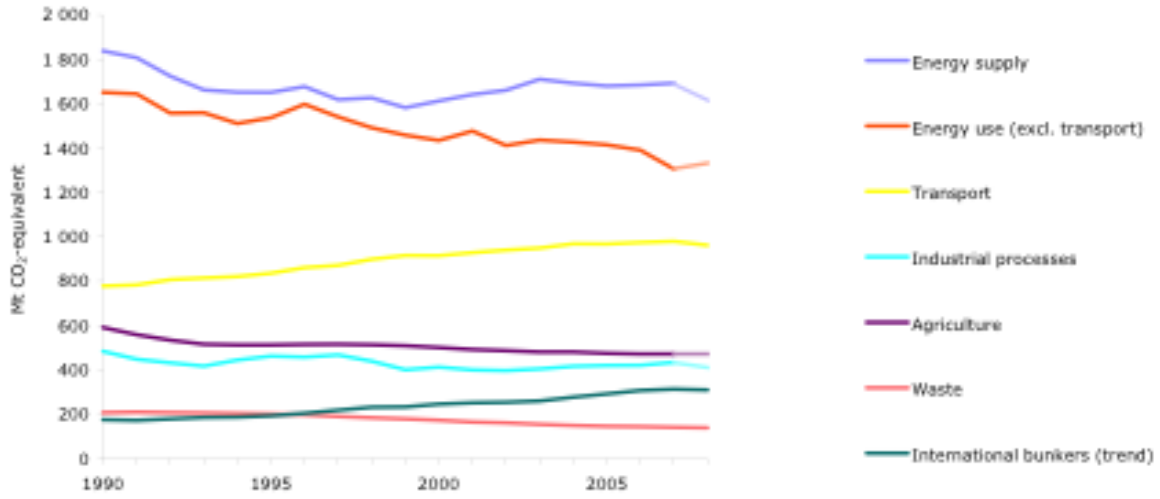
The impacts of climate change are some of the most significant threats facing Arctic communities, wildlife, and ecosystems. High northern latitudes are warming much faster than the rest of the globe, with some land areas in the Arctic increasing in temperature as much as 5°C during the 20th century, and on average 1-2°C across the entire Arctic, which is approximately double the rate of warming experienced by the rest of the world.[93] The Arctic could warm further as much as 2-9°C by 2100.[94] Arctic sea ice is receding at a decadal rate of 2.7%, with 7.4% decadal decreases in the extent of summer ice.[95]

Warming in the Arctic and its impacts can be attributed to the fact that global GHG emissions from anthropogenic sources (mostly fossil fuel combustion) have increased by 70% from 1970 to 2004, which has led to the atmospheric CO_2 concentrations increasing by 35% since the industrial revolution.[96] Combined with an over 140% increase in atmospheric methane (CH_4) concentrations, atmospheric GHG levels are outside the natural range of the past 650,000 years.[97]

[92] AMAP, 2010, p. 8.
[93] IPCC, 2007a, 1.1; IPCC, 2007b, 15.1.1.
[94] IPCC, 2007b, 15.3.2.
[95] IPCC, 2007a, 1.1. The Arctic is experiencing greater warming than the rest of the world for at least four main reasons: decreased albedo due to ice melt; a greater fraction of energy received at the surface warms the atmosphere, as opposed to the tropics where more energy is used for evaporation; the warming atmospheric layer in the Arctic is shallower than in the tropics; and more exposed ocean absorbs more heat, which is then released into the atmosphere (Hassol, 2005, p. 20.)
[96] IPCC, 2007a, 2.1, 2.2.
[97] IPCC, 2007a, 2.2.

Most EU emissions (79%) come from the energy sector, through combustion of fossil fuels and fugitive emissions.[98] Another 9.6% and 8.3% of emissions come from agriculture and industrial processes, respectively.[99]

Figure 10 EU-27 GHG emissions, 1990-2008, by sector (does not include LULUCF)



Source: European Environmental Agency[100].

Figure 10 shows that the EU's emissions continue to decrease in most sectors, the notable exception being transport. Reductions in the electricity sector are mainly due to lower use of coal, which is being displaced with natural gas and renewables.[101] Improved transformation efficiency is also contributing to lower emissions from power generation. However, the main source of emissions reduction is from reduced energy demand by households and services. Generally warmer winters and high fuel prices, which rose by 56% between 2000 and 2008, are the likely drivers of change in this sector.[102] Methane emissions are declining due to changes in the agriculture sector, both from fewer livestock and improved management of manure.[103]

As a major GHG emitter and neighbour of the Arctic, the EU has a stake in the impacts of climate change on Arctic industries, communities, and ecosystems. The EU has indicated its concern over the drastic changes predicted for high northern latitudes as the global average temperature continues to increase, likely creating the need for significant adaptation efforts.[104] There may be economic benefits as well, including increased agricultural, shipping, hydrocarbon and tourism opportunities. However, climatic changes in the Arctic are likely to impact the rest of the globe, which requires that costs and benefits are evaluated holistically.[105]

[98] EEA, 2010b.
[99] EEA, 2010b.
[100] "International bunkers" indicates international aviation and maritime transport.
[101] EEA, 2010d, p. 2.
[102] EEA, 2010d, p. 4.
[103] EEA, 2010d, p. 3.
[104] European Commission, 2008, p. 5.
[105] For example, climate change-induced feedback loops in the Arctic can exacerbate the rate of climate change in the rest of the world. Under extreme climate change scenarios, melting of Arctic glaciers and warming of

Global warming is already causing significant changes in ice and snow cover, sea ice area, extent of permafrost, the number and size of glacial lakes and glaciers, and amount of precipitation in the Arctic region. Changes on both land and sea have the potential to radically change ecosystem dynamics and the human communities that depend on them.

The large temperature increase on Arctic land over the past 100 years has resulted in less snow and ice cover and more "greening," or a northward shift of forests, shrubs and other plants. Temperatures at the top of the permafrost layer have increased by approximately 3°C since 1980, and the maximum area of frozen ground has decreased by 7% in the Northern Hemisphere since 1990.[106] Melting permafrost can cause an initial expansion of surrounding lakes and groundwater, followed by drainage and disappearance of lakes, which has been detected in Alaska and Siberia.[107] Reduced permafrost also results in more Arctic wetlands, which release carbon and methane previously contained in the frozen soil into the atmosphere. These increased emissions would be slightly offset by greater photosynthetic activity, but not completely. Lower soil integrity as a result of thawing permafrost can lead to increased coastal erosion and retreating Arctic coastlines, and can put buildings and other infrastructure at risk.[108] Permafrost is sometimes relied upon as a design element for landfills and containment holding facilities, and its thawing could result in contamination of ground water and large cleanup costs.[109]

Glacial retreat in mountainous areas and melting of lake and river ice changes river flow, increases risk of flooding, and can reduce skiing opportunities, impacting the tourism industry.[110] Greater river flow into the Arctic Ocean, expected to increase by 10-30% by late 21st century, can mean greater hydropower potential but also causes freshening of marine waters.[111] There is concern that significant freshening could impact the thermohaline circulation of the world's oceans, which is a major driver of global weather patterns.[112]

Ocean acidification is another significant concern in the Arctic as a result of increased atmospheric CO_2 concentrations. CO_2 is more soluble in cold water, which results in faster acidification of the Arctic Ocean than in lower latitudes. This can reduce the diversity and abundance of calcareous organisms, an important marine food source, and thereby affect the rest of the Arctic food chain.[113] As greater areas of the Arctic Ocean are exposed to the atmosphere as a consequence of sea ice melt, and as more fresh water enters the Arctic Ocean, the potential for CO_2 dissolution increases and the buffering ability of the ocean decreases, further exacerbating acidification.

Warming of the Arctic Ocean has resulted in reduced sea ice as well as thinning ice. Thin ice melts more rapidly, indicating that the rate of sea ice melt is likely to increase as sea ice continues to become thinner.[114] Sea ice is important for many Arctic species such as polar bears, ringed seals, bowhead whales and narwhals. There may be economic benefits from

---

Arctic waters could disrupt oceanic thermohaline circulation, affecting global weather patterns and temperatures. IPCC, 2007b, 15.4.1.2.

[106] IPCC, 2007a, 1.1.
[107] IPCC, 2007a, 1.1.
[108] IPCC, 2007b, 1.3.3.1.
[109] IPCC, 2007b, 15.7.1.
[110] IPCC, 2007b, 15.4.1.2.
[111] IPCC, 2007b, 15.4.1.2.
[112] IPCC, 2007b, 15.4.1.2.
[113] Barry et al., 2010.
[114] AMAP, 2009, p. 3.

reduced Arctic sea ice, including access to hydrocarbon resources (discussed in Section 2.4 on energy), shipping (discussed in Section 2.8 on transport) and increased fishing stocks (discussed in Section 2.5 on fisheries), though these benefits are highly contingent on future climate change impacts, infrastructure development, world market prices of fossil fuels and development costs.

A northward shift in the habitat ranges of both land and sea species, due to warming waters and changes in ice cover, is expected to further impact Arctic ecosystems. Native Arctic species, which are specially adapted to harsh conditions, may have difficulty competing with invasive species in a changing environment. Changes in migration times and routes of birds and ocean mammals may occur, due both to warming and new anthropogenic interference. Invasive parasites and pests can threaten both plant and animal populations.[115]

The indigenous and local populations that are dependent on these native Arctic species and the stability of local ecosystems for a significant proportion of their food consumption will also be impacted. Consumption of wild food comprises 6-40% of energy intake for Arctic Canadians.[116] Changes in hydrology could put local communities at risk from coastal erosion, increased flooding and reduced drinking water availability.[117] Warming could bring about the introduction of new illnesses to Arctic inhabitants.[118]

There may also be some benefits to Arctic communities, including reduced heating costs, greater agriculture and forestry opportunities (which could increase food security), and reduced mortality from cold-related illnesses.

Though annual trends throughout the past several decades are increasing concern over the rapidity of the onset of climate change impacts, decadal swings in the Arctic system make long term predictions very difficult. Consistent, regular monitoring, such as provided by the DAMOCLES project, will be required for ascertaining the extent and likelihood of various climate change-related impacts on the Arctic.[119]

While reducing the presence of black carbon (BC) in the Arctic may reduce the rate of warming in the near term, BC emissions also influence cloud formation, which can have a cooling effect. It is important to fully understand the consequences of reducing BC emissions on warming.[120] In terms of its net effect on the Arctic warming, reducing deposition of BC on snow and ice would reduce the rate of melting. There are, additionally, other incentives for reducing BC emissions, particularly improving air quality and human health.

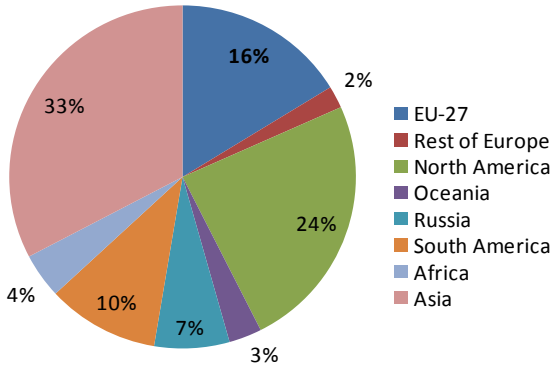
EU's Footprint

The EU's contribution to climate change impacts in the Arctic can be measured most simply through its total annual GHG emissions (see Figure 11). According to the UNFCCC, in 2008

[115] IPCC, 2007b, 15.4.2.2.
[116] IPCC, 2007b, 15.4.5.2.
[117] IPCC, 2007b, 15.4.1.4.
[118] IPCC, 2007b, 15.4.5.2.
[119] DAMOCLES, 2009. The DAMOCLES project is a consortium of institutions and countries (mostly based in Europe but also including Russia and Belarus) which coordinates observation, modeling and forecasting of Arctic climate change impacts.
[120] Chen, et al., 2010.

the EU-27 was the third largest emitter of global GHG emissions (16.3%) after North America (24.2%) and Asia (32.6%).[121,122]

Figure 11 Global shares of greenhouse gas emissions in 2007



***Note**: Turkey's emissions are allocated to Asia.*

Source: UNFCCC, 2009. The GHG data reported by Parties to the UNFCCC contain estimates for direct greenhouse gases, such as carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), perfluorocarbons (PFCs), Hydrofluorocarbons (HFCs), Sulphur hexafluoride (SF_6), as well as for indirect gases such as sulfur dioxide (SO_2), nitrogen oxides (NO_x), carbon monoxide (CO), and non-methane volatile organic compounds (NMVOC). Greenhouse gas emissions also include those from Land Use, Land-Use Change and Forestry (LULUCF).

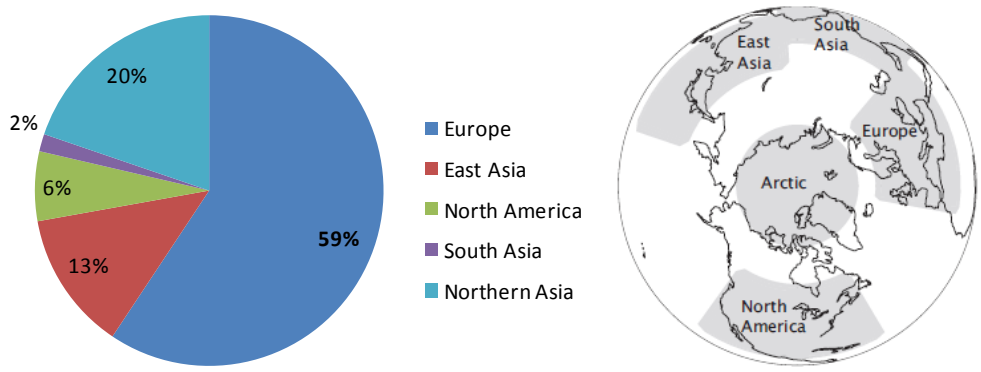
Black carbon (BC) likely has a net positive climate forcing in the Arctic by accumulating on ice and snow, increasing the rate of melting.[123] Recent research has shown that BC is likely to be the second greatest contributor to global warming, after CO_2.[124] Unlike CO_2, which stays in the atmosphere on average 200-300 years, BC's atmospheric lifetime is much shorter. BC particles also travel shorter distances than globally distributed greenhouse gases, and so Europe's geographic proximity to the Arctic is important. Therefore, the proportion of black carbon emissions reaching the Arctic is another indicator of EU contribution to Arctic climate change impacts (see Figure 12).

BC, as a carbonaceous aerosol, not only causes climatic impacts but may also impact the hydrologic cycle[125] and can reduce visibility and surface irradiance. BC emissions are shown to have wide ranging health effects, particularly respiratory and cardiovascular health.[126]

Sources of BC include industrial plants, such as coke and brick kilns (18% of global emissions), diesel combustion, cooking and heating stoves, agricultural burning, and oil and gas flaring.[127] Marine vessels contribute approximately 2% of global BC emissions.[128]

[121] UNFCCC, 2009.
[122] Another option would be total historical contribution to GHG atmospheric levels. This would increase the global contribution of the EU-27 to 23% (1990-2005). IEA, 2007, p. 201.
[123] EC COM(2001) 245, p. 2.
[124] Jacobson, 2010.
[125] AMAP/UNEP, 2008, p. 39.
[126] Durhaime, G., 2004, p.77.
[127] Baum, 2010, p. 19.
[128] Baum, 2010, p. 10.

Figure 12 Shares of anthropogenic black carbon emissions to the Arctic from selected source regions, 2008



***Notes**:**

For pollutants at the surface, where they are most harmful.

Map shows how the geographic areas are defined in the associated pie charts Europe 10W–50 E, 25 N–65 N, North America 125W–60W, 15 N–55 N, East Asia 95 E–160 E, 15 N–50 N, and South Asia 50 E–95 E, 5 N–35 N).

Northern Asian emissions are estimated based on the assumption that Arctic sensitivities to emissions from this region are generally similar to their European counterparts given the similarity in proximity and meteorological conditions.[129]

Shares are derived using results from a comparison of 17 meteorological pollution transport models. The numbers used in this report represent multi-model medians. Model calculations were based on meteorological conditions for the year 2001. The base year of the emission data is 2000 with some models using emission data for other years. However, differences are unlikely to be very important and 2001 conditions were well represented for anthropogenic emissions.[130]

Results for Europe include all emissions from the European continent (incl. Western Russia) and also from parts of Northern Africa and the Arabian Peninsula. Particularly non-EU Eastern European emissions can be expected to contribute a significant share of total European BC depositions in the Arctic.

Source: Shindell et al., 2008, and calculations by SERI.

Generally, BC source locations, particularly in summer, are still debated.[131] The multi-model comparison by Shindell et al. shows standard deviations of about 200% compared to medians, highlighting the big uncertainties in these estimations.[132] Numbers should therefore be used with caution. A new AMAP report on this topic, using new modelling techniques combined with latest results from Arctic surface measurements, is currently in preparation and is expected in spring 2011.

EU policies and multilateral agreements

The EU's main strategies to reduce GHGs are the EU Emissions Trading System (EU ETS) and the Effort Sharing Decision, as well as its implementation of the Kyoto Protocol. See Annex C for complete descriptions of EU climate change policies and relevant international agreements.

[129] Jenny Fisher, personal communication, 6 October 2010.
[130] Drew Shindell, personal communication, 20 October 2010.
[131] see Hirdman et al., 2010, p. 9352.
[132] Shindell et al., 2008.

Effectiveness of policy instruments

EU emissions reduction efforts

EU-27 emissions have been reducing steadily since 2003, due mainly to decreasing final energy demand from households.[133] Decreases were reported in public electricity and heat production sectors, in energy use by manufacturing industries and households, and in agriculture.[134] With 14% lower GHG emissions in 2009 than in 1990, the EU is more than halfway towards meeting its 2020 target.[135] However, it is important to determine why and how these reductions have occurred.

The 2.7 percentage point difference between 2008 and 2009 reductions is largely due to the economic crisis. Many European Union Allowances (EUAs) (5-8%) were unused during this period, which may keep the carbon price lower than optimal for incentivising structural emissions reduction efforts.[136] As long as emission reductions are due to slower economic growth and not structural changes, an increase in economic activity will undo any mitigation progress. A strong carbon price signal facilitated by an ambitious emissions cap is necessary for encouraging structural change. Though the European Commission asserts that some recent emissions reductions were due to mitigation efforts, concern remains that the EU cap is not low enough to create a sufficiently strong carbon price signal.[137]

Operators regulated under the EU ETS and ETS Compliance Forum officials have noted the continued need for strengthened compliance protocol, including increased transparency between regulators, Member States and operators.[138] However, in general, the level of compliance with the ETS has been very strong, with only 0.9% of installations failing to submit the required amount of emissions allowances in 2009.[139]

Regulation of transport sector emissions is a notable weak point in the EU's climate policies. The approach to reducing transport emissions does not sufficiently account for lifecycle fuel emissions for all fuels nor does it cover all transport modes. The use of passenger vehicle efficiency standards is a good starting point, and a necessary tool for incentivising greater vehicle efficiency. However, the use of the 'gCO_2/km' metric is not appropriate for regulating vehicle manufacturers, especially considering that the EU also intends to diversify the transport fuel mix. This is because vehicle manufacturers largely cannot control the carbon intensity of the fuels used by alternative fuel vehicles. Hydrogen fuel cell, electric and even flex-fuel cars are powered by fuels that can come from many different sources: hydrogen and electricity can come from fossil fuels or renewable energy, biofuels can come from an enormous array of biomass types ranging from corn to poplar trees. Regulating vehicle emissions at the vehicle manufacturer level does not directly or efficiently incentivise using lower-carbon feedstocks for these alternative fuels at the fuel producer level. For this reason (and for minimising transaction costs), US carbon-trading policy proposals have regulated

[133] EEA, 2010b.
[134] EEA, 2010a, p. 6.
[135] European Commission, 2010b, p. 3.
[136] European Commission, 2010b, p. 3.
[137] There is also concern that the EU ETS allows for too much offsetting through foreign emissions reductions, such that domestic initiatives are not being sufficiently incentivised. There is controversy over whether certain emissions reduction projects truly meet offsetting qualifications, especially 'additionality'. Carr, 2010.
[138] EC: Environment, 2010a.
[139] Europa, 2009.

lifecycle transport emissions at the fuel producer and importer level (see H.R. 2454 and S.1733).[140]

However, the EU may be on track with meeting its passenger vehicle efficiency goals, with 17% of EU vehicles sold in 2008 producing less than 120 gCO_2/km.[141]

There is also a need for stricter regulation of greenhouse gases that are also ozone depleting substances (ODS) and which are not covered by either Kyoto or Montreal Protocols.[142] If ODSs and their industrial substitutes are not appropriately disposed of or recycled, leakage emissions have the potential to grow significantly in the future. Hydrofluorocarbons (HFCs) alone could contribute from 9-19% of global CO_2-equivalent emissions by 2050 under a business as usual scenario.[143]

The EU regulates black carbon (BC) indirectly under its air quality directives. BC contributes to $PM_{2.5}$ and PM_{10} air pollution, so any regulation that limits these compounds indirectly impacts BC emissions. The EU has been able to reduce PM2.5 and PM10 emissions by 12% and 11% respectively over 2000 – 2007.[144]

EU support for Arctic climate adaptation institutions and research

Though all Arctic nations are highly developed and therefore are not likely to need international funding assistance for climate adaptation efforts, the EU can still play a role in supporting and carrying out research that informs Arctic climate adaptation efforts as well as assisting in the development of institutions which facilitate adaptation. Developing countries (LDCs, SIDS, African countries) and low carbon growth development strategies are receiving a large majority of the emphasis on adaptation needs, but as indicated above, Arctic communities will also face significant climate-related challenges.

It is unclear how much EU climate adaptation research would be dedicated to Arctic issues and if this effort would be supported by a centralised fund, such as proposed Climate Fund, and/or would be built into existing EU research and cooperation programmes such as the Northern Dimension and future Framework Programmes. The EU is still determining whether public financing would come directly from the EU budget, from a new common Climate Fund external to the EU budget, or whether Member States will contribute directly to projects, though still under the umbrella of the EU's single, global offer.[145] It is also unclear what criteria will guide the distribution of this funding and thereby its Arctic implications, if any.

More information is needed on what Arctic adaptation projects will be feasible and/or necessary as well as their costs. Potential areas in need of research are discussed in the Policy options below.

Policy options

Policies relevant to reducing the impact of climate change on the Arctic need to address both reducing emissions from the EU (and rest of globe) as well as supporting Arctic climate

[140] US House of Representatives, 2009, Sec. 722; US Senate 2009, Sec. 722.
[141] European Commission, 2010a, p. 6.
[142] Sher and Sauer, 2009, p. 4.
[143] Sher and Sauer, 2009, p. 1.
[144] EEA, 2009, pp. 42, 45.
[145] European Commission, 2009a, p. 11.

adaptation strategies and ensuring that climate mitigation strategies do not negatively impact the Arctic.

Reduce domestic GHG emissions

The EU should implement its more ambitious emissions reduction goal of 30% by 2020, with a 40% conditional goal in the event an international climate agreement is reached. Since the 20% goal was set, the economic costs of reaching it have decreased and made the 30% goal more feasible. Currently, the 20% goal would cost 0.45% of EU GDP by 2020, while the 30% goal would cost 0.54%, or €81 billion.[146] Furthermore, the International Energy Agency (IEA) estimates that increases in costs for delaying emissions reductions are substantial, reaching €300-400 billion globally for every year of delay in order to meet the 80% reduction goal by 2050.[147] Some strategies already under consideration by the EU for meeting the 30% goal are tightening the ETS cap, incentivising fast movement by industries by allocating free allowances to early adopters and implementing a carbon tax in non-ETS sectors.[148]

The EU could provide incentives to prioritize climate mitigation actions that include co-benefits for the Arctic region. The EU could also make the assessment of such co-benefits compulsory prior to the development of climate mitigation strategies. For example, carbon capture and storage is a component of EU climate mitigation policy and might be developed in or close to Arctic offshore oil and gas fields. Additional guidelines and survey will have to be conducted in order to ensure that this option does not create new and additional risks for the Arctic environment and people.

Reduce domestic black carbon (BC)

Some representatives from the European Commission have stated they are hesitant to shift the climate mitigation focus from CO_2 to BC.[149] However, there need not be a shift in focus, but rather additional efforts made to reduce the effect of BC on the rate of melting in the Arctic. BC emissions reductions is a short-term mitigation strategy, while CO_2 reductions would only impact the rate of climate change in the long term. Eliminating BC emissions from fossil fuel and biofuel combustion could reduce warming in the Arctic by up to 1.7°C within the next 15 years.[150]

One policy option for reducing BC emissions from the EU, which has already outlawed most agricultural burning and already limits these emissions (albeit indirectly) from most stationary sources, is to enforce stricter emissions standards for diesel engines. Enforcing sufficiently strict particulate standards for vehicles, such that Diesel Particulate Filters for passenger and commercial vehicles are required could reduce these emissions significantly. It is important to note that burning of biofuels also contributes to BC emissions, so they would need to be incorporated completely in such legislation. The Euro 5 and Euro 6 standards on light-duty vehicle emissions will be affecting vehicle emissions within the next five years, but there is some concern that these standards are not sufficiently stringent and are not being implemented with the urgency required for reducing the impacts of BC on the Arctic.[151]

[146] European Commission, 2010b, p. 8.
[147] European Commission, 2010a, p. 3.
[148] European Commission, 2010b, p. 7.
[149] EurActiv, 2010.
[150] Jacobson, 2010.
[151] Webster, 2009.

The EU can also directly require utilising particulate control technology in all vehicles, which is claimed to be an economically feasible strategy.[152]

Another important policy option for reducing EU BC emissions is to incorporate a ceiling on BC emissions under the National Emissions Ceiling directive as well as include BC under the Gothenburg Protocol of LRTAP.

Continue to promote global emissions reductions

The EU has been adjusting its emissions reduction policies through the EU ETS and other initiatives for over five years, and it is on track to make these policies even more effective. However, there is still opportunity for the EU to include setting more ambitious and world-leading targets for emissions reductions and pressuring other countries to follow.

The EU can do this by having a stronger voice at UNFCCC negotiations, where it can push for more aggressive and binding reduction targets than what has been proposed thus far. It is clear that existing, voluntary emissions reduction pledges listed under the Copenhagen Accord are not sufficient for keeping global temperature change under 2°C.[153]

The EU could also take the lead in calling for special consideration of the Arctic region under the UNFCCC, due to the high rate of temperature increase in the region as well as the vulnerability of the local ecosystems. Such a focus could include specific policies aiming to address feedback mechanisms such as thawing permafrost and melting sea ice. Addressing such mechanisms, as well as enhancing international cooperation, joint research, and exchange of information on issues specific to climate adaptation across the Arctic region, is key to international mitigation efforts.

Leadership is necessary for reducing global subsidies for high carbon fuels, including coal and petroleum. While there is, in general, global agreement that fossil fuel subsidies must be phased out to provide a level playing field for lower carbon technologies, there has not been significant movement in this direction. The Commission is currently debating whether or not to extend EU coal subsidies for another 12 years.[154] However, a gradual phase out of subsidies for coal mines by 2014[155] would encourage countries like Germany abandon its plans to build more coal power plants.[156]

Support reducing emissions from international shipping

The EU can also support the development of an international instrument to regulate maritime emissions. All revenues resulting from the implementation of a CO_2 charge or an operator emissions trading could be committed to the financing mechanism under the UNFCCC. Such an approach would provide incentive for developing nations to support the inclusion of maritime transport emissions in a post-2012 climate regime as it would have the potential to provide a major source of climate finance.

Currently, the EU has said it will move forward alone if there is no international agreement by the end of 2011.[157] In order to strengthen the positive incentive created by this position, the

[152] Webster, 2009.
[153] European Commission, 2010a, p. 3.
[154] ENDS, 2010, Brussels seeks to end coal subsidies by 2014.
[155] ENDS, 2010, Brussels seeks to end coal subsidies by 2014.
[156] DW-World, 2007; Schultz, 2010.
[157] COM(2010)265, p. 8.

EU could build a broader coalition of leading countries in order to ensure that it will not be the only party to the negotiation to move forward after 2011, should no international agreement be found under the UNFCCC. In such a case, the EU could also endeavour to find synergies in other international forums dealing with maritime transport, such as the International Convention on the Prevention of Pollution from Ships (MARPOL).

Provide support for adaptation research

The EU can continue to support Arctic-related climate research, and encourage more research on Arctic adaptation needs and strategies. Possible new or existing sources of funding and effort should be evaluated to ensure Arctic needs are supported.

Research should target the most pressing areas in need of adaptation. Currently, it is largely unclear what the largest Arctic impacts will be and how much can feasibly be done to address them. Therefore, more research is required on these themes, including:[158]

- A fine-scaled assessment of climate impacts on Arctic;
- Understanding the impact of multiple drivers (in addition to climate change impacts, economic development, emigration, etc.) on Arctic communities and ecosystems;
- Understanding the adaptive capacity of communities and ecosystems under significant change, to guide feasibility of adaptation strategies;
- Improved monitoring of possible impacts, in order to determine which are most pressing;
- Adaptation costs estimates for Arctic area, which will become clearer as research suggested above is carried out.

In addition to research needs, institutions for facilitating climate adaptation will need to be developed and supported. Adaptation efforts will likely require addressing infrastructure risks and flood damage from thawing permafrost, and capacity building in helping Arctic communities adapt to climate change impacts. This will require connecting local and indigenous populations to outside markets, familiarizing them with new technologies and facilitating resource sharing among indigenous groups and communities.[159] Indigenous peoples must be able to practice subsistence activities in protected areas to help protect biodiversity and cultural integrity. A better understanding is needed of what each community will require, since it appears that some groups are better at adapting than others.

Responsible development of the new opportunities that may become available due to climate change will be necessary, including in the fishing industry (see Section 2 on fisheries), tourism (Section 2.8 on tourism), hydrocarbon activities (see Section 2.4 on energy) and shipping (see Section 2.8 on transport).

[158] IPCC, 2007b, 15.8.
[159] IPCC, 2007b, 15.5.

2.4 Energy

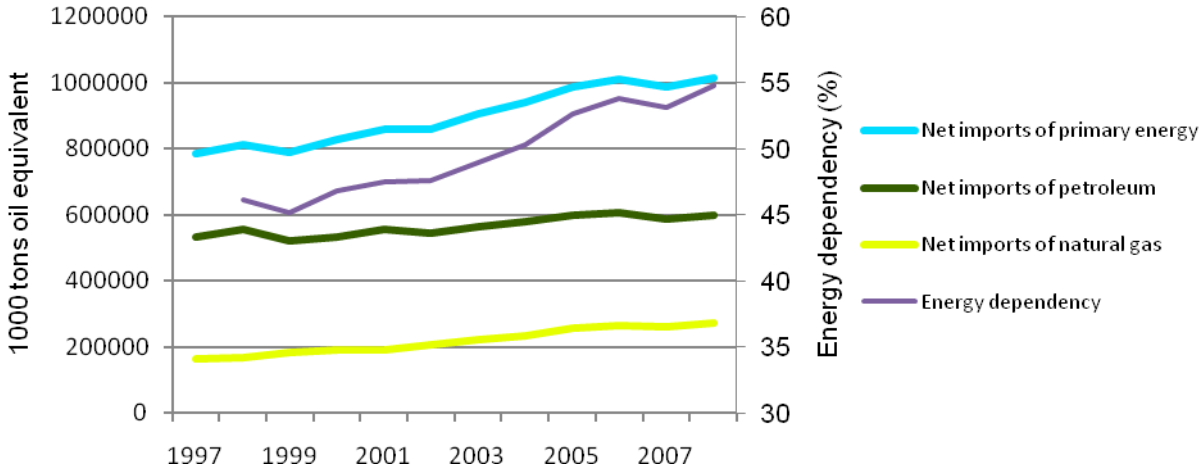
Status, trends, and pressures

The EU has one of the largest energy markets in the world.[160] Its enormous number and variety of energy producers and consumers, both within and outside the EU, makes for a complex policy landscape. EU energy policies largely deal with three main topic areas: (1) energy security, (2) addressing the environmental impacts of energy production and energy use, and (3) trade and market issues within and among Member States and external trading partners. This section will focus on the first two categories, which have the most relevance for the EU's energy relationship with the Arctic.

The EU produces approximately 46% of its total energy needs, a percentage which has been decreasing steadily for over a decade. Primary production of low-carbon energy, such as geothermal, solar, wind, and nuclear has been on the rise within the EU while primary production of coal, natural gas and petroleum has been slowly decreasing.

However, EU imports of high-carbon fuel sources are steadily rising, which indicates EU energy dependence on outside sources is increasing. This trend indicates that energy security will continue to become a greater challenge for the EU, whose energy dependence continues to grow (see Figure 13).[161]

Figure 13 EU-27 Net energy imports and energy dependence, 1997-2008



Source: Eurostat, Energy, 2010 [162].

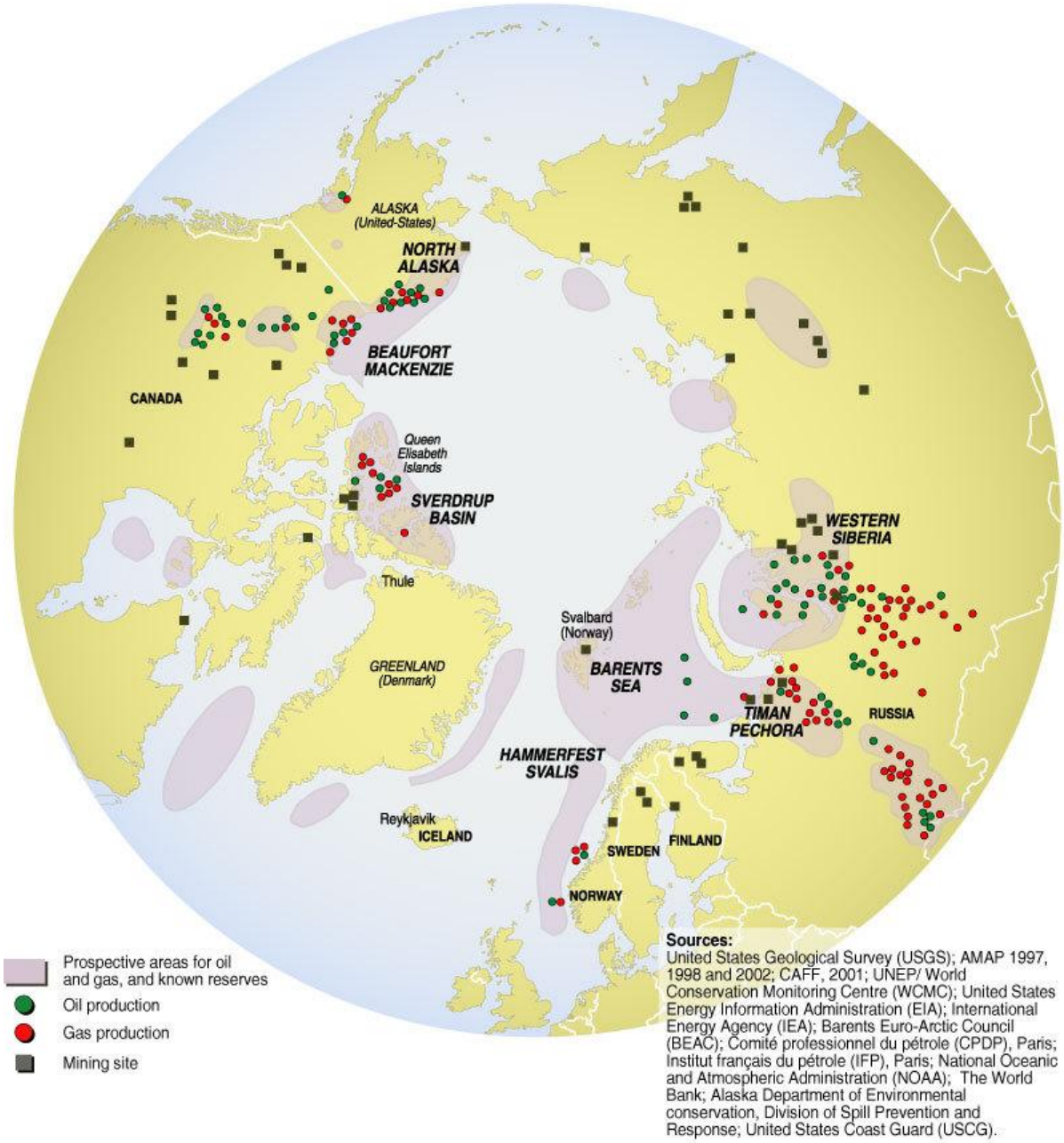
Most of the EU's energy imports come from the Middle East, Africa, and Russia, with Russia being the most important source of natural gas and petroleum.

[160] European Commission, 2006, p. 4.
[161] European Commission, 2001, p. 2 .
[162] Eurostat, 2010, Main Tables, Energy.

The EU has already begun to look to the Arctic as a source of hydrocarbons which could potentially increase EU energy security in the coming decades, particularly in the Barents Sea and through its well-established energy-trade relationship with Russia and Norway (see Figure 14)[163]. Norway has recently announced the availability of over 90 new blocks in the Barents and Norwegian Seas for the 2011 round of oil drilling licensing.[164] Advances in technology have made Arctic sources of hydrocarbons increasingly attractive, as well as the fact that it is a comparatively safer region of the world to extract oil and gas.[165] A recent US Geological Survey (USGS) study estimates that there are approximately 400 billion barrels of oil reserves in the Arctic, 84% of which are located offshore.[166] This would comprise 6.7% of the world's proven oil reserves and 26% of natural gas reserves, which are recoverable with current technology (but perhaps not all economically attractive).[167] The study also assumes it is possible to retrieve oil and gas through year-round sea ice.[168]

[163] European Commission, 2008b, p. 6, Arctic Energy Agenda, 2005.
[164] BarentsObserver.com, 2010a.
[165] Though some believe rising fuel costs make Arctic hydrocarbon recovery more economically feasible, it also increases the cost of operation in the Arctic. Therefore, a stable price regime may be more conducive to Arctic oil and gas development. Koivurova et al., 2008, p. 6; Huntington, 2007, p, 33.
[166] USGS, 2008, p. 4.
[167] USGS, 2008, p. 4.
[168] This is a controversial assumption. See James, 2010; Schmidt, 2010. Developments in the oil and gas industry have focused on improving the ability to operate in one-year sea ice. Keener and Allan, 2009.

Figure 14 Arctic hydrocarbon resources, existing sites and prospective areas, 2001



Source: UNEP/GRID-Arendal, 2007.

Receding Arctic sea ice due to climate change is likely to make recovery of offshore Arctic hydrocarbons even more attractive, but challenges will still remain.[169] Oil and gas infrastructure need to operate in and withstand difficult ice and weather conditions and changing sea and ice conditions require tracking with highly sophisticated technology.[170] This heightened risk is compounded by growing concerns over the safety and reliability of offshore drilling, illustrated by the recent Deepwater Horizon oil spill in the Gulf of Mexico. Nevertheless, BP plans to begin Arctic outer continental shelf production drilling in the

[169] Hasle et al., 2009; Schmidt, 2010; James 2010.
[170] Fissel, et al., 2009; Timco and Weeks, 2010; Spencer, et al., 2007.

Beaufort Sea from an artificial island in shallow nearshore water starting September 2010.[171] Shell also planned to begin exploratory drilling in 2010 up to 140 miles offshore in the Chuckchi Sea between Alaska and Russia.[172] Other companies will likely begin to follow suit, though no other companies have yet filed for drilling permits and are awaiting the results of various legal challenges to preliminary oil and gas development in the Arctic.[173] It is therefore of the utmost importance that policies be in place which ensure Arctic hydrocarbon exploitation grows in a controlled, environmentally and socially responsible manner.

Oil industry and EU legislators have taken some pause after the Gulf of Mexico oil spill in the spring and summer of 2010, but it is unclear the extent to which legislative action will be taken to prevent further accidents. European Commissioners met with oil industry representatives several times since the Deepwater Horizon oil spill to discuss issues of safety, and have discussed a moratorium on offshore drilling, as Norway has done (though the moratorium does not appear to apply to exploratory drilling).[174] There are other options: Greenland, for example, has innovatively decided to charge oil companies an up-front 'bond' of US$2 billion in order to compensate the country in the event of an oil spill off its coasts.[175]

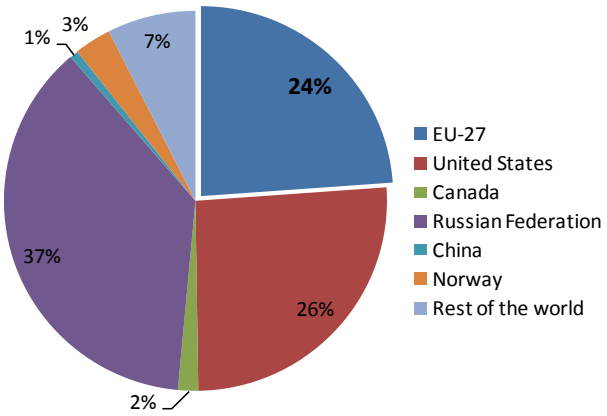
On 13 October 2010, the European Commission adopted the Communication, 'Facing the challenge of the safety of offshore oil and gas activities', which states: 'the Arctic equally merits specific attention due to its particularly sensitive natural environment, harsh climate and significant unexplored hydrocarbon reserves. Binding international rules or benchmarks should be introduced, building inter alia on the guidelines of the Arctic Council. Contacts with Arctic countries are essential in this regard.'[176] This Communication highlights that the EU's Arctic footprint will be affected by regulatory action on offshore drilling currently taking place in Arctic countries, which would impact the operations and safety requirements for EU companies.

EU's Footprint

The EU-27 receives 24% of the total output of the Arctic's oil and gas industry, including pipeline transportation (see Figure 15). Market influence and cooperation with Arctic energy partners will be important tools for encouraging sustainable energy exploitation in the Arctic.

[171] Green Energy News, 2010, BP Plans New Offshore Drilling Exploit in Arctic, online.
[172] Joling, 2010.
[173] Dennis Thurston, personal communication, 20 September 2010.
[174] Europe's Energy Portal, 2010; Euractiv, 2010; McCarthy, 2010.
[175] Webb, 2010.
[176] European Commission, 2010, p. 10.

Figure 15 Final demand for Arctic oil and gas production, including pipeline transportation, 2005



***Note**: The shares were calculated using GDP per capita data for the oil and gas extracting industry including pipeline transportation from AMAP's Arctic Oil and Gas 2007 report[177] and multiplying these with population data from the Arctic Human Development Report.[178] The share of the oil and gas industry's output which is consumed domestically is extracted from the OECD's input-output tables for 2005.[179] Actual imports and exports of Arctic territories are poorly documented, thus bilateral trade shares from the OECD[180] were used that do not distinguish between energy and non-energy mining and quarrying activities. This assumption could cause some distortions. However, a more accurate approximation cannot be derived at this stage.*

Source: Sustainable Environment Research Institute (SERI), 2010.

The Arctic's most infrastructure-intensive industries are oil, gas, diamond and metal extraction. Therefore, the EU's imports from all these industries, not only oil and gas, can be taken as a proxy for environmental impact from infrastructure. The EU's share represents 60% of total exports of the Arctic extractive industries.[181]

Impacts on the Arctic from energy production and consumption that can be attributed to the EU are divided into two categories: (1) transboundary emissions and physical impacts from EU energy consumption, and (2) direct impacts from activities in the Arctic to extract energy which is eventually consumed by the EU. Since the former category is addressed in several other sections (Section 2.3 on climate change section, Section 2.2 on chemicals and transboundary pollution), this section focuses on the latter.

Direct environmental impacts in the Arctic from energy extraction, through mining, drilling, infrastructure development and accidents pose a threat to ecosystems and communities already at risk due to climate change.

Oil spills, such as the Exxon Valdez accident in 1989, the Komi Republic pipeline leak in 1994 or the Alaskan North Slope pipeline leak in 2006, have created challenges for clean-up, environmental rehabilitation, and are economically costly.[182] However, given that 84% of

[177] AMAP, 2008, p.26.
[178] Bogoyavlenskiy, 2004, p.27.
[179] OECD, 2009, Input-Output tables (edition 2009): 1995–2005, Paris.
[180] OECD, 2006, STAN bilateral trade database (edition 2006): 1988–2004, Paris.
[181] The EU-27's share in exports from the Arctic extractive industries was calculated based on bilateral trade data from the OECD and additional information about the Arctic gross product as a percentage of national GDPs. OECD, 2009; Durhaime, G., 2004, p.77.
[182] Huntington et al., 2007, p. 29.

Arctic reserves are located offshore, it is of particular concern that there is little knowledge on the suitability of existing methods for oil clean-up in ice covered waters or in areas of broken sea ice.[183] There is also concern that if a spill from an uncontrolled well in an ice-free area occurs late in the Arctic summer, ice conditions could change quickly enough to prevent drilling a relief well until the following year.[184] For more specific information on the effect of oil pollution on wildlife and their habitats see Section 2.8 on transport.

Operational activities can be a significant source of pollution and physical impact and can have cumulative effects. For example, oil and gas flaring would release BC emissions, which can increase the rate of warming within the Arctic. Seismic exploration has been shown to affect the migration patterns of bowhead whales and reduces the accessibility of indigenous hunters to their game.[185] It may also cause polar bears to abandon their dens and thereby increase cub mortality.[186]

The effects of drilling activity, pipelines and subsurface installations on marine communities and seafloors vary. The geological composition of the sea floor appears to recover from exploratory drilling within a year in some cases.[187] The biological impacts depend on the communities present and their level of sensitivity to disturbance.[188]

Fuel combustion for onsite power generation, well testing, gas flaring and other operational leaks regularly release air pollutants such as NO_x, SO_2, VOCs, CO_2, methane and particulate matter into the atmosphere above the Arctic, contributing to Arctic haze and potentially exacerbating ice melt.

In order to explore the Arctic's large reserves of oil, gas and other minerals, pipelines, roads, harbour facilities and other transport infrastructure are required. These infrastructure developments increase land fragmentation, threaten biodiversity, and heighten the risk of polluting land and water ecosystems. The reduced size of natural habitats is a growing problem. Birds and predators, which have large ranges and travel long distances for food, are especially sensitive to infrastructure. In northern Norway, undisturbed areas have been reduced from 48% in 1900 to only 11.8% in 1998.[189] UNEP reports that current infrastructure growth will disturb 50-80% of Arctic within 50 years.[190] This also puts pressure on traditional occupations, such as reindeer husbandry, for which land is becoming scarce due to the current growth of infrastructure related to transportation, oil, gas and mineral extraction.[191]

Due to the fact that costs of dismantlement and rehabilitation are high, onshore energy infrastructure in the Arctic may stay in place, even after its use is discontinued, and so can continue its environmental impacts without monitoring.[192] Though decommissioning of this infrastructure is required, strong oversight is needed to ensure companies are held accountable for this step in the oil and gas development process.[193]

[183] CBC News, 2010; Schmidt, 2010.
[184] Joling, 2010; Schmidt, 2010.
[185] Nations et al. 2009; IWC-SC, 2004; NAS, 2003, p. 2; CAFF, 2001, p. 96; But see Rankin and Evans, 1998.
[186] CAFF, 2001, p. 96.
[187] Corrêa et al., 2008, p. 11.
[188] Williams et al. 2009, pp. 2-3.
[189] EEA, 2004, p. 16.
[190] CAFF, 2001, p. 99.
[191] EEA, 2004.
[192] NAS, 2003, p. 2.
[193] Huntington, 2007, p. xii.

There is also concern over nuclear contamination in the Arctic from dumping of nuclear waste and spent fuel, nuclear accidents like Chernobyl, atmospheric nuclear testing, and reprocessing plants in Europe.[194] A large portion of the dumping, from waste and reactors, can be attributed to the Soviet Union and Russia, while both the Soviet Union and the US are largely responsible for pollution from nuclear testing, with France, China and the UK also contributing.[195]

The social impacts of energy industry development on indigenous peoples are significant, but not always negative. Indigenous and local communities in the North Slope of Alaska admit that they have difficulty determining whether the pros of development, including employment opportunities, better health care and schools, outweigh the cons of lasting landscape alteration and reduced hunting success.[196] These communities are particularly concerned that the benefits will not last after the oil and gas has been exhausted, while the environmental impacts and abandoned infrastructure will remain.[197] Corresponding viewpoints have been expressed by SamiNorth – the Sami Institutions Network on Sami Affairs in Norway – which has emphasised the importance of a development framework in the High North that preserves the viability of indigenous peoples' communities when non-renewable resources run out. Such a framework allows indigenous peoples to take advantage of the opportunities presented by future industrial utilisation of natural resources, while at the same time ensuring that traditional industries, culture, languages and the community life of indigenous peoples are safeguarded and developed in a sustainable manner.[198]

EU policies and multilateral initiatives

Out of the many EU directives on energy, those most relevant to the Arctic regulate how much and what type of energy is used within the EU, the geographic sources of that energy, and its quality. The 2006 Green Paper on a European Strategy for Sustainable, Competitive and Secure Energy lists the following objectives for EU energy:

- Foster a competitive and open energy market, including single EU-wide electricity and gas markets,
- Encourage technology innovation, particularly with regard to renewable energy
- Diversify the energy mix
- Increase EU-wide solidarity with regard to energy policies (encouraging Member States to speak with one voice on energy to increase security)
- Prioritize sustainable development
- Calls for an international agreement on energy efficiency

Increasing reliance on renewable energy and maximizing efficiency will improve the energy security prospects of the EU and can help alleviate some of its reliance on oil and natural gas imports, including from the Arctic. However, significant hydrocarbon imports will still be needed for the foreseeable future and thus many EU foreign policies deal with improving

[194] Bøhmer et al., 2001, p. 48.
[195] Bøhmer et al., 2001, p. 50.
[196] NAS, 2003, p. 1.
[197] NAS, 2003, p. 3.
[198] Árran, 2007, II, c; Nystø, 2010, No. 4.

external energy-trade relationships. See Annex C for a description of key EU energy directives related to renewable energy requirements, energy efficiency and greening transport; external and energy security policy; and reducing the environmental footprint of the energy industry and multilateral agreements.

Effectiveness of policy instruments

EU Policies

Renewable Energy and Efficiency

The EU has made significant strides in the areas of renewable energy and energy efficiency over the past decades. Though it has not completely achieved all its quantitative goals, and could likely set even more stringent goals, the 20% renewable energy and energy efficiency guidelines are important predecessors to further progress.

Under the Renewable Energy (RE) Directive (2001/77/EC and 2003/30/EC) the EU has nearly achieved its 2010 goal of supplying 21% of electricity with renewable energy, with 19.9% renewable electricity, and has likely achieved the renewable transport fuel target of 5%.[199] Since 2004, 61 legal proceedings have been brought against Member States for non-compliance with 2001/77, which indicates the legal framework may not be sufficiently strong. More progress has been made by some Member States than others, and the Commission is concerned that there is a disconnect between renewable energy objectives set by Member States and enacting the programmes necessary to achieve them. Complicated administrative procedures, multiple permitting authorities and lack of adequate rules and precedents for grid connection has made renewable energy development very difficult in certain Member States, an issue which has been addressed in the updated 2009 RE Directive. It remains to be seen if these adjustments will enable even faster RE growth. It is important that the goals are consistent with and motivate higher development growth than would be the case without legislation. Weak 2020 RE goals may actually result in a slow-down of RE penetration, as might be the case in, for example, Austria, where the 2008 RE share was 28% with a 2020 goal of only 34%.[200]

Directive 2003/30/EC on utilising biofuels in transport has succeeded in its 2010 market penetration goals, but concerns over the sustainability of biofuels and whether they are a suitable mechanism for reducing the environmental footprint of transport remain. The EU has established sustainability standards for biofuels, but some critics state than biofuels are still unlikely to be a sustainable alternative to fossil fuels.[201] For example, the sustainability criteria account for land-use change emissions, but not indirect land-use change emissions, which have the potential to be orders of magnitude higher than the former. Fertilizer used for biomass agriculture contributes to emissions of N_2O, a greenhouse gas, such that there will inevitably be a trade-off between biodiversity concerns (that is, requiring more intense land use to produce more biomass crops on the same amount of land) and greenhouse gas reduction goals.[202] Therefore, biofuel use goals may need to be re-evaluated.

[199] European Commission, 2009a, p. 3, 6; ENDS, 2010a.
[200] ENDS, 2010b.
[201] Eickhout et al., 2008, p. 7.
[202] Eickhout et al., 2008, p. 6.

The main obstacles to achieving the 2020 energy efficiency goal of a 20% increase in energy savings include the poor implementation of existing legislation. Furthermore, even if all existing energy efficiency legislation were fully implemented, the EU would achieve 13% energy savings by 2020. Though all Member States have introduced National Energy Efficiency Action Plans which introduce road maps for achieving 9% energy savings as required under Directive 2006/32/EC, the Commission wants to ensure that these plans stand for real action.

Reducing Environmental Footprint of the Energy Industry

Two years after passing Recommendation 2001/331/EC on minimum criteria for environmental inspections, Member States were to report to the Commission on how it was applied. By 2007, the Commission reported that the information submitted by Member States was "incomplete or difficult to compare" and that there is still very little harmonisation of environmental inspection protocol across Member States, if inspection plans have been implemented at all. The European Parliament has called for a Directive on this matter that would also widen the scope of the original Recommendation and create an EU level inspection force.[203] So far there appears to be no further development of this Directive, but it is clear that greater oversight is necessary for effective implementation of environmental inspection criteria.

Directives 85/337/EEC, 97/11/EC and 2003/35/EC, or the Environmental Impact Assessment (EIA) Directive has been implemented via complete EIA regimes in all Member States.[204] Application of 2003/35, increasing public participation in the EIA process, appears to be more limited, and the public is not consistently involved in stakeholder consultation in many Member States.[205] Concerns remain that the screening process for whether an EIA is necessary varies greatly across Member States and that the complete list of selection criteria is not considered for all projects.[206] The lack of quality of information contained in EIAs is also a significant obstacle to address.

Furthermore, implementation of the EIA Directive has encountered difficulties in application to transboundary procedures, which is highly relevant to energy projects. This stems from the barriers to assessing multi-country impacts as a whole, including language and procedural differences as well as the lack of a single, harmonised EIA procedure.[207]

Directive 2001/42/EC, the Strategic Environmental Assessment (SEA) Directive has also been transposed into law by all Member States, which have described similar implementation difficulties as with the EIA Directive, including different scoping methods used across Member States, inconsistent use of screening criteria, and lack of quality information.[208] However, there has been more positive response to transboundary SEAs.[209] It is not clear why there has been a higher success rate with transboundary SEAs than EIAs.

These directives and initiatives are all important components of decreasing the environmental impact of endogenously-produced EU energy, which has implications for the

[203] European Parliament, 2008.
[204] European Commission, 2009c, p. 3.
[205] European Commission, 2009c, pp. 3-4.
[206] European Commission, 2009c, p. 5.
[207] European Commission, 2009c, p. 7.
[208] European Commission, 2009b, p. 4.
[209] European Commission, 2009b, p. 6.

Arctic as a region impacted by climate change and EU air pollutants, as well as for any EU states and companies that undertake energy projects in the European Arctic. The EIA and SEA directives also apply to EEA States (including Norway and Iceland), making them even more relevant in this context. However, bilateral and multilateral agreements are also likely to play a large role in ensuring that EU Arctic energy imports, mainly from Russia and Norway, are produced in an environmentally and socially conscious manner.

Multilateral agreements

In general, there is no Arctic-specific legal guidance on how to perform offshore hydrocarbon extraction under international law.[210] The body of international agreements that are relevant to energy production are furthermore likely too vague to provide the Arctic with substantial environmental protection from increased hydrocarbon activities. Those guidelines that are Arctic-specific are not legally binding.

The UN Convention on the Law of the Sea (UNCLOS) provides guidance on exploration and exploitation rights but only general language on managing environmental consequences.[211] The fact that some Arctic maritime boundaries have not yet been established as well as the uncertainty over the extent of some Arctic states extended continental shelf entitlements leaves large areas of ambiguity in the Arctic Ocean under UNCLOS as well as under the customary international law of the sea (which applies to the United States).[212]

The OSPAR Convention is clearer in terms of environmental protection in Arctic waters, but does not apply to the entire Arctic Ocean.

The Espoo Convention has been signed by all eight Arctic states, but Russia, Iceland and the US are not yet parties to it. Only four Arctic states have signed the SEA Protocol, which is important to sustainable development and responsible execution of any coordinated energy exploitation plan. Should a multilateral agreement on Arctic hydrocarbon activities be negotiated, observance and utilisation of the SEA Protocol would be well-advised.

Voluntary guidelines such as the Arctic Council's Arctic Offshore Oil and Gas Guidelines and the International Association of Oil and Gas Producer's on environmental protection during oil and gas exploration and production in Arctic offshore regions are not legally binding, and there are not consistent mechanisms in place across Arctic states to ensure that these guidelines would be followed. The Arctic Council has not yet evaluated how the guidelines have affected oil and gas recovery methods in the Arctic.

Notably, these guidelines have been revised twice, indicating that they are to an extent a living document, unlike most Arctic Council documents.

With regard to nuclear waste contamination in the Arctic, the EU discussed nuclear disarmament and decommissioning of first generation nuclear power plants with Russia during the EU-Russia Summit in May-June 2010. Ultimately, the European Parliament resolution adopted as a result of these talks did not contain any language on nuclear issues, but it did discuss interest in renewable energy, energy efficiency, and sustainable energy development.[213]

[210] Koivurova et al., 2008, p. 4.
[211] UNCLOS, VI.77, VI.81, X.2.145.
[212] Koivurova et al., 2008, p. 37.
[213] European Parliament, 2010, P7_TA(2010)0234

Policy options

In 2009, the EU Council adopted a document entitled "Council conclusions on Arctic issues", where the Council emphasised the need for gradual formulation of a policy on Arctic issues to address EU interests and responsibilities in the region.[214] According to the Council the EU policy on Arctic issues should:

- effectively mitigate climate change to preserve the unique characteristics of the Arctic region;
- reinforce multilateral governance through effective implementation of international, regional, bi-lateral agreements, frameworks and arrangements;
- enhance measures of international conventions, such as UNCLOS and other relevant international instruments;
- formulate and implement EU actions and policy taking into consideration the sensitivities of ecosystems as well as the needs and rights of Arctic residents; and
- maintain the Arctic as an area of peace and stability and highlight the need for responsible, sustainable and cautious actions, particularly in the area of resource extraction.[215]

As part of its climate mitigation strategy, the EU is already implementing renewable energy and efficiency measures to at least slow the increase in the amount of energy consumed and reduce emissions from total endogenous energy production. However, the EU will inevitably continue to rely more heavily on energy imports. In order to ensure that these imports would meet the same lifecycle emissions and environmental standards as endogenously-produced energy, the EU could create this requirement, which is already in place for biofuels.

Increased reliance on oil and gas imports, particularly from the Arctic, might incentivise coordinating with energy trading partners to complete SEAs and EIAs in areas of prospective hydrocarbon recovery expansion. EIAs in the context of energy production has led to such innovations as directional drilling, which allows for reaching more oil from a single platform.[216] EIAs are also an integral component of the Arctic Council's Offshore Oil and Gas Guidelines, which are designed to minimise hydrocarbon activities' impact on other expanding Arctic industries, such as tourism, recreation, fisheries, as well as important cultural and historical areas, including areas utilised by indigenous communities. The EU Arctic Communication mentions the possibility of endorsing the Arctic Offshore Oil and Gas Guidelines, but does not specify what endorsing the guidelines would entail.[217] The more recent EU Communication on the safety of offshore oil and gas activities calls for working with Arctic countries to develop 'binding international rules or benchmarks, building inter alia on the guidelines of the Arctic Council'.[218] These steps are also consistent with the priority objectives put forward in the EU Second Northern Dimension Action Plan 2004-2006[219] on industrial enterprises and indigenous peoples' interests in the North and with the statement

[214] Council conclusions of Arctic issues, 2009.
[215] Council conclusions of Arctic issues, 2009.
[216] CAFF, 2001, pp. 94-95.
[217] European Commission, 2008b, pp. 6-7.
[218] European Commission, 2010, p. 12.
[219] Annex I No. 1.1 p. 19.

of the 2004 Conference of the Parliamentarians of the Arctic Region.[220] In order to ensure that indigenous peoples' rights are respected in the management and exploitation of natural resources and the natural environment in the High North the Government of Norway will initiate a cross border circumpolar project to develop ethical guidelines for how different actors are to take indigenous peoples' interests into consideration when conducting economic activities in the High North. [221]

Among the research needed before significant expansion of Arctic hydrocarbon expansion is undertaken, studies of the effects of all energy-related activities are necessary to make EIAs more effective and meaningful. More can be determined about the environmental and social impacts of energy infrastructure beyond its physical footprint in Arctic regions, or the effects of seismic exploration on both marine and tundra species and habitats.[222] Expanding energy exploitation can only be done responsibly if reasonable limits to ecological impact are determined through onsite research. Further research is also needed for developing oil spill mitigation strategies in ice-covered waters and in areas of broken ice.

Additional existing policy shortcomings include:[223]

- A lack of common environmental standards among Arctic States for hydrocarbon activities.
- A lack of integrated management systems within and between Arctic States for monitoring hydrocarbon activities and enforcing any standards which may be developed.
- Arctic Council Offshore Oil and Gas Guidelines are non-binding.

Support a multilateral agreement on offshore oil and gas activities

The EU can support and work with Arctic states in improving multilateral and domestic energy policies, given that the EU is a major player in the energy sector. The shortcomings mentioned above could, for example, be addressed in the long run through an international or multilateral Arctic agreement on hydrocarbon activities, or at least offshore oil and gas activities. Following the recent Communication on offshore oil and gas activities, the EU could work with Arctic states to implement the provisions of such an agreement, which would have to take into account the specific circumstances of the Arctic, including the current impossibility of oil spill mitigation in many areas, its remoteness and higher risk of operational difficulties due to sea and weather conditions. It would provide the greatest benefit by implementing common environmental standards for energy recovery, requiring EIAs as outlined in several other international agreements and calling for the cooperation of all Arctic states in utilising infrastructure for emergency and pollution response. This could also include minimising black carbon pollution from oil and gas flaring and other operational activities.

The EU could coordinate the incorporation of the provisions embodied in the Arctic Offshore Oil and Gas Guidelines into domestic legislation with Arctic states. Such actions by the Arctic state would ensure an integrated management system in offshore oil and gas activities. The

[220] CPAR, 2004, No. 26, vii.
[221] Norwegian Ministry of Foreign Affairs, 2009, No. 7.3 p. 43.
[222] UF FWS, 2008; Wilbert et al., 2008.
[223] Cleveland, O'Carroll, 2009, p. 2.

EU could also support the formation of a coordinated effectiveness monitoring system and assist in monitoring the effectiveness of the guidelines.

Continue cooperation with Russia

EU energy dependence can conversely be seen as Russian economic dependence. Russia receives 60% of its foreign currency revenue from oil and gas exports,[224] most of which comes from the EU.[225] The EU could, through a bilateral agreement or through cooperation under the Barents Euro-Arctic Council (BEAC), support Russia in ensuring its energy development is sustainable. The existing 1994 Partnership and Cooperation Agreement between the EU and Russia will be replaced by a new EU-Russia Agreement – the negotiating process of which has started in 2008 and resulted in nine full negotiating rounds by May 2010.[226] The new Agreement expects to include substantive and legally binding commitments, inter alia, in the area of investment and energy.[227] The EU could thus seek to include provisions on environmental concerns in the Agreement. Such provisions could encourage or require land-use best practices for energy development projects, state-of-the-art hydrocarbon recovery machinery, and pollution control standards.

Utilise the Northern Dimension

The EU could also further enhance cooperation, for example, through the Northern Dimension (ND) policy – a common policy between the EU, Iceland, Norway and the Russian Federation. A strengthening of the ND initiative could contribute to achieving sustainable energy development in the Arctic. The ND could encourage financial assistance, require the use of best practices and modern technology and help to ensure the security of EU energy supply.

2.5 Fisheries

Status, trends, and pressures

Global fish consumption doubled from 1973-2003.[228] As a greater proportion of the growing world population demands high-quality protein, more vessels are commissioned to catch commercially popular fish. Over time this leads to too many vessels and too few fish, with some species harvested to near extinction. As of 2008, over 75% of fisheries worldwide are fully exploited, over exploited or recovering, and therefore incapable of meeting further increases in demand.[229]

Climate change is expected to warm Arctic waters, which may encourage greater numbers and diversity of marine animals to shift their habitat ranges northward. With sea ice cover

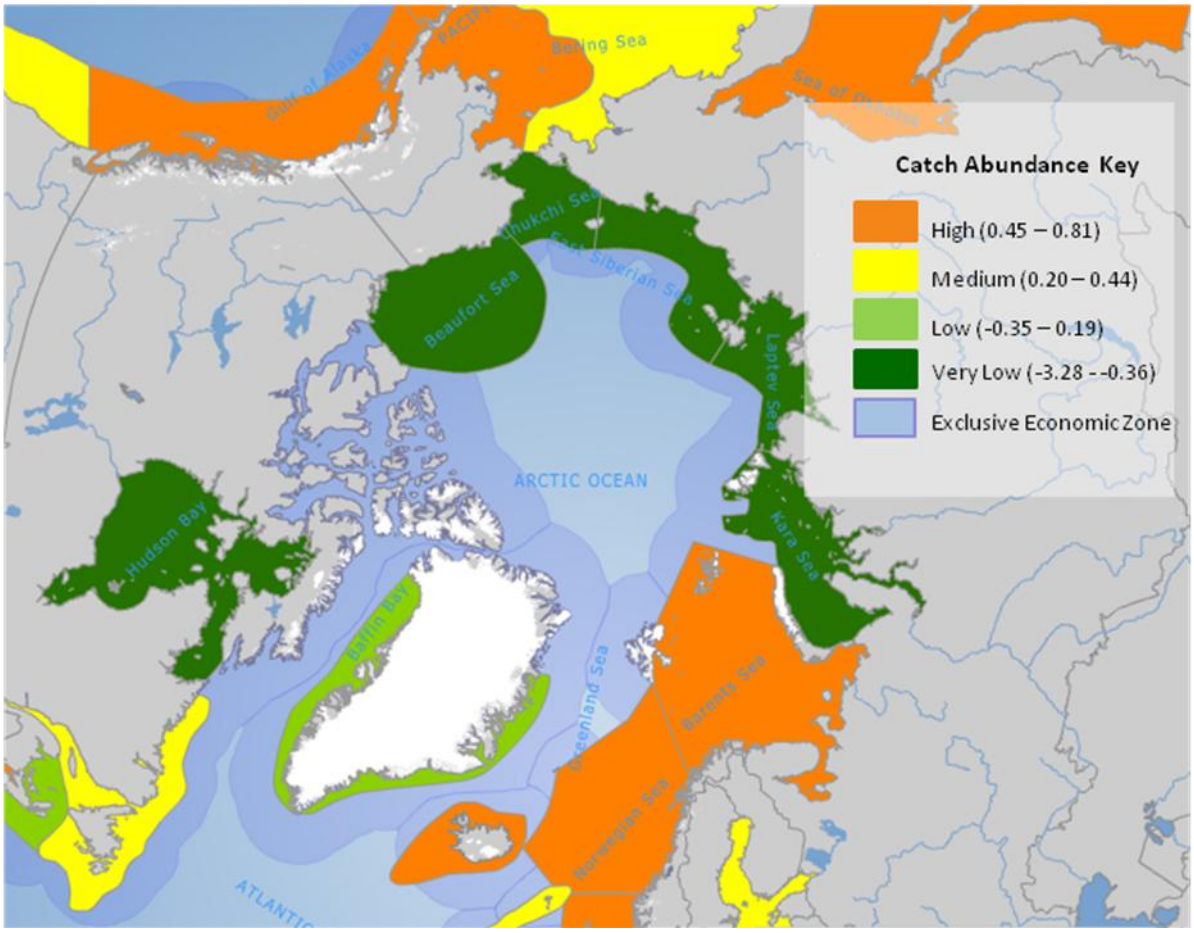
[224] Jeníček and Krepl, 2009, p. 10.
[225] Statistics show that 78% of Russian oil exports flow to Europe, while EU's dependency on Russian supplies is only 29%. Regarding the supplies of natural gas from Russia to the EU market, Russia's dependence on exports constitutes 98%, which means that Russia is more dependent on the EU than vice versa. Kovačovská, 2007, p. 11.
[226] EU External Action, 2010.
[227] EU External Action, 2010.
[228] European Commission, 2009, p. 28.
[229] Freitas et al., 2009, p. 3.

also expected to decline, there is great potential for a larger area of more abundant fishing grounds in the Arctic, which currently only provides 4% of global fish catches (see Figure 16).[230] Though there are opposing drivers to such development, including ocean acidification and competition from invasive species, the question remains about how the international community can ensure Arctic fisheries are developed sustainably, minimising overfishing, protecting non-target species and natural habitats, and upholding the rights and interests of local and indigenous peoples.

Arctic fisheries, as defined for the purposes of this report, lie within statistical area 18, and the northern sections of areas 21 (I, II, Va, XIV) and 27 (0A, 0B, 1A-F) as defined by the UN Food and Agriculture Organization (FAO).[231] Area 27 covers the Northeast Atlantic and encompasses most of the major Arctic fisheries: the Barents Sea, the Norwegian Sea, and the Iceland-Greenland area. This is also the only area in the Arctic covered explicitly by a Regional Fisheries Management Organisation (RFMO).[232] Area 21 covers the west side of Greenland and Northeast Canada.[233] Area 18 covers the rest of the Arctic water bodies and contains only one major Arctic fishery, the Bering Sea (the Bering Sea is sometimes not included as an Arctic fishery since it lies below 66°N).[234] According to the FAO, 89% of fish stocks in Area 27 have no room for further expansion of fishing efforts, and the status of the remaining 11% is unknown.[235] In Area 21, 61% of fish stocks have no room for expansion. Very little information is available on fish stocks in Area 18, a problem that will need to be addressed before significantly expanding Arctic fisheries.

[230] Rudloff, 2010a, p. 3.
[231] FAO, 2010a.
[232] Rudloff, 2010a, p. 5.
[233] FAO, 2010a.
[234] FAO. 2010a; Arctic Portal, 2010; Rudloff, 2010b, p. 9.
[235] Freitas et al., 2009, p. 8.

Figure 16 Arctic fisheries catch abundance (MT) 5 year average yield (log scale), 2000-2004



Source: Arctic Portal, 2010; Original Source: NOAA Large Marine Ecosystems of the World

Furthermore, illegal, unreported and unregulated (IUU) fishing for Atlantic cod and Alaska pollock has become a source of great concern in the Arctic region. IUU fishing contributes to overfishing and might, in the worst case, lead to 'a rapid and unexpected collapse' of the stock due to overfishing similar to the collapse of the North American cod stocks and the Alaska pollock stocks in the Central Bering Sea in the early 1990s.[236] Overfishing can reduce the size of the stock and distort its age structure, for instance by reducing the number of adult fish, which threatens the longer term viability of the stock. The longer IUU activities continue, the more severe the impacts can be.

The fisheries sector comprised only 0.1% of total EU GDP in 2007.[237] Though this indicates it may be of low economic relevance, fisheries sustainability is highly relevant to fishing communities and marine ecosystems that stand to benefit the most in the long term from cautious development of Arctic fisheries. Furthermore, EU dependence on fish imports to meet rising demand has grown from 43% to 64% from 2005 – 2008, indicating that EU impacts in the Arctic due to fishing may come in growing a proportion from third parties.[238]

[236] Burnett et al., 2008, p. 5.
[237] Rudloff, 2010b, p. 12.
[238] Rudloff, 2010b, p. 12.

There are multiple ways the EU can impact the Arctic and Arctic fisheries through fishing and related activities, including:

1) EU-flagged vessels can fish in Arctic waters, thereby impacting Arctic stocks and contributing any other environmental damage directly. The EU currently contributes only 4% of Arctic catches, so the impact of these vessels is likely to be low in the near future. However, this source of impact could grow if the presence of EU vessels in the Arctic grows

2) EU-flagged vessels can harvest stocks of fish or otherwise impact marine species outside the Arctic which are capable of migrating into Arctic waters. If any of these species are sources of protein for indigenous peoples, or are keystone species for an Arctic ecosystem, or are a tourist/recreational fishing attraction, such as sport fishing, in the Arctic, EU vessels can indirectly impact the Arctic. Many commercial Arctic stocks (polar cod, Atlantic cod, haddock) have ranges that extend into EU waters.[239]

3) EU-owned vessels under flags of convenience (FOC) (estimated to comprise 10% of EU-owned vessels) can either directly or indirectly impact Arctic stocks through the two situations mentioned above.[240] It is unclear how many EU FOC vessels operate in the Arctic, but this number could increase in the future as Arctic fisheries become more attractive.

4) Run-off and direct marine pollution from the EU can impact Arctic waters, putting pressure on distant fisheries and sensitive socio-ecological systems. Multiple policy instruments, such as the OSPAR Convention, Convention on Long-Range Transboundary Pollution, and MARPOL, are in place to reduce the presence and impact of marine pollution. They are not designed to reduce impact on fisheries in particular, however, and do not target the Arctic. There is a notable lack of policies focusing on commercial fisheries impact on indigenous Arctic communities, though this is mentioned in the Commission's Arctic Communication.[241]

5) Fish imported to the EU must meet certain health and sourcing standards. As a major importer of Arctic fish, EU standards will affect how foreign fisheries and thereby foreign vessels conduct business. Enforced sustainability standards can impact the environmental footprint of all vessels fishing in the Arctic. This is likely the most powerful role the EU can play, in addition to its role as a port State, in influencing the direction in which Arctic fisheries develop.[242]

The regulatory gap of Arctic fisheries is of particular concern for the EU, as indicated in a 2008 Communication. The Commission recommended a moratorium on new Arctic fisheries until regulatory framework for the high seas pocket in the Arctic Ocean is in place, similar to the US's Arctic Fishery Management Plan which prohibits commercial fishing in US Arctic waters until more data is available on the state of fish stocks.[243] It is difficult to determine the potential severity of each of the impacts listed because there is a dearth of data on Arctic

[239] FishBase.org, 2009; Molenaar et al., 2009, p. 9.
[240] Hosch, 2009, p. 23.
[241] EC COM(2008) 763 final, p. 8.
[242] Rudloff, 2010, p.6.
[243] EC COM(2008) 763 final, pp. 8-9; NOAA, 2009.

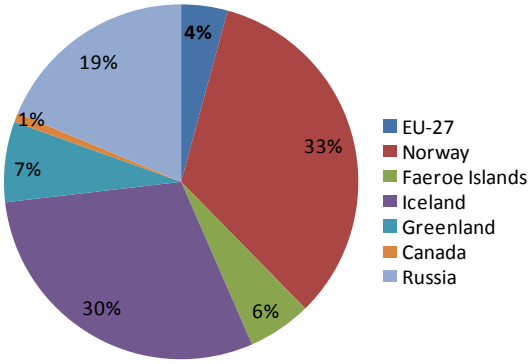
fisheries. The understanding of Arctic marine communities and the health of fish populations needed for ecosystem management is not currently available.[244] This data is needed before effective regulation can begin.

EU's Footprint

As discussed above, the EU can play an important role in sustainable Arctic fishery development. Although the EU does not possess an Arctic coastline, the EU's role in capture fisheries is through powers over EU Community vessels and natural and legal persons of EU Member States, as well as its roles as a port State and a market State. Though the EU accounts for less than 8% of the global fishing fleet, it is the most important seafood market in the world.[245]

Figure 17 shows the regional shares in fish capture production in Arctic waters in 2006. It clearly shows that Europe as a whole captures about three quarters of all fish in these waters, followed by Russia (19%) and Greenland (7%). Within Europe, Norway (33%) and Iceland (30%) make up for most of total fish capture production. EU-27 countries only contribute 4% to total Arctic fish catch production.

Figure 17 Fish capture production by region in Arctic waters, 2006



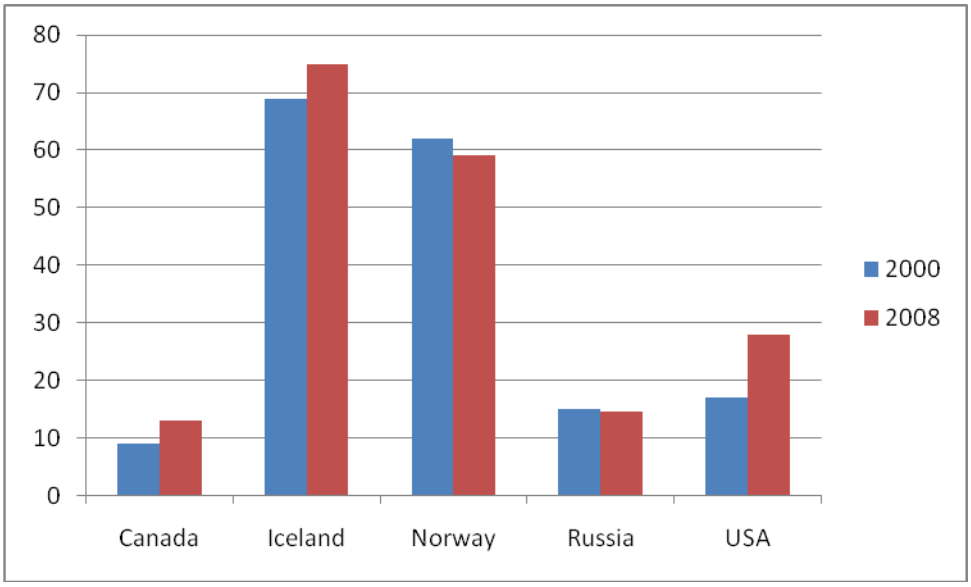
***Note**: Arctic defined as parts of FAO Fishing areas 18, 21 and 27 (above 66° latitude).*

Source: Adapted from Rudloff, 2010b, pp.46. Original source: FAO FishStat, 15 May 2010.

The main trading partner of many Arctic countries is the European Union, thus, from a consumption perspective the EU accounts for more than its share in fish capture production. As shown in Figure 18, Icelandic and Norwegian fisheries in particular are highly dependent on exports to the EU.[246]

[244] Molenaar, et al., 2009, p. 9.
[245] Europe accounts for 7.8% of the decked and powered fishing vessel fleet. Hosch, 2009, pp. 22, 43.
[246] Rudloff, 2010a, p. 10.

Figure 18 Percent of fish exports from Arctic states to the EU-27 in 2000 and 2008



Adapted from Rudloff, 2009, p. 10. Original source: UN, Comtrade Database, 30 April 2010.

It appears that the EU, whose fishing fleets retrieve only 4% of Arctic catches, is more likely to influence Arctic fisheries through market mechanisms than through its own fishing activity.[247] Based on the UN Comtrade database, the EU-27's fish imports from selected Arctic countries (Canada, Iceland, Norway, Russia, and USA) constitute 39% of total fish exports of these countries.[248]

Europe's relatively strict fish market regulations and legacy of fisheries policy can potentially contribute to responsible fisheries development in the Arctic.

EU policies and multilateral agreements

The EU Common Fisheries Policy, EU Integrated Maritime Policy and EU fish import standards and barriers are described in detail in Annex C. In addition, the EU's relationship with international fora, treaties, and instruments, including the OSPAR Convention, EU Northern Dimension, UN Convention on the Law of the Sea (UNCLOS) and the FAO Code of Conduct for Responsible Fisheries is described in Annex C. An analysis of their effectiveness follows in this section, below.

Effectiveness of policy instruments

Out of the five potential impact pathways listed above, the EU and international community have policies in place which seek to address all of them. This does not mean that more cannot be done to increase the efficacy of these instruments and their enforcement or to improve the scope of their regulation.

[247] Canada, Denmark, Russia, Norway and the United States retrieve approximately 80% of Arctic catch. Rudloff, 2010a, p. 7.
[248] UN Comtrade database, 2010.

EU Common Fisheries Policy

The Common Fisheries Policy (CFP) is a major instrument for regulating the impact of EU-flagged vessels in Arctic waters.[249] Since its reform in 2002, it claims several success stories in terms of fleet reduction, stock recovery and by-catch reduction, though none are within the Arctic. The northern hake stock, found in the North East Atlantic, North Sea and Skagerrak, has thrived under a recovery plan since 2003 and graduated to a management plan in 2008. [250] By-catch of cod during langoustine fishing was reduced from 50% to less than 5% by using more selective gear. [251]

The EU-15 reduced its number of fishing vessels by 12.4% from 2000-2005 (11% reduction in terms of tonnage), while Norway was able to achieve a 40% reduction in number of vessels (only 5% in terms of tonnage).[252] The FAO mentions that some of these vessels might be not be decommissioned but rather exported to other countries, which simply shifts fishing capacity somewhere else.

The Commission notes that fishing effort has been falling since 2000, but perhaps not due to regulation. Only 72% of allowed fishing effort was deployed in 2006.[253] This does not provide insight as to the efficacy of this aspect of the CFP, particularly in the event of an incentive to increase effort in newly developing Arctic fisheries.

However, with these successes noted, regulators and researchers believe EU fleets are still too large and its fish populations are overfished. On average, fishing quotas under the CFP are in excess of 40% above scientists' recommendations for fostering sustainable populations. Furthermore, these TACs are believed to be overshot due to underreporting by as much as 45%.[254] The rate at which EU fleets are decreasing is by many accounts too slow, at only 2-3% p.a., which does not fully compensate for technological creep (estimated to increase fishing capacity by 2-4% p.a.).[255]

The Commission's review of the CFP in 2009 sought to identify strategies for addressing some of these problems. One key conclusion was to involve fisheries in all levels of policy development to create more investment in compliance.

Most new Arctic fishery development is likely to happen in the EEZs of coastal Arctic states where ice melt is creating new areas of open water. Furthermore, it appears that the international community will not allow for unregulated fisheries development in the high seas pocket of the Arctic Ocean.[256] However, this may be of little importance to the fishing industry given that the bulk of Arctic fish (90%) are currently caught in EEZs. In the past, the EU fishing vessels have had controlled access to some of these waters through bilateral fisheries agreements with Norway and Iceland, though these agreements have expired in 2009. An EU bilateral fisheries agreement with Greenland will last at least until 2012.[257]

[249] Council of the European Union, 2002, Ch. 1 Art. 1.
[250] European Commission, 2009, p. 16.
[251] European Commission, 2009, p. 18.
[252] Hosch, 2009, p. 22-23.
[253] European Commission, 2009, p. 16.
[254] European Commission, 2009, p. 7, 15.
[255] European Commission, 2009, p 19.
[256] Erik Molenaar, personal communication, 2010.
[257] Rudloff, 2010a, p. 9; Rudloff, 2010b, p. 21; EC Fisheries, 2010.

UN Fish Stocks Agreement

The UN Fish Stock Agreement addresses straddling and highly migratory fish stocks that act as resources for both the EU and the Arctic. The efficacy of the UN Fish Stock Agreement was reviewed during diplomatic conferences in 2006 and again in May 2010. The recommendations and concerns of State Parties and fisheries stakeholders were compiled in 2006 and reviewed again in 2010 to determine if progress had been made.

The review identified an improvement in implementation of the precautionary principle and ecosystem approaches in States' management strategies. Progress has also been made in international compliance and transparency through RFMOs, although more support of RFMO endeavours is needed from members and cooperating non-members.[258]

Further efforts must be devoted to removing subsidies for building fisheries capacity and those that support IUU fishing. Greater management and oversight is still needed for deep-seas fisheries and compliance with existing RFMO measures is still lacking.[259] Little progress was identified with regard to nationals controlling their flag ships outside areas of national jurisdiction.[260]

These problem areas are especially relevant to new Arctic fisheries, which may continue to be accessible to EU vessels (the review did not specify the extent to which EU countries were implicated in substandard compliance with RFMO measures or controlling flagged vessels). The lack of RFMO oversight in all areas of the Arctic further exacerbates this problem.

Furthermore, the UN Fish Stock Agreement is only applicable to straddling and highly migratory fish stocks, meaning fish stocks that occur in one or more EEZs and the high seas. It is questionable whether this will help the majority of Arctic fish stocks, which are currently mainly shared (occupying two or more EEZs) and anadromous fish stocks. UNCLOS applies to these stocks, which provides only general and less operationalised provisions on fish conservation and management.[261]

FAO Code of Conduct for Responsible Fisheries, Agreement to Promote Compliance

The FAO Code of Conduct for Responsible Fisheries has the potential to reduce all four possible impacts described above, and the Code of Conduct appears to have influenced changes in fisheries management around the world.[262] FAO regularly monitors efforts to implement the Code and reports relevant actions to the FAO's Committee on Fisheries (COFI).

The most recent report from COFI indicates that in general countries are faster to adopt some aspects of the Code more than other, for example the IPOA-IUU. The Code has been referenced in the statutes and mandates of many RFMOs, and is mentioned by any fisheries wanting to indicate their interest in sustainability best practices. The Code is widely recognized as the keystone document for sustainable fishery practices and for effectively entwining the principles of responsibility, sustainability, precaution, and ecosystem-based

[258] UNFSA Review Conference, 2010, p. 10.
[259] UNFSA Review Conference, 2010, p. 6.
[260] UNFSA Review Conference, 2010, p. 15.
[261] Molenaar et al., 2009, p. 5.
[262] Hosch, 2009, p. 17.

management.[263] The challenges facing more comprehensive implementation of the Code (and sustainable fishing practices in general) include weak governance, fuelled by understaffed, underfunded fisheries ministries and conflicts of interest. Occasionally there are regional workshops dedicated to the Code, but none have focused on the Arctic.

Of relevance here is how much the EU implements the Code and how this might improve sustainable Arctic fishing. That FAO indicates that the EU has adopted a Code of Conduct for European Aquaculture, but does not mention any explicit developments attributable to the Code with regard to fisheries.

The FAO does mention some shortcomings of EU fisheries governance. According to the European Court of Auditors, one of the primary causes of fisheries management failure is unreliable catch data.[264] The EU, for example, reported 100% reliable and complete catch statistics in 2007, which the Court of Auditors overturned.[265] Of relevance to Arctic fisheries, the EU distant water fleet has a record of poor catch reporting to both EU and non-EU authorities. The Commission estimates that more than €1.1 billion in illegal seafood enters Europe each year (WWF claims 50% of fish sold in Europe are illegally caught or imported).[266] This could be an indicator of the inefficacy of the Code of Conduct as well as lack of EU oversight.

Though the EU may be known for its stringent fish import regulations, these numbers tell a different story. If the EU is to effectively use its market power to incentivize sustainable fisheries development in the Arctic, these loopholes must be addressed.

OSPAR Convention

The OSPAR Convention has the potential to limit the impact of EU pollution on the state of Arctic fisheries. However, this appears to be a new area of focus for OSPAR, so it is difficult to tell if its methods will be effective. OSPAR intends to develop closer ties to the Arctic Council and mentions fisheries resources as an area that is relevant to OSPAR's assessments and work programmes.[267] The OSPAR Commission has drafted a memorandum of understanding with the North East Atlantic Fisheries Commission (NEAFC), a RFMO relevant to areas that may see new Arctic fisheries, to cooperate in marine ecosystem conservation and information sharing.[268]

EU import and sourcing standards and barriers

These regulations have the potential to decrease the consumption of unsustainably harvested fish from EU vessels and EU-owned flags-of-convenience vessels, as well as third party suppliers, such as Arctic coastal states. As indicated by the FAO review, the EU can do more to close loopholes and make these sourcing standards more effective. It remains to be seen if the EU's newly instated "catch certificate" requirement will reduce IUU imports.

Policy options

[263] Hosch, 2009.
[264] Hosch, 2009, p. 48.
[265] Hosch, 2009, p. 48.
[266] Hosch, 2009, p. 46.
[267] OSPAR Annual Report, 2009, p. 11.
[268] Memorandum of Understanding, 2008.

EU options

EU fish imports must meet certain health and sourcing standards. As a major importer of Arctic fish, EU can implement standards which influence regulation of foreign fisheries. Enforced sustainability standards can impact the environmental footprint of all vessels fishing in the Arctic. This is a very powerful role the EU can play in influencing the direction in which Arctic fisheries develop.

Strengthen market-based instruments

The EU has the potential to influence its attractiveness as a market for Arctic fish imports through tariff reduction. It is important, however, that this policy be accompanied by strict environmental and sourcing standards, such as the "catch certificate," to incentivise sustainable fishery expansion. Very strict environmental standards for imports may conflict with World Trade Organisation (WTO) provisions, so certain requirements, such as eco-labelling, may have to be voluntary.[269]

Enforce IUU fishing regulations

The EU should continue its focus against IUU fishing. Any new and expanded fisheries in the Arctic should be subjected to strict control measures. This also falls largely under the jurisdiction of trade measures, thereby subjecting these initiatives to WTO limitations. It may be more effective for the EU to continue its efforts to develop and strengthen bilateral and multilateral agreements with major fisheries products trade partners (such agreements already exist with Norway, Iceland, Canada, the US, etc.), which allows for instating similar IUU requirements on the respective national fleets without implementing new import policies.[270] A notable exception to existing EU bilateral IUU agreements is Russia, however the existing Norway-Russia agreement in the Barents Sea appears to have halted IUU fishing of cod as of 2009. This is believed to be partly attributable to the new EU catch certificate scheme.[271] In addition to domestic efforts to reduce IUU fishing, the EU can also ratify the FAO Agreement on Port State Measures to Prevent, Deter, and Eliminate IUU Fishing (FAO PSM Agreement), and support other Parties in doing so as well.[272]

Close regulatory loopholes

The EU can direct Community vessels and citizens not to engage in fishing activities within certain Arctic marine areas until certain regulatory loopholes are closed. The EU can direct that catches from certain parts of the marine Arctic are not to be landed, transhipped, processed or packaged in Community ports, and that vessels involved in such catches are denied services in EU ports. Such action would be implemented in response to UNGA Resolution No. 61/105 on bottom fisheries and in support of the US Arctic Fishery Management Plan (FMP).

Fund scientific research

Basic fisheries research is necessary for ensuring sustainable management of any fishery, and scientists can begin in the Arctic by beginning to understand levels of fish stocks and species interactions before fishing activity increases substantially. Furthermore, the EU could

[269] The Commission has discussed an eco-labelling scheme for fisheries products in COM(2005) 275.
[270] Rudloff, 2010b, p. 33.
[271] Norwegian Ministry of Fisheries and Coastal Affairs, 2010.
[272] For more information on the FAO PSM Agreement, see Annex C.

support the International Council for the Exploration of the Seas (ICES) in addressing the abovementioned needs, by, for example, adjusting the work plan and terms of reference of its Arctic Fisheries Working Group.

Multilateral options

As ice cover recedes and interest in expanding Arctic fisheries grows, policy instruments to address the impacts of fisheries can be implemented on many levels. Individual action by Arctic states, whether as flag, coastal, port or market states is necessary for regulating fishing and related activities within national jurisdictions and beyond. Norway has undertaken such action surrounding Svalbard, its Arctic archipelago, as well as the US in its Arctic waters with the Arctic Fishery Management Plan. Agreements between Arctic states will be necessary for shared or migratory stocks.

Support or initiate a declaration on Arctic fisheries

A declaration on how the UN Fish Stocks Agreement and related conservation measures will apply to the changing Arctic fisheries industry, specifying plans for explicit and comprehensive RFMO regulation, would be beneficial.[273] It would also ideally state that no new fishing efforts will be permitted until adequate research is carried out on the impact of such activities on habitats, both target and non-target species and indigenous peoples.

Develop new RFMO or arrangement for straddling and discrete high seas fish stocks in the Arctic waters

The agreement would be based on the UN Fish Stocks Agreement. The Commission Communication on the Arctic as well as the US Congress resolution acknowledges the need for a fisheries regulatory framework in the region. The Communication lists this as a priority policy instrument.

Support strategic environmental impact assessments for new fisheries

The EU could promote strategic environmental impact assessment (SEA) for new fisheries in the Arctic marine area. EIAs are needed in FAO statistical areas 18 and 27, where until now status of fish stocks has been largely ignored.

2.6 Forestry

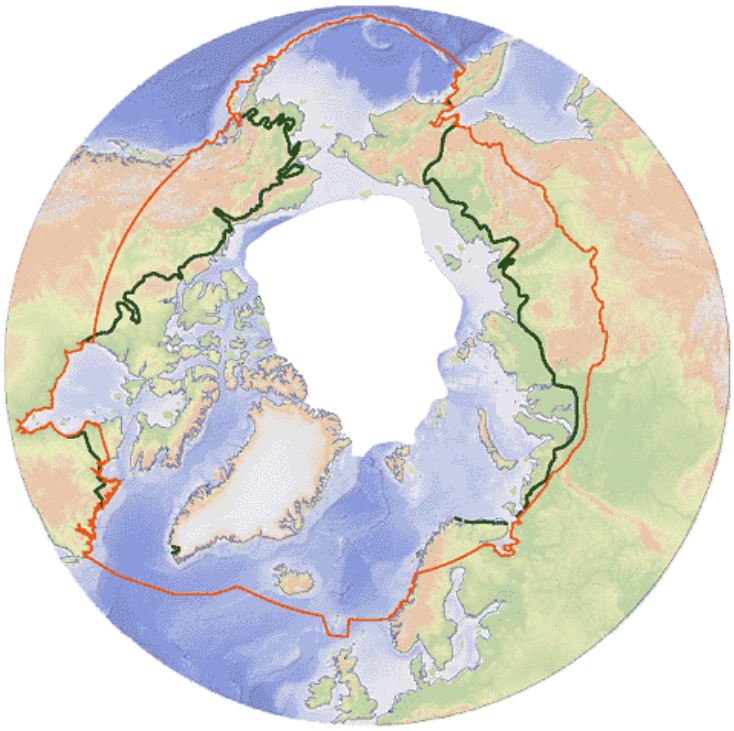
Status, trends, and pressures

The Arctic, by some definitions, is the area north of the treeline, meaning that technically there are no Arctic forests. Instead, in this section we will use the term ‘boreal forest,’ which includes sub-Arctic forests. The boreal forest encompasses the northernmost parts of the boreal forest zone. This forest zone is the northernmost and coldest forest zone in the Northern Hemisphere. It forms a belt about 1000 km in width across North America, Europe and Asia and is situated south of the treeless tundra and north of the temperate forest (see

[273] Molenaar, et al., 2009, p. 6.

Figure 19). The boreal forest biome makes up about 27% of the world's forest cover, with the largest areas located in Russia and Canada.[274]

Figure 19 Boreal forest is found south of Arctic tree line, shown with dark green line, 2002



***Note**: The orange line indicates the Arctic, as defined by the Arctic Council's Arctic Climate Impact Assessment (ACIA) and the Arctic Monitoring and Assessment Programme (AMAP).*

Source: UNEP/GRID Arendal (2002)

The boreal forest consists of a wide variety of tree species, dominated by evergreens such as firs, pines, spruces. Deciduous tree species, such as larch, can also be found. The boreal forest region has a distinctive set of biodiversity with lower species richness than the temperate forest and higher richness than the tundra. Species richness varies in different regions of boreal forest, but in general, the southern boreal regions contain more species than the northern regions.

The boreal forests have played an important role in the development of economies and societies in the boreal zone. Forestry has declined during the last century, but boreal forests are still of economic importance. In some areas forestry and wood-processing form the major economic activities.[275] In particular, indigenous peoples living in the sub-Arctic boreal forest zone depend on these resources.

Pressures on boreal forests include both direct impacts from human activities and climate change. Human activities include forestry, land conversion to farmland or flooding to make

[274] ACIA, 2005 pp. 784-785.
[275] Arctic Centre,1998.

reservoirs for hydroelectric generating stations, clearing of seismic lines, installation of pipelines, and forestry infrastructure. Mine sites are cut into the forest resulting in habitat loss and fragmentation. The most recent threat to the boreal forest is exploration and development of oil and natural gas reserves[276] and the development of the energy market using wood for energy. The rising demand for bioenergy offers new opportunities for forest enterprises to sell timber of poorer qualities.[277] Due to the economic crisis, all forest product markets fell in 2008 except for the wood energy market, which continued to grow.[278] It has been projected that if no corrective action is undertaken this development could even result in a wood supply gap in Europe in the coming years.[279] In addition, in some places, such as Lapland, Finland, logging activities may also endanger migratory routes and grazing areas used in reindeer husbandry. However, due to the small growth rates of trees near the transition from forest to tundra, exploitation of these far northern forests is rather uneconomical, except for the initial extraction of the few trees large enough to be used in timber mills.[280] Climate change might increase forest productivity in these areas and forestry might become a more viable economic activity with the accompanying negative effects for biodiversity.

In addition, the boreal forest is affected by and also contributes to climate change through its role in the atmospheric carbon cycle. Global CO_2 levels are influenced by the uptake in growth, storing carbon in live and dead plant matter and release through decomposition, animal respiration and combusting during fire. An increase in temperature as a result of climate change is expected to increase growth and expand the northern distribution.[281] As a result of climate change, the Arctic treeline has already begun to shift northward in some areas, replacing the Arctic tundra, and is predicted to move even further north.[282] The expansion in boreal forest is associated with an increased carbon sink. However, the direct climate effect on individual tree growth could vary. Response to temperature increases show increasing as well as decreasing growth rates. The type of response can even vary within a species. For example within the white spruce population over 40% showed a negative growth response to summer temperature while fewer than 40% had a positive response to temperature.[283] The change in treeline by expansion of boreal forest, therefore, is not simple and is likely to become more complex with changing negative and positive feedbacks. As a result, the increase in carbon uptake could be less than expected as well.

Furthermore, climate change is a major factor controlling the biodiversity in the boreal forests because it influences the distribution of species and communities. Northern migration of southern species due to northward shift in suitable habitats increases the northern species richness. The present boreal forest is the product of several periods of past global warming and cooling resulting in a large genetic diversity, enabling the forest to adapt to changing conditions such as climate warming. Furthermore, the large natural distribution of tree species requires a large genetic diversity to adapt to various conditions. One of the major risks for boreal forest from the effects of climate change is the loss in genetic diversity. Fire in

[276] Natural Resources Canada, 2005, p. 55.
[277] Rametsteiner et al., 2008, p. 34.
[278] UNECE Timber Committee, 2009.
[279] Sheridan and Dussler, 2008.
[280] ACIA, 2005, p. 553.
[281] White et al., 2000, as cited by ACIA, 2005, p. 851.
[282] Lloyd et al., 2003.
[283] Wilmking et al., 2004.

boreal forests sustains species diversity and climate change affects the naturally occurring fire regime. Insect populations increase due to warming. Pest species involved in large-scale boreal outbreaks are bark and wood-boring beetles, defoliating insects and insects that attack roots and cones.[284] The impact of climate change triggering natural events that reduce species richness such as fire and insect outbreaks might occur faster than the species can adapt and for other populations to migrate. The final consequence may be the loss of both genetic diversity and the ability to adapt to future changes in climate conditions.

EU's Footprint

While several human activities impact the boreal forest, the greatest impact arises from forestry.[285] The impacts of forestry range from decreasing species diversity to habitat loss and fragmentation.

Due to a lack of specific boreal forest data – especially trade data – it was not possible to gain a complete picture of the EU's impact on boreal forests. However, there is some data on EU dependence on forestry products in the Barents region. Much of the Barents region, 75% of which is located in Russia, is covered with coniferous forests, and forestry is an important economic sector.[286] Finland and Sweden alone supply 60% of EU pulp production, 25% of paper and cardboard production, and 30% of 'sawn goods'.[287]

Forestry mainly focuses on the large, old trees. The old forests are especially important for the conservation of biodiversity because they provide a wide range of habitats and support various species of plants and animals. As the boreal forest shows poor recovery based on its slow-growth, one impact of forestry is that the old boreal forests will become rare. As a result, species diversity, which depends on these trees, will most likely disappear or dramatically decrease.[288] Targeted for early harvest, old forests are already rare. Young forests do not provide these different habitat types and consequently show less biodiversity.

Habitat loss and fragmentation add to the decrease in genetic diversity by diminishing the genetic pool and preventing species migration. As a result, the ability to adapt to changing conditions is decreasing. Forestry, therefore, amplifies the effects of climate change and vice versa.

With forestry activity both providing employment while at the same time potentially threatening the health of boreal forests and people's livelihoods, the socio-economic consequences can be described in a qualitative way at best in this context. Due to forest activities, the people living in the Arctic may benefit from increased employment, but in the long term intensive harvesting of forest products will lead to a decline in health of the forest and make it even more vulnerable to climate change derived impacts (mainly fires and insect outbreaks).[289] Changes in forestry would therefore affect the social structure of the human population as well.

[284] ACIA, 2005, p. 830.
[285] ACIA, 2005, p. 795.
[286] Välkky, et al., 2008. p. 9
[287] Välkky, et al., 2008. p. 3
[288] ACIA, 2005, p. 552-553.
[289] ACIA, 2005, p. 552.

Despite the effects of forestry activities, it is likely that the effects of climate change outweigh the effects of forestry in the boreal forest. The EU footprint, therefore, mainly results from its contribution to climate change (see Section 2.3 on climate change) rather than forest exploitation.

EU policies and multilateral agreements

The Treaties establishing the European Union do not explicitly provide for a common EU forest policy. In this regard, the formulation and implementation of forest policy is first and foremost subject to competences of the Member States, which is supported by the following statement in the EU Council Resolution on a Forestry Strategy for the European Union: "the Treaty establishing the European Community makes no provision for a specific common forestry policy and [...] responsibility for forestry policy lies with the Member States".[290] However, forestry activities overlap with many of the EU competences explicitly granted in the EU Treaty and therefore might provide a legal basis for the Union to regulate in this issue area. This assumption is demonstrated by the adoption by the EU of its Forestry Strategy[291] to guide forest management in the Member States. Furthermore, the EU has enacted secondary regulation that is relevant to forestry.[292] The EU has also legislated in the field of trade with the adoption of its of an action plan on Forest Law Enforcement, Governance and Trade (FLEGT).[293] More recently, the European Parliament, the Presidency of the EU and the Commission have reached an agreement in June 2010 on the adoption of a regulation to address the import of wood products resulting from illegal harvesting. Once this regulation fully enters in force in 2012, companies will be required to use a due diligence system and carry out risk assessments where illegal activities are suspected. They will also be expected to trace back imported timber to the location where it was harvested.

In addition, the EU is party to multilateral agreements that influence decision-making and management of Arctic forests. For example, Russia, Norway, Finland and Sweden have cooperated under the Barents Forest Sector Task Force of the Barents Euro-Arctic Council (BEAC) to develop a Northern Dimension Forest Sector Programme and establish a 'model forest concept'.[294] Further discussion of these polices is provided in Annex C.

Effectiveness of policy instruments

Mitigating impacts of intensive forest management

Intensive forest management can be mitigated by direct regulation of the forest industry or indirectly through non-forest measures, such as nature conservation. As the EU Treaties do not provide an explicit EU competence in the field of forestry, the EU could only adopt legally-binding measures if they can be based on an EU competence in another sector. Two

[290] The Council of European Union, 1999.
[291] The Council of European Union, 1999.
[292] For instance: The Council of European Union, 2005; The European Parliament and the Council of the European Union, 2009; The European Parliament and the Council of the European Union, 2003, The Council of the European Communities, 1992.
[293] FLEG Action Plan by the European Commission, endorsed by the European Council. See: The Council of European Union, 2003.
[294] BEAC, 2010 (online)

key examples are the Natura 2000 network – established through the Birds Directive and Habitats Directive – and Common Agricultural Policy (CAP). The Natura 2000 network aims to protect important forest areas. In the boreal region, more than 5000 regions were assigned to Natura2000 sites. The CAP is an essential EU financial instrument for funding afforestation in the EU. The accompanied Rural Development Plans (RDPs) offer concrete possibilities to implement measures of forest protection in the boreal region.

Mitigating climate change and pollution impacts

Climate change impacts on boreal forests include increases in insect outbreaks, and forest fires, changed growth patterns of trees, a northward shift of species, and consequently a change in species diversity. Existing policies do not provide instruments that can mitigate such impacts directly. Air-borne pollution impacts on boreal forests are mitigated by European policy instruments regulating air pollution in EU Member States (see Section 2.2 on chemicals and transboundary pollution for more detail).

Mitigating socio-economic consequences

Socio-economic consequences of the above mentioned impacts and mitigation efforts are contradictory. While protection of biodiversity may have a positive effect on boreal forests' health and provide a sustainable future for employment in the forest industry in future, it may hurt employment in the short term. One policy instrument that may positively affect employment in the Arctic forestry sector in the short term is the Biomass Action Plan (BAP). As one of the key actions under the Climate and Energy Package (CEP) it encourages Member States to establish national biomass action plans (nBAPs[295]) specifically outlining what measures will be taken to develop biomass resources and mobilise new biomass resources for different uses while adhering to sustainability criteria for the biomass of domestic origin. Both Sweden and Finland foresee a regular growth in the generation of electricity from biomass up to 2020.[296] However, neither of these action plans provides specific elements addressing the particular nature of boreal forests. These concrete measures could strengthen sustainable forest management and lead to employment in this sector.

Policy options

The EU developed its Forest Law Enforcement, Governance, and Trade (FLEGT) policy as one tool to address illegal logging abroad. The current EU FLEGT action plan includes an emphasis on Russia.[297] The second step of the implementation of the action plan consists of Voluntary Partnerships Agreements with third countries. The inclusion of such a VPA with Russia could ensure the proper implementation of the action plan within this country, including its Arctic regions.[298] This adoption could facilitate the implementation of the draft regulation banning all imports to the EU of illegally harvested timber.

[295] Currently referred to as National Renewable Energy Action Plans (NREAPs).
[296] See Table 75 in Beurskens and Hekkenberg, 2010.
[297] FLEGT Action Plan: European Commission, 2003.
[298] The ban on imports from illegal logging very recently adopted by the European Parliament provides a good opportunity to address this issue. See: EU Parliament, 2010.

In addition, The Ministerial Conference for the Protection of Forests in Europe is considering a pan-European legally binding agreement on sustainable forest management. If such an agreement is concluded, its scope might cover, in addition to the forest areas already under the EU jurisdiction in Finland and Sweden, vast forests in northern regions of Norway and Russia. The EU could play a key role in promoting the negotiations towards such an agreement to extend the principles of SFM to the whole pan-European region under a legally binding framework. It is critical that the Russian perspective is considered in the negotiations towards such an agreement. The EU could also play a key role in ensuring the environmental and cultural integrity of the agreement. Within the EU's Arctic jurisdiction (i.e. Finland and Sweden), forests cover most of the sub-Arctic land area. The protection of these ecosystems is important for Europe to consider as it develops ways to reduce its Arctic footprint. The following two options could reduce the impact of the EU on its boreal forests:

Strengthen sustainable forest management in the EU

Sustainable Forest Management (SFM) is a key concept underlining the EU Forest Strategy, and was designed largely based on Scandinavian forestry practices. However, its implementation could be enhanced in two ways. First, SFM could become a compulsory standard applied systematically to all forestry activities within the member states of the European Union. Such a decision could be supported by the creation of an official certification scheme (for instance extending the Forest Focus scheme to the monitoring of forest management at the local level). The EU could also endorse some of the existing certification schemes based on a set of criteria and make compulsory the certification of all forest exploitation by one of these schemes (for instance the Forest Stewardship Council [FSC] and the Programme for the Endorsement of Forest Certification Schemes [PEFC]).

Secondly, the guidelines defining practices accepted under the framework of SFM could be tightened to increase the environmental integrity of forestry practices. For instance, foresters could be encouraged to increase the genetic diversity of trees to help limit the consequences on forest ecosystems. Also, particular constraints applying to old-growth sub-Arctic boreal forests could be acknowledged in the implementation of the principles of SFM.

Help reduce pressure on boreal forests

The second approach that the EU can adopt in order to reduce the pressure on boreal forest ecosystems is to generally reduce the demand for wood products. The reduction of the consumption of pulp and paper within the Member States could lead to a reduced pressure on forest ecosystems in Finland and Sweden, though these countries do employ sustainable forestry programmes and have many protected forested areas. Continued cooperation with Russia under the BEAC, for example, and working towards a sustainable forestry framework that applies in the Russian Barents region would be a key step forward. Only 10% of forests in the Russian Barents region are protected.[299] Analysis of whether sufficient and appropriate sub-Arctic forest areas are protected with regard to biodiversity and sustainability concerns would be helpful in this regard. The role of the energy industry in relation to the demand for renewable resources could be further acknowledged and its actors involved in the reduction of wood supply for energy demands.

[299] Välkky, et al., 2008. p. 40.

2.7 Tourism

Status, trends, and pressures

The popularity of Arctic tourism has increased greatly over the past two decades due to increases both in demand and supply. Tourists are becoming increasingly interested in 'ecotourism' and wilderness destinations, both of which are readily available in the Arctic.[300] The global concern over climate change and, correspondingly, the perceived "expiration date" of Arctic landscapes and wildlife, is further driving demand for tourism services in the high North. Tourists are able to come on cruise vessels or by aircraft. The northern lights and other attractions are increasingly being marketed by specialist tour operators.[301] Considering that Europeans comprise about half of all international travellers and Europe's proximity to (and overlap with) the Arctic, it is very likely that European citizens comprise a large portion of this growing demand.[302]

The cruise ship industry is the fastest growing sector of the travel market and one of the top tourist attractions in the Arctic.[303] According to the Arctic Council's Marine Shipping Assessment (AMSA) 2009 Report, marine-based tourism accounts for the largest segment of the Arctic tourism industry in terms of numbers of persons, geographic range and types of recreation activities.[304] Svalbard, Norway, an Arctic archipelago, has seen its annual cruise passengers increase from about 20,000 in 2000 to nearly 30,000 in 2008, while its cruise ship landing sites have risen by about one third in that time.[305] Notably, the number of tourists from cruise ships has remained stable between 2004 and 2008 at approximately 30,000.[306] Approximately 370,000 cruise passengers visited Norway in 2007, the number of cruise ships in Canada doubled from 2005 to 2006, and Alaska cruise visitor volume rose over 1 million in 2007.[307] Many areas in northern Russia, Greenland and the North Pole have recently become accessible to tourists, either due to reduced military activity or the warming climate.[308] As tourism is of growing importance to the Arctic economy, some regions are giving high priority to tourism development.[309]

In recent years the EU government and the tourism industry have emphasized the need for developing "sustainable tourism," considering that inbound and outbound tourism contribute to EU GHG emissions.[310] At the same time, recent decline in numbers of EU tourists since 2009 is encouraging the tourism industry to look for new ways to promote tourism.[311] For the past three years (2007-2009), the European Tourism Forum has focused on sustainability.[312]

---

[300] Globally, ecotourism is growing at three times the rate of tourism overall. SMART, 2006, p.6; Guðmundsdóttir, 2009, pp. 1-2.
[301] EEA, 2004, p. 19.
[302] TSG, 2007, p. 4.
[303] Daily Mail, 2007.
[304] AMSA, 2009, p. 78.
[305] Geitz et al., 2004, p. 4.
[306] Statistics Norway, 2009, p. 17.
[307] Snyder, 2007a, p. 4.
[308] Snyder, 2007a, p. 8, 10; Sustainable Tourism Case Studies: Arctic Tourism, online.
[309] Duhaime, 2004, p. 74.
[310] TSG, 2007, p. 11.
[311] European Commission, 2010, p. 4.
[312] The European Tourism Forum is an annual conference which started in 2001 and focuses on promotion and improvement of various tourism sectors and communication strategies. Participants include a wide range of tourism stakeholders including SME owners, government officials, representatives of NGOs, etc. The themes

Sustainable tourism and eco-tourism is growing in popularity, and tour operators envisage that it could create "ambassadors" for preservation of threatened habitats and wildlife, encouraging protection of these ecosystems. European tourists are exhibiting similar concerns: 35% of EU-27 tourists consider the environment when making travel plans, and a further 16% have not considered environment in the past but intend to in the future.[313] The EU Tourism Sustainability Group emphasizes that tourism itself can become a driving force for sustainable regulation and development, since popularity of many destinations depends on the pristine quality of its natural environment.

This focus on sustainability is a positive development as Arctic tourist spots continue to grow in popularity, which heightens the risk of social and environmental stress on natural habitats, wildlife and indigenous peoples.

While the economic importance of tourism for many northern communities is recognized, the purpose of this report is to evaluate the environmental footprint created in the Arctic by tourism activities, much of which is already addressed by existing policies, as discussed in the subsections below. The unique qualities of the Arctic are the same characteristics that make reducing the direct environmental impacts of tourism challenging. Extreme and unpredictable weather, remote locations and sub-zero waters require tourists and tourism enterprises to plan for the worst, bringing large amounts of gear potentially destructive to Arctic wildlife and which may end up as litter. Substantial amounts of fuel are required to access isolated areas by ship, air-craft and other vehicles.[314] These remote areas may lack sufficient trash and sewage handling facilities, which can result in trash burning or otherwise unsanitary and polluting methods for disposing of waste.[315] Slow growing and rare flora are easily disturbed by hikers, bikes, all-terrain vehicles (ATVs) and snowmobiles.[316] Tourist groups may come quite close to the megafauna attractions (polar bears, walruses, reindeer, and whales) and there is some concern that this is a disturbance to the animals.[317]

In particular, cruise ships can significantly disturb Arctic habitat and communities. This is not only due to the potential for grounding or sinking, but oil spills, waste water discharge, water pollution from hull paint, and many other risks.[318] A cruise ship dumps overboard an estimated 3.5 kg of waste per passenger daily, and tourism activities are believed to be a significant source of marine litter.[319] Oil spills both from accidents and routine ship operation can have both an immediate negative effect on wildlife and can also result in the bioaccumulation of toxins over time, threatening populations of plants and animals.[320] Cruise ships' ballast water can introduce new and invasive marine species into Arctic ecosystems, which compete with native species for resources. The areas most vulnerable to cruise ship

for the past three years were: „EU Tourism and the Economic Downturn: New Opportunities for a Sustainable and Prosperous Future?" (2009), "The European Tourism Offer: Quality and Sustainability vis-à-vis Demand Trends" (2008), "Sustainable Management of Tourist Destinations" (2007). EC Enterprise and Industry: Tourism 2009, European Tourism Forum.

313 EC Enterprise and Industry, 2009, p. 27.
314 Dawson, et al., 2010, p. 326.
315 Snyder, 2007b, p. 17; Rennie, 2010.
316 Snyder, 2007b, p. 15.
317 OSPAR, 2008, p. 18.
318 Geitz et al., 2004, pp. 19-20.
319 Geitz et al., 2004, p. 26; OSPAR, 2008, p. 22.
320 Geitz et al., 2004, p. 19.

impacts include cliffs where birds are feeding and moulting, soft-bottom and tidal communities, deltas and lagoons.[321]

It is difficult to quantify tourism's environmental impact on the Arctic. Some of the potential impacts mentioned here may not currently represent significant challenges, and many are likely to be isolated in areas of relatively high tourist traffic. A 1994 estimate indicates tourism contributes less than one percent of human impacts in the Arctic.[322] However, there are now more than 5 million tourists visiting the Arctic each year, and there is potential for these impacts to grow in significance and severity in tandem with tourism industry growth if preventative steps are not taken.[323]

Arctic tourism is highly seasonal, which can cause some communities to be seasonally transformed. This has the potential to stress local infrastructure, law enforcement and social institutions.[324] The number of visitors per year in relation to permanent population is quite high in several areas of the Arctic, making it a key component of the regional economy, but also making it a source of potential disruption to local lifestyles and environments.[325] There is the potential for miscommunication and tension between local and indigenous peoples and tourists and tour operators, due to language barriers and different lifestyles.[326] Similarly, greater numbers of seasonal labourers working in the tourism industry can change the social dynamics of sparsely populated regions and create further stress for locals.

Aside from the environmental impacts of tourism activities, positive impacts of tourism growth both in the Arctic and the EU include economic growth, job creation and building a market for local and indigenous goods, thereby increasing the incentive for cultural preservation. The local economic and social benefits of tourism vary between different Arctic regions and the type of tourism that they offer. Since most Arctic tour enterprises are run by operators based outside the Arctic, little revenue of this type of tourism accrues to the indigenous people or local communities. In contrast to locally-based tourism businesses, such as the Santa Claus Village in Finland, the Ice Hotel in Sweden, and various ski centres, which contribute to the local economy, the local social and economic benefits of Arctic tour enterprises are therefore limited. Consequently, in both northern Iceland and Finnish Lapland, for example, policy measures have been taken to make tourism a year-round field of employment for locals.[327]

There is generally a need for further research into the links between tourism and climate change, Arctic economic development, and biodiversity conservation.[328] But national parks in the Arctic already present one example of the convergence of these issues and a way that tourism can promote nature conservation. There are quite a few European national parks located in the Arctic which serve as nature reserves and areas of biodiversity protection as well as places where the public can enjoy comparatively unspoilt nature (see Section 2.1 on biodiversity). The largest park in the world, Northeast Greenland National Park, is found above the Arctic Circle, while Sweden, Norway and Finland are home to dozens of Arctic and sub-Arctic parks.[329] Increasing numbers of visitors to national parks in the Arctic can put

[321] Geitz et al., 2004, p. 15.
[322] Stewart et al., 2005, p. 386.
[323] Hall and Saarinen, 2009, p. 304.
[324] Snyder, 2010b, p. 18.
[325] Hall and Saarinen, 2009, p. 304; CAFF, 2002, p. 29.
[326] SMART, 2005.
[327] Akureyri's Regional Growth Agreement.
[328] Hall and Saarinen, 2009, p. 305.
[329] National Parks of North Europe, online.

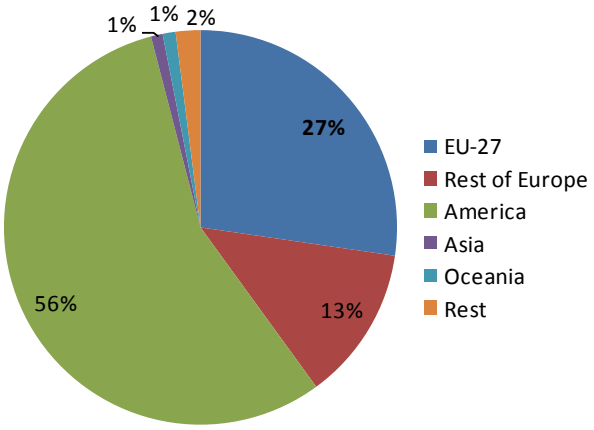
extra pressure on these already climate change-threatened ecosystems and their protected wildlife populations. Governments must therefore plan for a higher volume of visitors and develop strategies for managing their environmental footprint. With the appropriate management, national parks can act as a conservation tool and stimulate tourism at the same time.[330]

EU's Footprint

The EU contribution to the direct impacts of tourism-related activity in the Arctic is difficult to determine. There is currently no composite, comprehensive data on numbers of tourists in the Arctic, let alone information broken down to a level at which the EU-27 share of these numbers can be identified. Information on the EU share of cruise ship traffic in the Arctic is similarly unavailable. This is complicated by the fact that so many ships in the Arctic today – especially from the cruise ship industry – are sailing under flags of convenience (FOCs). So a ship might be owned and operated by a company in the EU, but its flag may not be that of the particular EU Member State in which its owner company is located. This section therefore presents a general picture of the way in which the EU impacts the Arctic via tourism activity.

According to calculations based on national statistical sources,[331] it can be estimated that the European share in nights spent by visitors of the Arctic (excluding the Russian Arctic) was 40%, while American visitors accounted for 56%, and visitors from Oceania and Asia for 1% each (see Figure 20).

Figure 20 Distribution of visitors to Arctic countries and regions by origin, around 2007[332]



***Note**: The category "Rest of Europe" includes travellers from EU and non-EU countries that could not be allocated with certainty to the EU-27. Most data sources consulted only specify the numbers of tourists from a few countries and give either continental or global aggregates for the remaining areas. For example they give specific numbers for visitors from big countries such as the US, UK, Germany, Japan, but in many cases do not give numbers for small or low income countries such as Eastern European and African countries. In general it has to be said that*

[330] CAFF, 2002, p. 28.

[331] Innovation Norway, 2007. pp.10,13,18; Nutek, 2008, pp. 39f; Statistics Finland, 2010; Statistics Greenland, 2009; Alaska Office of Tourism Development, 2007a. pp. 46f; Alaska Office of Tourism Development, 2007b, pp.19, 44; Alaska Office of Tourism Development, 2007c; Statistics Canada, 2010; Canadian Tourism Commission, 2010; Department of Tourism and Culture Yukon, 2010; Statistics Iceland, 2010.

[332] Data availability: Finland 2007, Sweden 2007, Norway 2006, Iceland 2007, Greenland 2008, Canada 2004/2009, Alaska 2006.

the degree of detail differs from country to country substantially. Lack of detailed data sources also explains the category "Rest" in the figure above, which represents tourists with origins not further specified. Numbers for Russian tourists, wherever available separately (e.g. in statistics for Sweden and Norway), were allocated to the Asian continental sum in the figure above. Numbers for the Russian Arctic and the Faroe Islands are not currently available.

Source: Sustainable Environment Research Institute (SERI), 2010.

Indirect impact on the Arctic from tourism-driven GHG emissions is also substantial. Tourism-related transport accounts for approximately 14% of EU-25 GHG emissions.[333] Most of these emissions are due to air travel, which is expected to grow significantly over the next decade.[334]

EU policies and multilateral agreements

The EU Tourism Policy, EU Structural Funds, Sustainable Model for Arctic Regional Tourism (SMART) (2000), and EU participation in the UNESCO World Heritage Convention are described in detail in Annex C. EU standards for waste management and related regulations under IMO to which the Arctic cruise ship industry is also subject, in addition to, for example, the high standard waste management systems in place in several Arctic areas and communities, are discussed in Section 2.8 on transport. Relevant elements of UNCLOS Article 19 relating to territorial seas and national requirements that coastal States are entitled to impose are also included in the Transport section. An analysis of the effectiveness of these tourism-related policies follows in the next section.

Effectiveness of policy instruments

EU Tourism Policy recommendations have trickled down to several Member States in the form of concrete initiatives. The Mediterranean and Baltic regions, Denmark, and Calvià, Spain have implemented strategies to promote sustainable tourism.[335] In the European Arctic, Finland has formulated "sustainable nature-based tourism plans" for its northern national parks Pyhä-Luosto and Pallas-Yllästunturi.[336] Certain Swedish Arctic tourism businesses are incorporating environmental and social consciousness in their practices, such as minimizing impact of nature tours, highlighting and employing locals and their culture, and devoting portions of revenue to local education and research.[337] Moreover, Swedish companies devoted to environmentally and culturally sound standards of tourism are awarded the 'Nature's Best' label, the first label for sustainable tourism in Europe.[338] Certain tourism companies operating in the Arctic have begun to self-regulate, through membership in organizations such as AECO, incorporating standards and guidelines that take the natural and cultural environment into account in their tourism practices.

[333] Peeters et al., 2007, p. 89, 90.
[334] Peeters, et al., 2007, p. 90.
[335] Working Group D Final Report, 2001.
[336] EC Enterprise, 2008, p. 9.
[337] SMART, 2005.
[338] Probably the best nature tours in Europe, Nature's Best web-page, online.

It remains to be seen if any of the EU Structural Funds mentioned in Annex C will be directed toward sustainable tourism projects in the European Arctic regions. Given that these policy suggestions and funding sources are non-binding and non-dedicated, it is uncertain whether they will have a wide-spread impact. Momentum in the direction of sustainable tourism is certainly building in Europe due to increased demand for eco-tourism and heightened environmental concern, but the ability of the government to contribute to this movement depends on how EU level policies are translated into Member State- and local-level regulations. This is particularly pertinent for the Arctic region concerning implementation and enforcement of safety and traffic regulations for cruise ships.

The Northern Periphery Programme (NPP), funded through the European Regional Development Fund (ERDF), is an effective tool for funding projects that support sustainable tourism development in the Arctic. For example, the Northern Maritime Corridor project, completed in 2005, sought to connect Northern coastal areas in the Arctic by developing sustainable and safe sea transport.[339] The Nature Based Tourism project, completed in 2006, researched strategies for strengthening the environmental attributes and sustainable product development of nature-based tourism in the Northern Periphery.[340] A current project is focusing on developing health care and emergency response capacities in sparsely populated areas, an important aspect of maintaining safer local communities and supporting increased numbers of tourists.[341]

The UNESCO World Heritage Convention is a possible structure for preserving natural and cultural heritage sites, which can be at risk from tourism-driven overuse and destruction. Europe has exhibited a strong commitment to the Convention in the past, with 288 inscribed sites as of 2005.[342] Arctic sites, though currently underrepresented, have been identified as a priority region for future nominations, particularly sub-polar Arctic tundra and river deltas in Russia.[343] This depends, however, on nominations submitted by State Parties.

Initiatives such as SMART have the potential to effect change on the ground level by communicating directly with tourists and tourism providers. Their collection of best practices and training modules are integral to spreading sustainability initiatives at the local level. However, they tend to lack dedicated funding and can fizzle out over time without sufficient member support, staff or executive direction. For example, the Sustainable Arctic Tourism Association's (SATA) attempt to implement an international "Sustainable Arctic Transportation" label has been abandoned.[344] They were unable to secure funding to continue promoting the findings of SMART, though copies of the Training Manual are still distributed occasionally.[345]

Regional and national level policies can be effective in promoting and maintaining a thriving sustainable tourism industry, given the adequate support of the tourism industry and cooperation of tourists.[346] For example, the Norwegian government's explicitly stated goal of making Svalbard the world's best managed wilderness destination, announced in the early 1990s, was carried out by dividing the area into sections in which different activities were

[339] NPP, 2004, Main Projects.
[340] NPP, 2004, Main Projects.
[341] NPP, 2010, Main Projects: CoSafe.
[342] World Heritage Reports, Periodic Report and Action Plan: Europe, 2007, p. 32.
[343] World Heritage Reports, Periodic Report and Action Plan: Europe, 2007, pp. 31-32.
[344] Couvrette, 2010.
[345] Couvrette, 2010.
[346] Guðmundsdóttir, 2009.

permitted, depending on suitability of the environment and conservation concerns. The tourism industry in Svalbard was mainly jumpstarted and developed by the Norwegian government, but always through the lens of maintaining the natural endowment of the area, namely the highly isolated and "untouched" wilderness. Today, when asked if they are interested in having a road built in Svalbard to improve accessibility for tourists, local tourism providers insist that this would "take away the excitement and the spirit of Svalbard".[347] This "best practice" example and the best practices listed on the SMART website indicates that highly integrated goals of tourism growth and sustainability can over time result in tourist destinations where both tourists and enterprises are invested in environmental preservation.

Policy options

The EU's ability to influence the environmental, economic and social impacts of EU tourists in the Arctic regions outside of Europe is largely limited. An EU-wide 'sustainable tourism' policy would directly affect the impact of EU tourists on the Arctic if they are travelling to Finland or Sweden and perhaps Norway, Iceland and Greenland, but to a lesser extent if they are visiting Canada, Alaska, Russia, the North Pole, etc. However, the EU could play a stronger role in limiting greenhouse gas emissions from tourism-related transportation. EU tourism, both incoming and outgoing, is a source of GHG emissions, which carry negative environmental impact for the Arctic regardless of where they are emitted. Therefore, policy instruments should focus on the following:

1) reducing direct tourism impact on Arctic areas and cultures within Europe and elsewhere and
2) reducing GHG emissions related to all tourism activities, especially from tourism-related transportation.
3) safer shipping, the threat of invasive species, as well as search and rescue mechanisms (these issues are dealt with in more detail in Section 2.8 on transport).

Support establishment of an "Arctic Tourism Association"

The formation of a European Arctic Tourism Association (EATA) to manage Europe-based tourism to the Arctic, or the creation of an International Arctic Tourism Association (IATA) to manage all tourism in the Arctic would contribute to a simplified and more effective management of tourism in the Arctic. Similar to the International Association of Antarctic Tour Operators (IAATO) the EATA or IATA could be a self-regulatory organization with high environmental, security and behavioural standards. The already existing Association of Arctic Expedition Cruise Operators (AECO) could serve as a starting point for a new association, which could create a label for "Sustainable Arctic Tourism" as proposed, yet not implemented, by the Sustainable Arctic Tourism Association (SATA) in 2005. Financial support is within the scope of the Northern Periphery Programme or EU Structural Funds. On a larger note, the creation of a Sustainable Arctic Tourism Fund could be an option as a supportive measure for EATA or IATA. Before the facilitation of new tourist destinations, the social and environmental impacts of tourism operations can be strategically assessed within the scope of the new association while the implementation of "best practices" identified by

[347] Guðmundsdóttir, 2009, p. 11.

SMART or other research projects can be a focal point of European tourism policies. By introducing a strategic social and environmental assessment for tourism, the EU could be a forerunner in tourism governance.

Help reduce GHG emissions

To address the reduction of GHG emissions related to tourism, the EU Tourism Sustainability Group has several suggestions for decarbonising tourism: using lower-carbon transportation fuels, promoting low-carbon modes of transportation at tourist destinations (e.g. bicycles, walking), making carbon offset schemes available to travellers and including the aviation sector in the EU Emissions Trading Scheme (EU ETS).[348] There are synergies among these issues and many other policy areas (e.g. local zoning, energy policy) and cannot be addressed through tourism policy alone. Nevertheless, the World Travel and Tourism Council has set a goal of reducing global GHG emissions from tourism by 25-30% by 2020, which could potentially be achieved by increasing energy efficiency and utilizing renewable energy in tourist accommodations.[349] Decreasing emissions from transportation will be much more difficult, especially because currently there is no feasible low-carbon substitute for jet fuel.[350]

Designate Arctic World Heritage Sites

While only two sites in the European Arctic are designated as World Heritage Sites, the Tentative List includes several Arctic sites, such as the Svalbard Archipelago and Jan Mayen Island, Norway, The Holy place of worship of Ukonsaari by the Sámi people at Inari, Finland, or Aasivissuit, Arnangarnup Qoorua (Greenlandic inland and coastal hunting area), Greenland.[351] In order to reduce impacts of tourism on the fragile Arctic environment and on the Arctic indigenous cultures, the EU could encourage its member and EEA states to support additional Arctic natural and cultural sites for nomination under the World Heritage Convention.

Continue to link tourism and conservation

Designation of Arctic World Heritage sites could contribute to linking tourism and conservation. Although there is still a lack of research on the impacts of ecotourism on the Arctic environment, the linkage between conservation and tourism is not new. For example, the Laponia World Heritage site in Sweden does not promote large-scale tourism, but advertises the necessity for environmentally responsible tourism, benefitting the local population in order to raise awareness and increase economic possibilities for conservation efforts.[352] In Svalbard, the linkage between tourism and conservation is furthermore promoted by the United Nations[353] as well as in the WWF's *Ten Principles for Arctic Tourism*.[354] The EU could facilitate further cooperation of this nature.

[348] TSG, 2007, pp. 9-10.
[349] WTTC, 2007, online.
[350] Gössling et al., 2009, pp. 8-10.
[351] UNESCO World Heritage, Tentative Lists.
[352] Laponia World Heritage, Ecotourism, online.
[353] UN News Centre, 2010.
[354] WWF: Ten Principles for Arctic Tourism.

2.8 Transport

Status, trends, and pressures

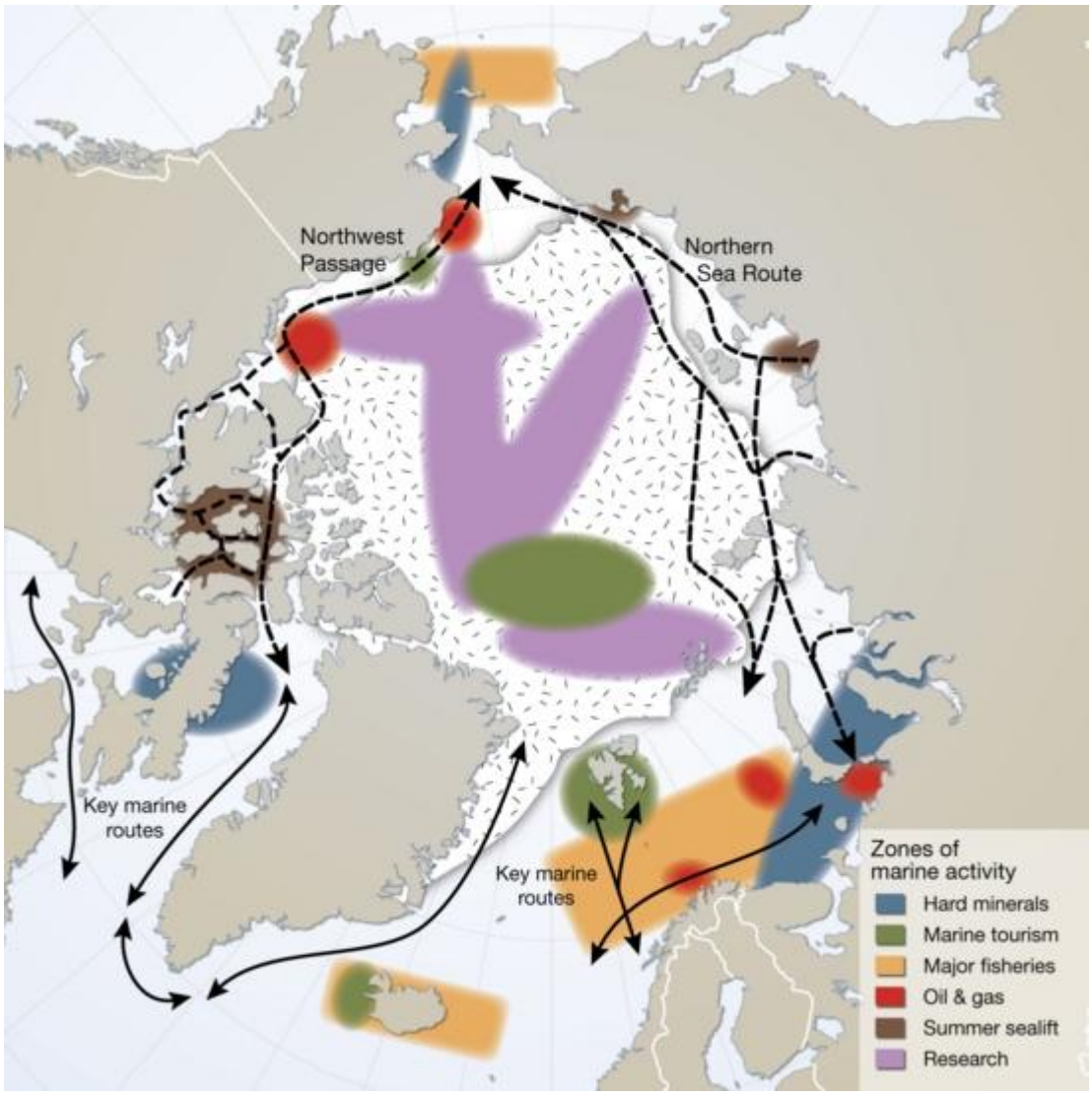
Transport comprises a significant connection between the EU and the Arctic, both literally and figuratively. EU-owned ships travelling to, from and within the Arctic, as well as air travel and road transport are expected to increase their environmental impact on the Arctic directly and indirectly in the coming decades. The topic of "transport" covers a wide range of economic activities and policies, and is closely linked with other topics, such as tourism, fisheries, energy and climate change. This section focuses on EU involvement in Arctic shipping.[355]

Shipping is the focus because changes in the Arctic over the next few decades, namely the recession of sea ice, are likely to incentivize more shipping activity over greater areas and for longer periods during the year. The economic implications of this development are of interest to all Arctic coastal states, indicated by the many recent governmental conferences and reports that address the expected changes in Arctic shipping and its effects on economic development.[356] Marine transport in the Arctic is difficult and plagued by unique risks: poor weather conditions and a relative lack of complete and precise charts for the entire region, communication systems, and navigational aids. Cold temperatures can reduce the effectiveness of deck equipment, including emergency equipment.[357] Rescue and clean up is both difficult and costly for more remote areas. A lack of clearly delimitated maritime boundaries also creates difficulty for the crew who may be uncertain about which international and national laws apply at a given time. Ice in particular creates a challenge for the ship's hull, its propulsion equipment and any appendages.

Even with these challenges, up to 6,000 vessels operate in the Arctic each year, 1,600 of which are fishing vessels (see Figure 21).[358] Scientists predict that the Arctic could be "ice free" for a period during the summer as soon as 2040 (summer sea ice has been decreasing by 6.2% per decade since 1979, with the lowest area in the past century recorded in the summer of 2007).[359] Sea ice melt in 2010 was on track to break the 2007 record, but the melting rate decreased in July and August.[360] The gradual removal of this barrier as well as demand for Arctic oil and gas could mean an increase in Arctic shipping traffic.[361] The Barents Sea in particular expects to see more shipping activity in the next 10-20 years due to increased petroleum traffic from Russia to Europe and the US, Norwegian petroleum activities, as well as greater numbers of cruise ships.[362]

[355] As in the AMSA 2009 Report, which serves as a key references for this section, Arctic shipping here refers to all types of marine transport, including tankers, bulk carriers, offshore supply vessels, passenger ships, tub/barge combinations, fishing vessels, ferries, research vessels, and government and commercial icebreakers.
[356] For example, Iceland's "Breaking the Ice: Arctic Development and Maritime Transportation" conference (2007) and the Arctic Maritime Shipping Assessment (2009).
[357] IMO, 2002a.
[358] AMSA, 2009, p. 4.
[359] AMSA, 2009, pp. 25-26.
[360] National Snow and Ice Data Center, 2010.
[361] AMSA, 2009, p. 97.
[362] Norwegian Maritime Directorate, 2003, p. 2.

Figure 21 Current marine shipping uses in the Arctic, 2010



Source: UNEP/GRID-Arendal, 2010.

A large majority of the vessels currently reported in the Arctic Circle are flagged under the USA, Russia, Norway, Iceland, Greenland, the Faroe Islands and Canada.[363] This could change in the future if the Arctic becomes a navigable route connecting the Atlantic and Pacific oceans, a limited alternative to the Suez and Panama Canals which are already used to near capacity.[364] A two to three month summer season for Arctic maritime transport may be possible with *Polar Class* ships.[365] A wider variety of nations may begin using Arctic shipping routes due to the simple fact that, for example, it would shorten transport distances between Europe and East Asia by 40%.[366] However, this distance advantage is greatly diminished by the presence of Arctic sea ice for eight to nine months each year, thereby

[363] AMSA, 2009, p. 71.
[364] Breaking the Ice, 2007, p. 7.
[365] AMSA, 2009, pp. 103-104.
[366] Breaking the Ice, 2007, p. 7.

slowing ship speeds and necessitating convoy support of vessels incapable of independent ice operations.[367]

Research interest in the opening of viable shipping routes through the Northern passages has recently increased.[368] Moreover, the shipping industry is already reacting to these prospects by ordering or building polar class vessels.[369]

Increased future transport through the Arctic will further aggravate the existing environmental impacts of shipping in the Arctic, notably the degradation of air quality from the release of carbon monoxide, nitric oxide and other chemical substances by the ships' combustion engines.[370] During the summer months, surface ozone concentrations in the Arctic could be enhanced by two or three times in the next decades as a result of ship operations through the northern passages.[371]

However, an Arctic shipping boom is not inevitable. Significant government involvement will likely be needed to build adequate Arctic shipping infrastructure such as ports, information and surveillance systems on safe navigation, emergency response, and ice information collection and distribution (including continually updated charts of ice distribution, characteristics of the ice, satellite imagery, etc.).[372] Development is also needed in ship technology, especially in the areas of ice breaking and versatility of operation in both Arctic and warmer waters. Safety of new routes needs to be established. International cooperation will be needed in establishing standards of marine environmental safety, crew training and education.

Stakeholders agree the ability to overcome these barriers will play a bigger role in promoting Arctic shipping than climate change and receding ice.[373] The EU can play a role in ensuring that these developments are accompanied by sufficient environmental impact assessments and updating existing international agreements. EU maritime environmental and safety standards have been modified over the past decade in response to highly visible incidents, but may not be sufficient for significantly expanded Arctic shipping.

EU's Footprint

The following focuses on the direct impacts of EU-driven Arctic shipping. The most important *indirect* impact of Arctic shipping – air pollutant emissions – is examined in further detail in Section 2.2 on chemicals and transboundary pollution. It is also important to note that there are other EU-driven transport-related activities aside from shipping that have an impact on the Arctic, namely, emissions from EU/Arctic aviation; road transport associated with industrial infrastructure in the Arctic; and recreational transportation (e.g. biking, snowmobiling). These activities are touched upon in Section 2.2 on chemicals and transboundary pollution, Section 2.4 on energy, and Section 2.7 on tourism, respectively.

[367] AMSA, 2009, p.103.
[368] Kitagawa, 2009; Somanathan et al., 2009; Liu and Kronbak, 2010.
[369] Chircop, 2009, pp. 356-357.
[370] Granier et al., 2006.
[371] Granier et al., 2006.
[372] Beginning 1 July 2010, Canada.
[373] AMSA, 2009, p. 116.

The EU contribution to the direct impacts of Arctic shipping is difficult to determine. Other than first steps taken by the AMSA report, there is currently no composite, comprehensive compilation of data on the specifics of marine traffic in the Arctic, let alone a data set that allows for a closer investigation of the EU percentage share of such numbers. Efforts to capture relevant and accurate data are complicated multiple factors: there are several geographic definitions of the Arctic; many ships are sailing under flags of convenience (FOCs); and "shipping traffic" includes a wide range of vessels, including fishing vessels, tankers, container ships, icebreakers, cruise ships, offshore development fleets, and more. This section therefore presents a general picture of the way in which the EU impacts the Arctic through shipping activities.

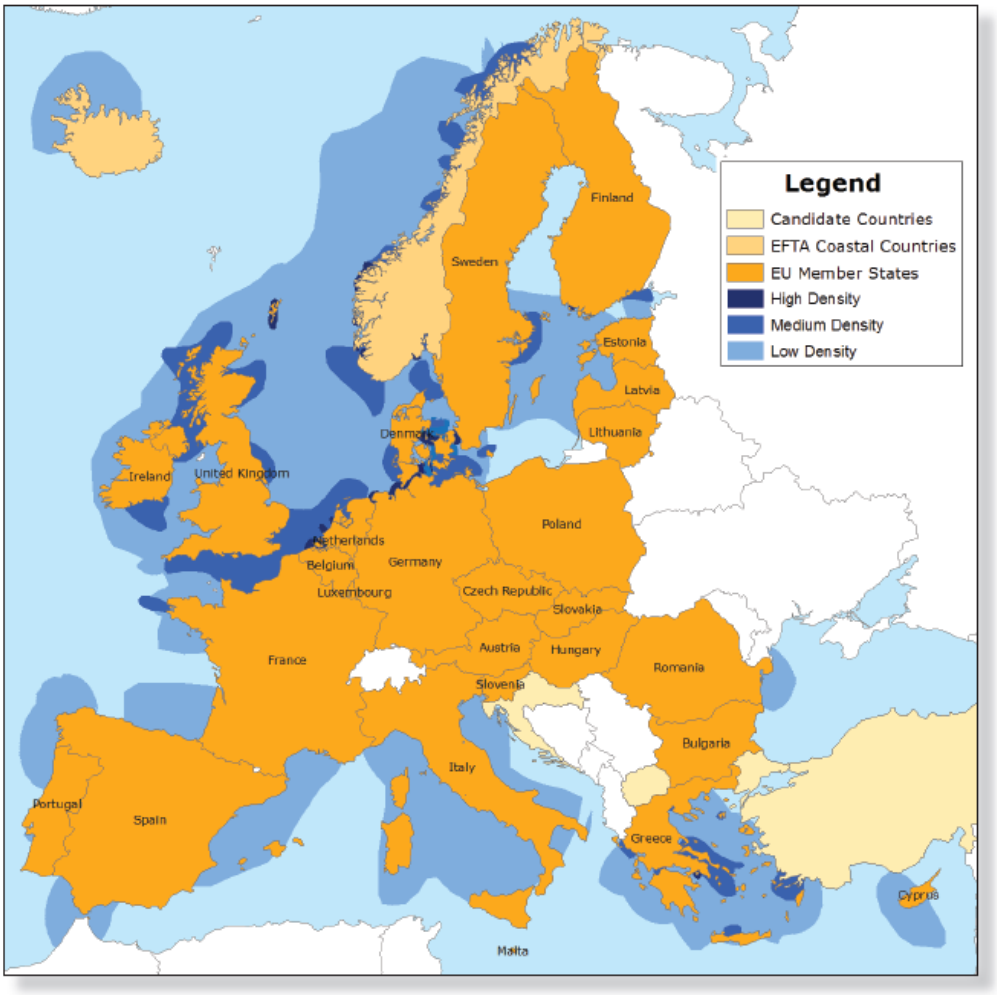
EU-driven shipping transport directly impacts the Arctic both through accidents and normal operation. International and EU policy has been particularly concerned with oil tankers, which carry enormous potential for destruction and economic loss in the event of an accident.

The EU oil trade is the largest in the world, comprising 27% of global imports.[374] Its 855 oil tankers are 15% of the world total, but it is estimated that EU companies control 35% of the world tanker fleet through FOCs.[375] Including Norway, the European-owned fleet comprises over 50% of the global fleet. This puts Europe in a good position to regulate oil tankers both as flag States and port States.

In 2004, 22% of the EU oil tanker fleet was over 20 years old, the age at which vessels tend to be at a higher risk of accident and spills.[376] Seventy per cent of EU oil tanker movement is along the northern and Atlantic coasts, which are also the areas where the most shipping incidents occur (see Figure 22). When considering the potential for increased petroleum trade activity in the Arctic combined with the EU's aging tanker fleet, risk of oil spill in the Arctic is heightened. Arctic ice, darkness and fog all further increase that risk, as well as complicate the rescue and clean-up process.

[374] European Commission, 2000a, p. 8.
[375] European Commission, 2000a, p. 8.
[376] EC, 2004, p. 161.

Figure 22 Density of European shipping accidents, 2010



Source: EMSA, 2010b, p. 31.

Oil discharges, from accidents and normal vessel operations, can impact wildlife and their habitats through water and food chain toxification, and suffocation or starvation for many marine species. Oil spills can also impact wilderness areas and local communities dependent on healthy oceans.

Other potential shipping impacts include waste dumping, navigation noise that can disrupt marine animal activities and migration, anchoring effects on the ocean floor, and destruction of iceways necessary for mobility of local communities and indigenous hunting activities. For example, indigenous communities have noted that increased shipping activity can noticeably reduce the presence of narwhals, requiring hunters to travel farther to find game. Some individuals have requested that certain sea ice passages be left undisturbed, and many indigenous peoples insist that the Arctic be free of contamination.[377]

EU policies and multilateral agreements

[377] AMSA, 2009, p. 126.

The EU policies that govern marine environmental and vessel safety are the three Erika packages, largely galvanized by the sinking of oil tanker Erika in 1999, which spilled 14,000 tonnes of oil off the coast of Brittany, France.[378] Over the following decade, the EU implemented new and revised shipping regulations meant to address the lack of oversight and precaution that led to the Erika disaster. This legislation and the EU's role in international agreements on these issues are described in Annex C. An analysis of their effectiveness follows in the next section.

Effectiveness of policy instruments

EU policies

By some measures, the first two Erika packages have been effective in reducing oil spills due to accidents. Its objectives largely align with the three major contributors to oil tanker spills, which are old age of the vessel, human error (due to fatigue or inadequate training), and corrosion in ballast tanks. Seventy-five ships have been black-listed by the Commission due to exceeding the age-limit and two-time detention limit.[379] Reducing the number of single hull ships is important if this will contribute to safer navigation, but double hull ships require special maintenance and cleaning, the lack of which may result in greater corrosion.[380] Given that age is the most significant risk factor of oil tankers and most double hull vessels are relatively new, it remains to be seen if double hull ships will truly be safer than single hull in the coming decades.[381]

The activities of the newly established (by Erika II) European Maritime Safety Agency (EMSA) have included, in 2008 alone, 18 inspections of classification societies, 8 trainings of seafarers under STCW, 37 instances of assistance to the Commission, 5 inspections of port State control and 7 inspections of Port Reception Facilities for ballast water and discharges.[382]

The EMSA's Maritime Accident Review provides an overview of the impact of these activities on vessel accidents and pollution. In 2009, 626 vessels were involved in 540 accidents in and around EU waters, which is a decrease from 2007 and 2008 but a 17% increase from 2006.[383] The amount of accident-related spilled oil was 1,500-2,000 tonnes in 2009, a significant decrease from 2007 and 2008 (7,000-8,000 and 2,000-3,000 respectively).[384] Some of the oil spills were in the Arctic area, such as the Full City accident which released 200-300 tonnes of oil that spread along a significant section of the Norwegian coast.[385] Cargo ship Petrozavodsk grounded off Bjørnøya in the Arctic and spilled 60 tonnes of fuel (among other pollutants), resulting in many dead and injured sea birds. The Governor of Svalbard called for a ban on ships carrying heavy fuel around the archipelago.[386]

[378] IMO, 2002b.
[379] EMSA, 2010a .
[380] Mattson, 2006, p. 192.
[381] Mattson, 2006, p. 192.
[382] EMSA, 2009, p. 31.
[383] EMSA, 2010b, p. 6.
[384] From reported accidents (not necessarily from tankers only). EMSA, 2010b, p. 6.
[385] EMSA, 2010b, p. 29.
[386] EMSA, 2010b, p. 29.

The EU is making some unsteady progress in its attempt to increase the safety of shipping: EU waters saw 540 accidents in 2009, a decrease from 2007 and 2008 but a 17% increase from 2006.[387] The recent decline is exhibited in spite of the fact that the seaborne oil trade continues to increase significantly. This is a positive development and could indicate that maritime safety policy is starting to head in the right direction.

Multilateral agreements

There are a number of international agreements that address marine environmental protection and shipping safety (for details, see Annex C to the report). These agreements provide an important framework for regulating the environmental impacts of shipping, but are all generally limited in their effectiveness by gaps in reporting and compliance.

International Convention for the Prevention of Pollution from Ships (MARPOL 73/78)

Since its establishment, MARPOL has generally been considered more effective than the 1954 Oil Pollution Convention it replaced, chiefly because of its improvement of enforcement schemes. However, apart from the fact that pollution from oil tankers appears to be in decline[388] – unlike discharges from other types of ships – proper assessment of MARPOL's effectiveness is hampered by a lack of adequate baseline information against which improvements can be measured.[389]

MARPOL has improved on the 1954 Convention in a few key ways. Whereas the number of ratifications to the 1954 Convention was relatively low, the parties to MARPOL comprise over 98% of merchant tonnage (Annexes I and II).[390] Under the 1954 Convention, insufficient interest in acting outside territorial waters and difficulties in collecting evidence and proceeding against ships rarely entering certain ports resulted in inadequate enforcement by flag States.[391] Under MARPOL, cooperation provisions regarding certification, inspection, reporting, and the strengthening of port state jurisdiction have greatly enhanced its effectiveness and have led to, for example, the Paris MOU and the Tokyo MOU, under which flags and ships are blacklisted as substandard if States do not comply with the requirements of MARPOL.

However, a lack of sufficient enforcement mechanisms within certain areas of regulation within MARPOL still constitutes a problem. For example, Annex V bans all dumping of plastics at sea, but inadequate enforcement and the lack of cooperation between ports and regulators limit the effectiveness of the regulation.[392]

Various crucial amendments to MARPOL have been implemented in response to international maritime disasters and have resulted in, for example, the phasing out of single-hull tankers. The actual effect (i.e., the number of accidents with severe environmental

[387] EMSA, 2010b, p. 6.
[388] According to GESAMP (the Joint Group of Experts on the Scientific Aspects of Marine Environmental Protection), thanks in part to MARPOL, there has been a decline in operational discharges and oil spillages at sea from tankers since the 1990s. This assessment has been shared also by other conducted surveys (e.g., 1990 US National Academy for Sciences report for IMO).
[389] Birnie et al., 2009, p. 405-413.
[390] Figures for 2007 and obligatory Annexes I and !!. Optional Annexes III-VI ratifications represented respectively 94%, 75%, 96% and 74%. See Birnie et al., 2009, p. 404.
[391] Birnie et al. (2009), p. 403.
[392] OPSAR, 2009, p. 79. The same can be stated about EU Port Waste Reception Directive, which lacks more stringent enforcement mechanisms.

implications) of this measure is yet to be assessed, when the double-hull tankers become older and thus comparable with single-hull tankers presently in operation (20-30 years in service). What cannot be clearly determined, however, is whether adjustments made by the oil tanker industry have not been based more on heightened apprehension within the industry about further disasters rather than new IMO regulations.[393]

Measures to protect the environment under MARPOL could be extended to the Arctic if the IMO Marine Environment Protection Committee (MEPC) were to conclude an amendment similar to the new regulation 43 in MARPOL Annex I that recently banned the use and carriage of heavy grade oil in the Antarctic area (i.e. south of 60°S).[394]

Another feature of MARPOL of particular relevance to the Arctic is the specification under each of the annexes of Particularly Sensitive Sea Areas (PSSAs). Designating PSSAs in the Arctic could help protect the region from the impacts of increased shipping activity.

International Convention on Oil Pollution Preparedness Response and Cooperation, 1990; and the Protocol on Preparedness, Response and Co-operation to pollution Incidents by Hazardous and Noxious Substances, 2000 (OPRC-HNS Protocol)

Given that the Convention only entered into force in 1995 and the Protocol in 2007, the overall evaluation of its effectiveness has yet to be conducted. However, according to Article 13 of the Convention, effectiveness shall be evaluated "in the light of its objectives, particularly with respect to the principles underlying cooperation and assistance".[395] In practice this will be determined by whether ships carrying oil or HNS are covered by preparedness and response regimes, whether national and regional systems for preparedness and response fulfil the minimum requirements of the Convention, and by the effectiveness of reporting mechanisms (i.e. approximate percentage of spills that are reported, or the quality of a state's response to pollution reports).[396]

Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter (London Convention)

Given that the number of reporting parties is much lower than the number of contracting parties (40% in 2007, 20% in 2008), the effectiveness of the London Convention is difficult to ascertain.[397] The Convention's system of compliance based on self-reporting has yielded little information on the amount of waste dumped and does not appear to be particularly effective. Only a handful of EU countries have reported on compliance.

It is important to note that most high seas violators are never detected or caught. [398] There are no resources or designated authorities for patrolling in these areas and it is nearly impossible to prove an offender is guilty once they have reached port. Ex-post visual observations of oil record books and tanks at port do not guarantee that pollution from ships on the high seas are detected.[399] Of particular concern are flag of convenience (FOC) States, which have little incentive to perform adequate inspections of their flag vessels before they

[393] Mattson, 2006, p. 189.
[394] GESAMP, 2010, p. 73.
[395] IMO, 1990, art. 13.
[396] IMO, 1990, arts. 3-6.
[397] IMO, 2009b.
[398] Mattson, 2006, p. 189.
[399] Mattson, 2006, p. 189.

leave port. This can be addressed in part by increased port State control, but it does not remove the difficulty of detecting high seas violators. It is unclear how this obstacle can be addressed, but it is particularly relevant to the Arctic, where clean up is difficult and access to certain areas can be irregular due to ice cover.

Policy options

Many of the basic problems that need to be addressed as Arctic shipping expands have been recognised by the EU and the international community. While the European Union has a limited direct impact on Arctic shipping and infrastructure, it does have the ability to enhance environmental safety measures, especially in regard to oil spills, ballast water, invasive species, navigation and monitoring. Moreover, as a major user of Arctic waters (representing 25% of the total world commercial fleet)[400] and an actor with concern for the Arctic environment and for the safety of its vessels, goods and passengers, the EU can take up a leading role on the international stage. Three key strategies the EU should consider are as follows.

Support development of a strong IMO Polar Code

At present, polar vessel construction standards are unevenly applied.[401] A step towards rectifying this and promoting safe Arctic shipping is to make the IMO *Guidelines for Ships operating in Arctic Ice covered Waters* (or the Polar Code) mandatory.[402] Discussion on developing the *Guidelines* into a binding instrument is already taking place within the IMO and may be the next step after the 2009 amendment of the Polar Code to include maritime areas under the Antarctic Treaty.[403]

The EU could actively advocate this process and promote the implementation of the any future binding instruments. Regardless of whether the Polar Code is made mandatory or remains in the form of guidelines, the EU could strengthen the effectiveness of the Polar Code and demonstrate regulatory leadership by incorporating the Code's provisions into EU legislation. All flag States, including EU members, have the ability to impose special standards on their vessels, such as specifying discharge, emission and ballast water exchange requirements for Arctic-bound ships.[404] The EU could, for example, make mandatory the requirements for Polar Class vessels developed under the International Association of Classification Societies (IACS) and could introduce mandatory training for ice navigators.[405]

[400] European Commission, 2009c, p. 1.
[401] AMSA, 2009, p. 187.
[402] Molenaar and Corell, 2009, p. 6.
[403] The ongoing work within IMO Sub-Committee on Ship Design and Equipment. See IMO, Ships operating in polar regions, online.
[404] Molenaar and Corell, 2009, p. 6.
[405] AMSA, 2009, pp. 68, 187.

Support designation of Particularly Sensitive Sea Areas (PSSA) in the Arctic

In spite of the fact that even a marginal increase in Arctic shipping could threaten particularly fragile ecosystems in the Arctic,[406] there are currently no Arctic waters that are designated as Particularly Sensitive Sea Areas (PSSAs) under the IMO (MARPOL).

In order for the designation of Arctic PSSAs to impact shipping activities, Associated Protective Measures (APMs) appropriate for the areas in question must be introduced.[407] Arctic PSSAs could be protected through navigational routing systems, and more stringent emission, discharge and ballast standards, as long as legal bases for such protection can be identified. An example of an existing APM is the one covering the Wadden Sea PSSA, which includes designation as a MARPOL Special Area against discharge of oil and garbage, routing systems that make certain shipping routes compulsory for ships carrying hazardous goods, and compulsory reporting for ships.[408] Examples of the routing and reporting measures particularly useful for the EU action include traffic separation schemes in the Baltic and off the Norwegian coast, two way routes off the coast of Iceland and mandatory ship reporting systems off the coast of Greenland.[409]

For a marine area to qualify as a PSSA candidate, it must be in need of special protection due to ecological, socio-economic, or scientific attributes that may be vulnerable to shipping activities.[410] Any IMO Member State can make a proposal for the designation of a PSSA, including in international waters. States proposing establishment of an Arctic PSSA would need to demonstrate how a PSSA and APMs would enhance protection of the marine environment from threats posed by international shipping.[411] Thus far, innovative criteria for determining suitable PSSA candidates are not ruled out and it is very likely that many Arctic areas could meet PSSA criteria.

Recommendations in the AMSA 2009 Report, which were approved by the Arctic Council, encourage the members of the Council to explore the establishment of such internationally designated areas.[412] Various studies conducted by the Arctic Council, and PAME in particular, could be use to justify the designation of Arctic PSSAs and to demonstrate the need for new regulations. It would be far more preferable and politically realistic if the proposal for PSSA designation in the Arctic were made by the Arctic states, especially since Arctic Ocean coastal states are allowed to enforce laws and regulations to combat vessel-source pollution in ice-covered EEZ waters based on art. 234 of UNCLOS.[413] Nevertheless, the EU and its Member States could advocate and support PSSA establishment and should capitalize on the experience from the establishment of PSSAs for the Wadden Sea and the Baltic Sea.[414]

[406] VanderZwaag et al., 2008, p. 31.
[407] IMO, 2005, *PSSA Guidelines,* Titles. 6-7; Molenaar, 2009, p. 313.
[408] Common Wadden Sea Secretariat, The Wadden Sea designated as particularly sensitive sea area (PSSA), online.
[409] VanderZwaag et al., 2008, p. 42; See also Molenaar et al., 2010, pp. 14-16.
[410] IMO, 2007; IMO, 2005 [hereafter *PSSA Guidelines*]; AMSA, 2009, pp. 61-62.
[411] Molenaar and Corell, 2009, p. 6; IMO, 2005, *PSSA Guidelines,* Title 7; VanderZwaag et al., 2008,p. 12.
[412] AMSA, 2009, p. 7.
[413] In special situations, which may occur in the Arctic, special measures under art. 211(6) of UNCLOS referring to internal, territorial waters and EEZ may be also applied.
[414] See, e.g., Southampton Institute, 2001.

Experience from the designation of the Baltic PSSA[415] shows that proceeding in the matter must be done with caution, as it requires widely accepted compromise and the broad cooperation of potential partners in the Arctic.[416] If the designation of PSSAs in the Arctic proves politically problematic, other similar options that should be carefully considered include advocating, both within IMO and in bilateral relations, measures under art. 234 of UNCLOS, identification of Special Areas under MARPOL, or introduction of measures under SOLAS to adopt new ships' routing systems (including, for example, traffic separation schemes, two-way routes, no anchoring areas, reporting regimes, etc. mandatory or recommendatory for all ships or certain classes of ships or ships carrying a particular cargo), which do not require the designation of a specific PSSA.[417]

Support development of Arctic shipping infrastructure

Remedying the inadequacy of shipping infrastructure in the Arctic will require significant international effort and cooperation (including efforts across public and private sectors) to ensure that any further development and expansion is safe and environmentally sound. Contingency planning, preparedness and emergency response for pollution incidents, improvement of search and rescue facilities, establishment of appropriate places of refuge, communication systems, ice navigation training, accurate and complete navigational charts, reception facilities for ship-generated waste, building up or expanding of traffic surveillance systems, reporting schemes and enhancement of enforcement mechanisms, and port service procedures are all examples of what is still needed in terms of Arctic shipping infrastructure.[418] Given these challenges, there are several ways in which the EU can take an active role in the development of Arctic shipping infrastructure:

1) Emergency response capacity and pollution response are perhaps the most important aspects of ensuring that the environmental impact of increased Arctic shipping is minimized.[419] Therefore, proper search and rescue facilities should be available along the main shipping routes. In light of this and the fact that the AMSA recommendations have encouraged other interested parties to participate in a future SAR Instrument for the Arctic, the EU could promote the multi-national Arctic Search and Rescue Instrument,[420] proposed mainly by the US and Russia, which is planned for signature at the May 2011 Arctic Council Ministerial Meeting.

2) The EU could also explore the possibility of taking part in the creation of an Arctic marine traffic awareness system, also advocated in AMSA, in order to improve monitoring and tracking of marine activity and enhance real-time data sharing.[421] One of the challenges of a new Arctic marine traffic awareness system will be the real-time and seamless transfer of ship data among the states participating.

3) Given that shipping routes in the North Atlantic, Greenlandic Sea, Norwegian Sea and Barents Sea are a matter of concern to key EU partners within the Northern Dimension and the European Economic Area, the EU could consider closer

[415] Opposition from Russia resulted in the exclusion of Russian waters from the new PSSA.
[416] VanderZwaag et al., 2008, p. 41; Molenaar et al., 2010, pp. 12-13.
[417] VanderZwaag, et al., 2008, p. 31.
[418] Molenaar et al., 2010, p. 20; AMSA, 2009, p. 7.
[419] Breaking the Ice, 2007, p. 16.
[420] See US Department of State, Arctic search and rescue, online.
[421] AMSA, 2009, pp. 5, 6, 55-59, 68; Molenaar and Corell, 2009, p. 4.

cooperation – and could even include maritime infrastructure development to a greater extent – in programmes such as Interreg. Provision for cooperation in the modernization of management, operations and navigation infrastructure for waterways and ports has already been included, for example, in the 1994 Cooperation Agreement with the Russian Federation.[422] The EU could put greater emphasis on this area of cooperation with the advance of its Integrated Maritime Policy and its new Arctic Policy.

4) The EU could examine the possibility of expanding the "Motorways of the Sea"[423] network northward or linking it to existing traffic regimes, towards the Arctic ports of Norway (presently Narvik is designated as the MoS port) and even Russia. Both effective governance and infrastructure exist in the Norwegian and Barents seas, so such development could potentially integrate maritime traffic regimes in these areas and prepare the EU for increased maritime traffic and the opening of future Arctic sea passages. Such discussion could take place through, for example, the Barents Euro-Arctic Council (BEAC). This is of particular importance given that the "expansion of current routes is required to allow alternative courses when hazardous ice conditions are encountered".[424]

2.9 Arctic indigenous and local livelihoods

Status, trends, and pressures

It is outside the scope of this report to present a comprehensive description of Arctic indigenous and local communities and the many ways in which their livelihoods are impacted by EU activity. The objective is rather to highlight the ways in which the EU environmental footprint in the Arctic is connected to local and indigenous livelihoods, and specifically the relationship between the EU and indigenous communities in the Arctic. In this section, there is a focus on indigenous peoples because of particular EU interest in their special legal status and specific situation in many parts of the Arctic, especially in the aftermath of tensions over the EU Regulation on seal trade products.

For the purposes of this section focusing on Arctic indigenous peoples, we use the same definition of the Arctic as in the Arctic Human Development Report (AHDR).[425] The sub-regions and countries that receive particular attention are the European Arctic, Northwest Russia and North America, due to the interests of the EU, subsequent to the seal regulation.

Arctic population and economy

The total size of the human population in the Arctic – approximately 4 million people – has seen a gradual decline over the last few decades. Up until the 1950s, the population of the Arctic was growing throughout the North, especially in the Soviet Union, where rapid industrialization and urbanization was taking place. But since the 1990s, the Arctic has been

[422] European Council and Commission, 1997.
[423] EC Mobility and Transport, Motorways of the Sea, online.
[424] AMSA, pp. 91, 186; European Commission, 2009a.
[425] Young and Einarsson, 2004, pp.17-18.

experiencing a net population loss. Beginning in the 1960s and 1970s, initially in Nordic states but later also in other Arctic regions, the beginning of an out-migration trend became apparent. Finnish Lapland, for example, lost 8% of its population between 1993 and 2001, and the Russian North lost 25% of its 1989 population by 2002.[426]

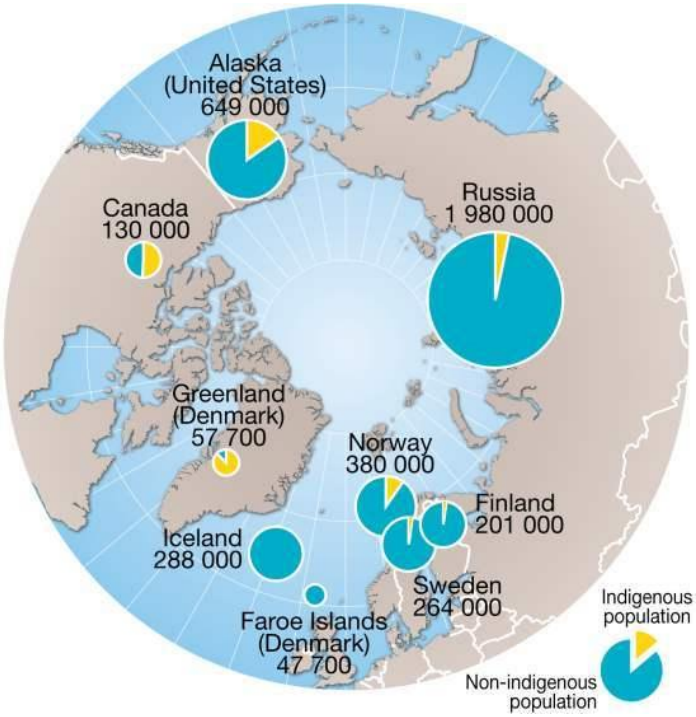
Current migration patterns in the Arctic vary between regions and are highly dependent upon economic conditions, but are also shaped by state policies. For example, while in most Arctic countries inhabitants are encouraged to remain in or to move to the North, in Russia, state policy is aimed at depopulating northern cities, where the costs of providing various services are higher than in the southern regions of the country.

Another pattern visible across the Arctic, aside from the general trend in migration away from the Arctic, is a gradual shift in population distribution towards urban areas within the Arctic. A large part of the Arctic population resides in major cities of the region, such as Murmansk (the largest of the Arctic cities, with a population of 340,000) and Anchorage (home to 260,000 inhabitants, or 40% of the Alaskan population).[427] In Canada, Fennoscandia, and Greenland, major towns are comparatively small, but still constitute a significant part of the population.[428] Many of these towns continue growing, despite the general outmigration trends, owing primarily to in-migration from Arctic rural areas. Certain towns based on oil and gas extraction are also growing, such as Noyabrsk and Novy Urengoi, in Russia (90,000-100,000 inhabitants). Another sign of the shift to urban areas is the higher growth of the Sámi population in major cities, such as Helsinki and Stockholm, as compared to the population size of the Sámi homeland in Lapland.

Figure 23, below, illustrates the distribution of the Arctic population residing north of the AHDR boundary and gives an indication of the relatively small size of the population directly influenced by EU activities and policies.

[426] Bogoyavlenskiy and Siggner, 2004, pp. 27-29, 38-39. For extensive data on Arctic population and migration trends, see ArcticStat (online). For data on Greenland populations through 2008, see ArcticStat, Greenland (online).
[427] Bogoyavlenskiy and Siggner, 2004, pp. 30-31.
[428] For example, Whitehorse has 19,000 inhabitants, Nuuk 15,000, Tromso 50,000, and Rovaniemi 45,000.

Figure 23 Population distribution across Arctic countries, 2004



Sources: Arctic Pollution Issues: A State of the Arctic Environment Report. Stefansson Arctic Institute, 2004. Arctic Human Development Report, by Hugo Ahlenius, UNEP/GRID-Arendal. Available at: http://www.grida.no/polar/ipy/2840.aspx (viewed 8 September 2010).

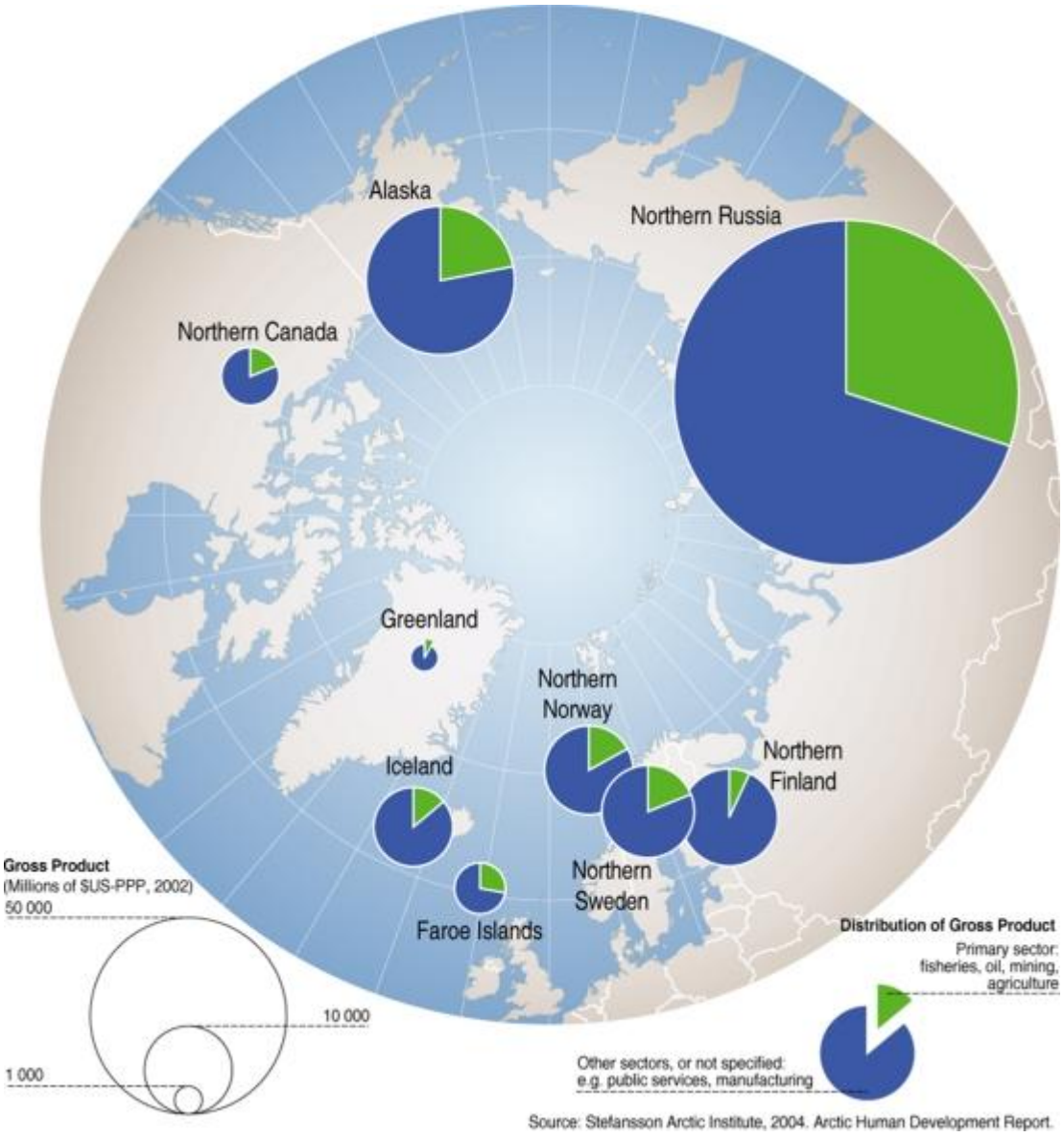
The Arctic represents a vital part of both the global economy and the national economies of the Arctic states. The Arctic economy is highly diversified, with significant differences between various Arctic states due largely to the particular features of their Arctic regions – especially the abundance and availability of natural resources. For example, in 2005, the Russian Arctic produced 70% of the total Arctic GDP (224,766 Million $US-PPP), much of which was generated by its extractive industries.[429] The picture is rather different, though, elsewhere in the Arctic. For example, in 2005, the second largest portion of total Arctic GDP was only 12%, which was produced by Alaska, also rich in carbon resources. Alaska's GDP per capita was 30% higher than the GDP per capita of the U.S. as a whole and in that year, Alaska recorded the highest GDP per capita in the Arctic (114 % above average -- more than twice the average GDP per capita in the Arctic), in stark contrast to Russia. The Finnish Arctic produced 6% of total Arctic GDP in 2005 (13,742 mill. $US-PPP), but unlike the hydrocarbon-rich Russian Arctic, its GDP per capita was 22% lower than the GDP per capita for Finland as a whole, and its GDP per capita was 6% lower than the average Arctic GDP per capita.[430]

It should be noted, however, that GDP is a very difficult tool for measurement in the Arctic, first because the methods for determining GDP value vary from country to country (especially Russia), second because per capita calculations are complicated by the fact that most revenues do not stay in the Arctic but go elsewhere, and finally because a substantial part of Arctic GDP is derived from transfer payments. The numbers mentioned above are presented

[429] Glomsrød, 2006, p. 18, 59.
[430] Glomsrød and Aslaksen, 2006, p.18.

merely as a way of providing a general picture of the variation in Arctic economies. Figure 24 shows a graphical image of the Arctic economy by sector.

Figure 24 Economy of the Arctic, by sector, 2005



Source: Hugo Ahlenius, UNEP/GRID-Arendal, *http://maps.grida.no/go/graphic/economy_of_the_arctic_by_sector*

The Arctic regional economy is characterised by a formal and an informal economy. One key particularity of the Arctic economy is the highly-integrated interdependence that has evolved between the two, especially for indigenous communities.[431] The major components of the formal economy in the Arctic region include tourism, fisheries, large-scale mineral and energy development and reindeer husbandry.[432] Aside from these, especially in northern Norway, Sweden and Finland, the service sector is the basis of most employment, including health care, government employment at municipal and county level, and education. Transfer

[431] Kofinas, Subsistence hunting in a global economy, online.
[432] Hall and Saarinen, 2009, p. 304.

payments also constitute a vital part of the Arctic population's livelihood and GDP. In this way, the central governments of Arctic states support consumption and public services in the Arctic.[433]

The informal part of the Arctic economy consists of small-scale subsistence hunting, herding, fishing, trapping, and gathering that contributes significantly to the dietary intake of households and communities in some parts of the Arctic.[434] It is important to note, however, that nowhere in the Arctic are these subsistence activities the only source of livelihood. Even with the use of modern machinery (such as snowmobiles and guns), livelihood based solely on subsistence activities is virtually impossible in the present-day Arctic, unless it is substantially supported by governmental transfers. Equally unlikely, however, particularly for indigenous persons, is livelihood without any supplemental subsistence activities, given the lack of good employment opportunities and high costs of food imported from the South.[435]

Therefore, Arctic indigenous communities, in particular, have a mixed economy in which subsistence hunting, fishing and gathering is complemented by paid employment in various formal economy sectors such as tourism, public services, and resource extraction. As many as 74% of the Inuit, Sámi and people of Chukotka perform fishing, 31% hunt sea mammals, 21% hunt walrus, and 42% hunt seal or ugruk.[436] Although customary harvesting practices are not a part of the formal economy in the Arctic, they are also not completely independent of market economies. Products of indigenous hunting are often sold through formal market channels and the most important income for reindeer herders, for example, comes from the sale of meat, which makes reindeer husbandry integrated within a market economy.[437] Other products of indigenous hunting sold in the formal market include seal products.

Indigenous peoples in the Arctic

Approximately 400,000 indigenous people live in the Arctic, constituting about 10% of the total Arctic population, and representing a major part of the population living in the Arctic hinterlands. The proportion of total population accounted for by indigenous peoples varies across Arctic regions, from 2-4% in Russia and Fennoscandia, to 50% in Arctic Canada and almost 90% of total population in Greenland (see Figure 23, above).[438] Groups in the Arctic acknowledged as indigenous are Sámi, Nenets, Samoyeds, Vepsians, Inuit in Greenland, and other, mainly Finno-Ugric groups. Sámi are the only indigenous people living in the European Union, with a total population ranging from 60-100 thousand, of which around 25-30 thousand live in Finland and Sweden (EU), and around 35-50 thousand in Norway (EEA).[439]

In contrast to mainstream society, the situation for indigenous peoples differs strongly in terms of their traditional livelihoods as well as their challenges related to land rights and self-determination. Defining "indigenous peoples" is difficult due to the great diversity of peoples in question. The 1989 International Labor Organization (ILO) Convention No. 169[440] emphasised the cultural differences, customary law, pre-existence (before times of

[433] Durhaime, 2004, p.69; Nordic Council of Ministers, 2010, p.49; Glomsrød and Aslaksen, 2006, p.18.
[434] Duhaime, 2004, p. 74.
[435] ACIA, 2005, pp. 656-657.
[436] Survey of Living Conditions in the Arctic, 2007, p. 48,
[437] Jernsletten and Klokov, 2002, p. 5, 33; Aslaksen et al., 2008, p. 93.
[438] Bogoyavlenskiy and Siggner, 2004, p. 29.
[439] Information Centre of Saami Parliament in Sweden, The Saami in figures, online.
[440] ILO Convention 169, 1989.

colonization) and continuity, autonomy distinctive relationship with their territories, and self-identification of indigenous peoples. In his definition from 1983, UN Special Rapporteur J. Martinez-Cobo adds to these attributes, non-dominance within nation-state and determination to retain group's identity[441]

To avoid terminological difficulties, today's approach often identifies specific groups rather than applying any fixed definition. In Russia, for example, the law refers to "small peoples" and offers protection only to groups numbering less than 50,000 people, which makes the definition acknowledged within international law less relevant in the national context.[442] Arctic indigenous peoples are often still involved in traditional activities, such as hunting, reindeer herding, gathering, whaling, or fishing, which contribute to a mixed (traditional-modern) economy on which indigenous subsistence is based. Due to the great diversity of economic and cultural characteristics, the Arctic's indigenous cultures represent a great value for the region and are an intrinsic part of the Arctic identity.[443] It is important to note that this diversity of characteristics, as well as varying local environmental circumstances and population sizes across the eight Arctic countries, means that descriptions of the challenges faced by indigenous peoples in one part of the Arctic are not necessarily common to those in other parts of the Arctic.

Indigenous peoples are perceived as stewards of the environment, as they possess a deep traditional ecological knowledge (TEK) of the surrounding environment. However, environmental goals and indigenous rights and interests are often not fully congruent. Various areas inhabited or utilised by indigenous peoples in the Arctic are central for biodiversity protection.[444] However, many communities have a different vision of environmental conservation. They often claim that decision makers have insufficient understanding of local ecosystems and do not conduct conservation activities with concern for indigenous rights. Indigenous groups want to participate in conservation frameworks and, at the same time, continue to use natural resources as they have done for centuries.[445] Of vital importance for indigenous peoples is the control over their own lands and resources. This means primarily land rights, utility rights, economic autonomy and the right to self-determination.[446]

EU's Footprint

The economy and means of subsistence in northern Europe are influenced by EU policies such as biodiversity policy, the Common Agricultural Policy, the Common Fisheries Policy, regional policy, and cross-border cooperation, as well as the functioning of the single market itself. The impacts of resource extraction, climate change and pollutants are especially visible in the Arctic and some of these impacts are connected to EU activities and policies. Certain EU trade regulations and other conservation policies stemming from concerns for

[441] United Nations Economic and Social Council, 1989; See also Thornberry, 1994, pp. 59-61.
[442] Young an Einarsson,, 2004, p. 21.
[443] ACIA, 2005, pp. 652-658.
[444] For instance, coastlines of Canadian Arctic archipelago and Greenland or fell areas in Lapland.
[445] Heinämäki, 2009, *passim*; Sobrevila, C., 2008, *passim*.
[446] All rights that are now incorporated in the 2007 UN Declaration on the Rights of Indigenous Peoples. For an overview, see Charters and Stavenhagen, 2009.

environmental protection have also had significant impacts on Arctic indigenous and local livelihoods.

Measuring EU impact on Arctic livelihoods in quantitative terms is particularly problematic. Not only are there no numbers available that indicate what percentage of Arctic GDP is derived from EU economic activity, the mixed economy typical of so many Arctic communities render data on employment rates incomplete. This section therefore presents a general picture of the impact that resource exploitation, climate change and pollution have on Arctic livelihoods. The EU contribution to these is identified in the sections on energy, climate change, and chemicals and transboundary pollution, respectively.

Traditional livelihoods and resource exploitation

Natural resource extraction is perceived by indigenous and local communities as both an opportunity and a threat. Obvious economic advantages, such as new employment opportunities and development of community services, must be weighed against the risks such developments incur:

- First, resource extraction usually has an adverse impact on the natural environment, and thus, on the quality of life in the surrounding area.
- Second, new industries often interfere with other forms of land use – usually subsistence or agricultural activities, for instance, by destroying reindeer winter breeding grounds and migratory routes or jeopardizing fishing in rivers, lakes and seas (e.g., the case of mining and forestry in Lapland, development in Mackensey delta in Canada, as well as pipeline projects in Canada and Alaska). Energy infrastructure (i.e. drilling sites, pipelines, roads, etc.) disrupts the migration routes of reindeer. Tourism, mining and large scale forestry – particularly in Finland, where pulp and paper are produced, largely for the European market – also destroys or devalues pastures and reindeer breeding grounds. But even forestry and boreal forest conservation affects the conditions for reindeer herding and other traditional economic activities, and limits indigenous peoples' access to resources they have traditionally utilised.[447]
- Third, socio-economic and legal pressures related to resource extraction aggravate the continuity of traditional livelihoods in the affected areas. The domestic legislative preference for highly economically viable natural resource extraction threatens and impairs the integrity of reindeer husbandry, which is generally regarded as a low-level economic activity. Increasing pressures stemming from resource exploitation weaken the economic viability of reindeer husbandry even further and force reindeer herders (e.g. in Finnish and Swedish Lapland) to either abandon reindeer husbandry or seek secondary employment.[448]
- Fourth, the influx of workers, who sometimes outnumber the local population, creates various social problems and significantly changes the structure of the communities involved.

[447] This is a problem in many parts of the Arctic, as in the case of recent conflict between reindeer herders and forestry in the Finnish Inari municipality and between herding and conservation activities in Malla nature reserve in northern Finland. Even though the reserve was established in 1916, conflicts still occur (Kyllönen, et al., 2006, pp. 706-708.).

[448] Ulvevadet and Klokov, 2004.

- Finally, natural resource developments become the source of numerous problems when the desired resource has been depleted. Even with contingency plans in place, communities are rarely able to recover or return to the conditions they enjoyed before extraction activities began.

The complexity of the relation between resource exploitation, traditional livelihoods and indigenous peoples' rights is well reflected in the conflict between Sámi reindeer herders and the forest industry in northern Finland. While reindeer husbandry is economically weak, the forest industry constitutes a large part of the Finnish GDP. Although reindeer husbandry is protected under Finnish law, loopholes in the legislation favour forestry operations on valuable pasture grounds, inevitably further weakening the position of reindeer husbandry. Since non-private lands in Finland belong to the state and are administered by the Finnish Forest and Park Service, which is both a government agency and a corporation, and since Finland has not ratified ILO Convention No. 169, invoking rights for indigenous peoples based on national and international instruments becomes a challenging task. Environmental groups can contribute to supporting indigenous rights.[449] However, lack of proper environmental and social assessment prior to commencement of activities still remains a problem in a number of northern regions.

It is important to note that various conflicts stemming from resource use are not limited to conflicts between traditional subsistence activities and other land uses. For instance, in Finnish Lapland, planned development of uranium mining clashes with the requirements of tourism, as it may jeopardize the image of the region on which the tourism industry bases its success. Both tourism and resource extraction are often perceived as a threat to nature conservation, examples of which can be seen, for instance, throughout Lapland, where new hotels, tourist accommodation or skiing infrastructure are located near the boundaries of protected areas.

The EU contributes to these issues through its strong demand for energy (see Section 2.4 on energy). Russia is the main provider of oil and gas to Europe and the United States, and in its recent Arctic strategy, has pointed to the Arctic as its main energy source. Russia's main oil fields are found in the Nenets Autonomous Okrug (NAO) and the Khanti-Mansiisk Autonomous Okrug (KMAO), and the Yamal- Nenets Autonomous Okrug (YNAO) is the site of a giant gas field.[450]

Threats posed by climate change[451]

Arctic indigenous peoples have long been affected by ongoing changes in their socio-economic and political environment, e.g. through colonization, forced resettlement or cultural change. Indigenous communities were resilient and adaptive to changes and such may be the case with global warming. However, the unprecedented pace and nature of the changes may pose a challenge we are unable to fully assess at the moment. Climate change puts enormous pressure on the cultural continuity and adaptive capacity of Arctic indigenous

[449] Sellheim, 2010.
[450] Stammler and Forbes, 2006, pp. 48-57.
[451] IUCN, 2008, pp. 33, 34; ACIA, 2005, pp. 92-97. For more information on the impact of climate change on the Arctic communities, see Koivurova, et al., 2008 and ACIA, 2005, Chapters 3 and 12.

peoples and unprecedented changes in various aspects of livelihoods and economy are likely to occur.[452]

Thawing permafrost and melting ice affect community infrastructure, housing and transport connections. Housing in the Arctic is likely to undergo changes as melting permafrost and coastal erosion force inhabitants to resettle or to reinforce the shoreline, a highly costly undertaking. The subsistence economy is likely to change, as traditional ecological knowledge and hunting and fishing habits, particularly in North America, Greenland and Russian Arctic coastal areas, are no longer applicable in a quickly changing environment. This may result in the Arctic diet becoming even more dependent on goods produced elsewhere. Weak economic conditions could become even more aggravated.

Warmer winters and changes in the rates of spring melt directly affect ice conditions crucial for hunting and travelling. The unpredictability of ice conditions make traditional hunting and fishing more difficult and risky, as the traditional knowledge about the conditions in certain places and seasons becomes less appropriate to changing weather and landscape. Unusual weather events may occur more often, affecting activities such as reindeer herding because the layer of icy snow prevents reindeer from feeding on moss and lichen in the winter). Warming waters and retreating sea ice may also cause fish stocks and marine mammal populations to relocate, which might cut off many communities from their main sources of food from the land and force hunters to change or abandon their traditional ways of hunting.

A changing environment and the non-applicability of new knowledge also threaten the cultural integrity of Arctic indigenous peoples, as their connection to the land, which serves as a fundamental basis of cultural and social identity, changes. Mythologies, spiritual practices or oral traditions become obsolete in an environment which is no longer as it was in the past. The transmission of knowledge and culture to the next generations is therefore put in jeopardy.

In summary, as stated in the ACIA, the impacts of climate change on indigenous peoples makes “people feel like strangers in their own land”, because “local landscapes, seascapes, and icescapes are becoming unfamiliar”.[453]

Threats posed by pollution

Most pollutants (organic and heavy metals such as lead, mercury and cadmium) entering the Arctic environment originate in North America, Europe and Asia, and are transported to the Arctic by wind, ocean currents and river outflow. The combination of environmental conditions and biomagnification occurring in aquatic food webs results in the accumulation of certain persistent contaminants in local food in the Arctic at levels often higher than in the southern latitudes where these pollutants originate. Increased maritime traffic – especially in the summer – both due to operational pollution and maritime disasters also bears risk of the release of hazardous material into the fragile Arctic environment. Pollutants affect the whole food chain in the region, contaminating country food sources, especially Arctic mammals, birds and fish stocks. This, together with traditional dietary habits, results in many groups in

[452] ACIA, 2005, p. 87; Rees et al., 2006. (For a case study on how climate change affects Sámi livelihood, including impacts on salmon fishing, availability of lichen for reindeer husbandry due to appearance of an icy layer of snow, as well as difficulties in transportation due to changing ice conditions on lakes and rivers, see Helander, 2005).

[453] ACIA, 2005, p. 94.

the Arctic being highly exposed to these contaminants. Those most vulnerable to low-level chronic food-borne exposure to contaminants are pregnant women, the developing fetus and infants. Measuring the exact impact of pollutants on human health poses various challenges, however, particularly because of the small size of Arctic communities and problems with distinguishing between the effect of contaminants and other present impacts. In addition, tracking contaminant elements in country food sources is more difficult than examining products of formal agriculture. It is clear, however, that there is a need to reduce human exposure to contaminants in the Arctic.[454]

EU regulations and policies concerning environment

In addition to these threats to the Arctic environment, EU trade regulations and conservation policies aimed at environmental preservation sometimes have an unintended impact on Arctic livelihoods. Examples include the EU Regulation on seal trade products as well as development of protected areas that has resulted in relocation or limited access to resources for indigenous groups.[455] As a result of past conflicts that have arisen in this context, it is now recognised that all conservation schemes should include concern for the rights and interests of indigenous and local communities.

EU policies and multilateral agreements

EU policy on indigenous peoples and EU policies affecting indigenous peoples, in both the European and non-European Arctic, as well as EU participation in related multilateral agreements and international fora are described in Annex C. An analysis of their effectiveness follows in the next section.

Effectiveness of policy instruments

EU policies

Protocol 3 to the Act of Accession of Sweden and Finland

Arctic indigenous peoples became a direct concern of the EU upon the accession of Finland and Sweden to the EU in 1995. A special protocol was added to the accession treaty in order to limit the impact of certain EU policies on Sámi livelihood and reindeer herding. This instrument has, for instance, effectively secured the exclusive right of the Swedish Sámi to herd reindeer. In the Protocol, parties left an open door to further provisions regulating the coexistence of EU legislation and laws in Nordic countries referring to the Sámi.

EU cross-border and external co-operation

Various EU programmes and policies for cooperation between EU border regions in the North, as well as EU bilateral relationships with Russia, Norway and Greenland, have the potential to influence the livelihoods and economies in the Arctic regions of these countries. In these programmes and policies, there is a visible lack of reference to indigenous

[454] ACIA, 2005, pp. 890-892; AMAP Assessment 2002, pp. 114-118. See also in depth analysis by AMAP: AMAP, 2003.
[455] Sobrevila, 2008, pp. 6-7; Bille Larsen, 2006.

communities and environmental issues, and especially to the environmental dimension of human rights.

There is little emphasis on indigenous issues in EU cooperation with Russia, for example. Indigenous peoples are not mentioned at all in the Partnership and Co-operation Agreement, which is the main document framing EU-Russia relations.[456] In the EU Country Strategy Paper on Russia, rights of indigenous peoples and minorities are mentioned as a cross-cutting issue. However, in the assessment of the situation in Russia, for example, indigenous peoples are mentioned only with regard to the possible positive impact that new forestry regulations may have on indigenous ownership and user rights.[457] Moreover, there is little connection between environmental policy and related social issues; instead, environmental issues seem to be addressed only in light of the impact Russia has on the European environment.[458]

Another example of the limited connection between environment and indigenous issues is the social and environmental impact assessment conducted within the Kolarctic programme, which addresses environmental problems crucial for indigenous subsistence. The specific situation of the Sámi and the Nenets in relation to environment is mentioned only in the context of general principles.[459] And the rights of indigenous peoples are addressed neither in the context of Russian human rights activities nor in the context of environmental degradation in Russia.[460]

EU annual human rights reports refer to Arctic indigenous peoples only when development cooperation with Russia is concerned. Moreover, the environmental dimension of human rights, crucial for indigenous people, is not explicitly included in the analysis of the human rights situation.[461]

The only EU programmes directly addressing Sámi and Inuit issues – Interreg IV A North and Interreg IV Northern Periphery Programme – similarly lack a strong environmental dimension in the way that they aim to protect and develop indigenous livelihoods. This may adversely affect the success of these programmes.

Indigenous peoples in the EU development aid policy and human rights frameworks

As indicated in Annex C, there are fairly comprehensive guidelines for the approach to and cooperation with indigenous peoples within the EU development aid policy framework, which, in certain situations, could also be applicable to the Arctic. Participation and self-definition of development objectives are important components of these policies, which may potentially add to their effectiveness. But their potential efficacy is limited by certain shortcomings. First, they appear to lack a focus on the connection between the state of the environment and the welfare of indigenous communities, which is the main differentiation between indigenous communities and other ethnic or social groups. Second, the policies could be greatly strengthened by the introduction of a rights-based approach, especially in reference to the

[456] Official Journal of the European Communities, 1997.
[457] European Commission, Country Strategy Paper 2007-2013 Russian Federation, pp. 14, 26. [hereinafter Russia CSP]
[458] Russia CSP, p. 14.
[459] The Kolarctic Programme, p. 27. [hereinafter *Kolarctic Programme*]
[460] Delegation of the European Commission to Russia, 2009.
[461] See all human rights reports at the Council of the European Union website at http://www.consilium.europa.eu/showPage.aspx?id=970&lang=en (viewed 7 June 2010).

environmental impact of various EU activities. The rights-based approach is already visible in annual EU human rights reports, but is not yet explicitly included at the policy level.

Natura 2000, biodiversity and environmental policies

According to recent European Council Conclusions, EU policies affecting the Arctic are to be formulated with respect to Arctic biodiversity and for the "needs and rights of Arctic residents, including indigenous peoples".[462] But, in some cases, EU biodiversity policy and the Natura 2000 network are not sensitive to the specific situation of the Sámi population and may not include proper participatory mechanisms. In general, there are no precise guidelines regarding the participation of local communities in the designation and management of the Natura 2000 network, which is the responsibility of individual Member States. However, there are numerous examples of participation practices in various EU states and regions.[463]

A strong Arctic indigenous component is also lacking in EU trade and environmental policies and because of this, the rights and interests of indigenous communities are often not included in the policy-making process. An assessment is needed on how these policies may impact indigenous and local communities (both inside and outside the EU). The adoption process for the EU seal regulation showed that there are no permanent venues for indigenous peoples from within or outside the EU or the EEA to enable them to be meaningfully consulted on EU activities potentially affecting their livelihood and environment (see also, Annex C). Indigenous organizations took part in the consultation process leading to the seal regulation and current development of implementing measures, but only as industry stakeholders.[464] To rectify this, the EU has been exploring possibilities for more structured and permanent dialogue with Arctic indigenous peoples, beginning with an "Arctic Dialogue" Workshop in March 2010, which was attended by representatives of the European Commission, Arctic States and indigenous peoples. Although various proposals for the format and content of future dialogue were put forward, no definite conclusions were reached.[465]

EU-Greenland relationship

EU cooperation with Greenland gives the EU tools to enhance the viability of indigenous culture, institutions and organizations through the provision of funding and influence on the relationship between environment and indigenous livelihoods.[466] For example, the EU provides financial assistance to support the "Greenland Education Programme" (altogether €175 million in the period 2007-2013) and thus significantly supports education and training activities in Greenland, with the potential to positively impact the labour market and capacities of the population. Presently the Government of Greenland is seeking to strengthen cooperation with the EU in the areas of environment, research, and food safety.[467]

[462] Council of the European Union, 2009. [hereinafter Council conclusions 2009]
[463] European Commission, 2005, pp. 11, 26.
[464] European Commission, "Seal hunting".
[465] European Commission, *Summary of the "Arctic Dialogue" Workshop*.
[466] Council of the European Union, 2006; European Community, Greenland, Denmark, 2006a; European Community, Greenland, Denmark, 2006b, p. 32 and *passim*; European Commission, Programming document for the sustainable development of Greenland, p. 10 and *passim* and attachments.
[467] European Commission, EU Relations with Greenland, online.

Multilateral agreements

International agreements relevant to indigenous peoples

The UN Declaration on Indigenous Peoples, which the EU supports,[468] is a non-binding instrument but it has had an impact on legal systems in various states.[469] The Indigenous and Tribal Peoples Convention (ILO Convention No. 169) is the only binding international legal instrument dealing with indigenous peoples' issues, and has been of major relevance for the development of legal systems in countries with indigenous populations (in the European context, especially in Norway). Moreover, because a number of EU states have ratified the Convention, this instrument is likely to influence the development of EU policies in the future. However, a total of 22 ratifications of the Convention greatly limits the effectiveness of the instrument on the global scale.[470] The UN Permanent Forum on Indigenous Issues (UNPFII) has proven capable of raising certain issues and promoting indigenous rights, but, the de facto legal situation involving indigenous peoples' rights has nevertheless not improved much.

In the context of Arctic fora, soft-law bodies that have given indigenous representatives the opportunity to participate in the development of Arctic cooperation, such as the Arctic Council and Barents Euro-Arctic Region (BEAR), play a major role in the empowerment of Arctic peoples by giving them access to state officials and public opinion, as well as by giving them influence on research initiatives and new cooperation projects taking place in the region. The limitations of Arctic fora are primarily related to their consultative, non-binding character (see also Annex C).

Policy options

Over the long term, the EU's contribution to environmental degradation on indigenous livelihoods and cultures can be mitigated primarily through the reduction of the EU footprint on the Arctic environment. In the short term, the EU can put in place proper participatory mechanisms to help ensure that future policies include an indigenous perspective, are effective, and avoid policy implementation that might be perceived as infringing on indigenous rights. Decision-makers must be knowledgeable on the specific legal status and the particular nature of the livelihoods, cultures and economies of indigenous peoples. Historically, the concerns of indigenous peoples have not been sufficiently articulated through regular stakeholder or civil society channels. Therefore, all proposed short-term policy options in this section relate to the need for an enhanced dialogue between indigenous peoples and the EU at all stages of policy formulation and implementation that affect indigenous peoples.

Participation in decision-making processes affecting indigenous peoples is not only an important means of securing their rights and interests, but also constitutes a human right in itself. The EU commitment to dialogue has already been confirmed during the "Arctic Dialogue" Workshop,[471] which also proposed a number of instrumental options for indigenous

[468] Council of the European Union, 1998.
[469] For example, Bolivia adopted the declaration as a national law.
[470] See: http://www.ilo.org/ilolex/cgi-lex/ratifce.pl?C169.
[471] European Commission, *Summary of the "Arctic Dialogue" Workshop*; AMSA (2007), pp. 5-6. [hereinafter *Summary*, 2010].

participation. Possible topics for EU-indigenous dialogue may be comprised of, inter alia: biodiversity, animal products, climate change and its socio-economic impacts, promoting rights of indigenous peoples in international law, global governance in the Arctic, trans-boundary pollutants, and opportunities for enhancing the effectiveness of EU policy on indigenous peoples in connection with environment.[472] The following mechanisms for facilitating Arctic indigenous peoples' access to EU decision-making process should be considered.

Establish an Indigenous Peoples' office in Brussels

EU institutions could, together with indigenous peoples, establish an indigenous peoples' office in Brussels and provide it with continuous and stable financial and logistical support. A new office would provide indigenous peoples with ongoing access to EU officials and a common representation could become a venue for the coordination of indigenous positions on EU developments and could simplify the dialogue with the indigenous world. Indigenous groups and organizations have limited resources at their disposal and the maintenance of the proposed indigenous office would constitute a comparatively significant financial effort. Therefore, substantial support from the EU would be necessary. The office could address participatory issues within EU development aid, challenges of Arctic peoples, and the lack of Sámi representation in Brussels, which has already been identified especially in the 2008 Arctic Communication.[473] Finally, to facilitate indigenous involvement in European processes, the EU could coordinate with indigenous peoples on its relevant activity in international organizations; it could develop a set of guiding principles for cooperation with indigenous groups, and add indigenous issues to the EU's bilateral dialogue agenda.[474]

Establish a Working Group on Indigenous Peoples under the Northern Dimension policy

The proposed Northern Dimension Working Group on Indigenous Peoples (ND WGIP) could serve both programmes within the Northern Dimension policy as well as provide advice to EU institutions concerning the EU impact on Arctic indigenous peoples in general.[475] As the ND is an umbrella policy for various instruments (ENPI, Interreg, structural funds, democracy promotion instruments, cultural exchange), creating one venue for advising on all aspects of the EU's activity in the European Arctic is a logical option.[476] The EU could also coordinate with existing Arctic participation mechanisms, especially the Working Group on Indigenous Peoples (WGIP) under BEAR, which is represented both in the Barents Euro-Arctic Council (BEAC) (of which the European Commission is a member) and in meetings of the Regional Council. The existing WGIP under BEAR is composed of representatives of the Barents

[472] *Summary,* 2010.
[473] European Commission, 2008b, p. 5.
[474] *Summary,* 2010.
[475] Arctic Transform policy options included similar concept of *Climate Change Impact Assessment Working Group* and *Indigenous Rights Review Working Group* under Arctic Council, suggesting that "many well-meaning projects to help Arctic communities to adapt to climate change may in fact severely hit the life-nerve of societies and change the structure and dynamics of the regions, communities and families in unintended, unfortunate and unforeseen directions." See Indigenous Peoples Working Group, 2008, p. 4 [hereinafter Arctic Transform WGIP policy options].
[476] See, e.g., Sulyandziga, P., "Adjusting the Northern Dimension to the New Challenges of the Arctic and the Indigenous Peoples," speech at the Conference "Common Concern for the Arctic," Nordic Council of Ministers 9-10 September 2008, Ilullisat, Greenland.

indigenous peoples and holds an advisory status in addition to its regular working group responsibilities.

Establish participatory mechanisms within EU biodiversity policy

EU environment and biodiversity conservation policy could incorporate indigenous participatory mechanisms. Indigenous peoples hold vast traditional ecological knowledge (TEK) and including their perspective early in the process could help avoid possible land-use conflicts connected with the introduction of conservation schemes. For example, the Natura 2000 network could take greater account of Sámi presence in Natura 2000 areas in EU Lapland and in the EEA, if the programme is in fact expanded (see also, Section 2.1 on biodiversity). In all cases where Natura 2000 areas overlap with indigenous (i.e. Sámi) areas, participatory mechanisms for indigenous and other local communities should be in place. Specific guidelines or a summary of best practices based on Member States' experience in this context could be produced. In this context, TEK should be taken into account both during the designation of conservation sites and the development of management plans. It is important to note that indigenous and other local communities may not have the appropriate organisational and financial resources or other needed capacity to fully take part in conservation processes. Thus, communities and indigenous peoples may need to be supported to act on equal footing with other stakeholders or experts invited to discuss Natura 2000 issues.

Support indigenous peoples in international fora

It is important that indigenous peoples' voices be heard during international negotiations, particularly when many decisions made at the international level can impact indigenous communities directly (for example, the impacts of decisions on reducing emissions from deforestation and forest degradation under the UNFCCC on the way indigenous and local communities can utilise forest resources). Often it is too financially difficult for indigenous peoples to send representatives to the meetings of international fora. Therefore, these groups must be supported in either attending these meetings or dedicated pathways for communication directly from indigenous stakeholders to negotiators and decision-makers must be established and consistently recognised.

3 Future Scenarios (up to 2030)

3.1 Introduction

The future magnitude and character of the EU's footprint in the Arctic is dependent on a number of highly uncertain variables. To better understand how the EU's Arctic footprint could change as a result of the convergence of several changing variables by 2030, a set of three future scenarios has been developed, below. These scenarios are based on an expert workshop held in April 2010 (see, Annex D for further details).

The three future scenarios are based on the assumption that the magnitude of the EU's impact on the Arctic is determined not only by the pressures emerging from the EU, but also by the Arctic's relative vulnerability to those pressures, determined by the severity of climate change impacts and availability and effectiveness of management strategies. Consequently, these scenarios take four variables as the most critical to the future development of the EU footprint in the Arctic:

(1) EU economic growth: the amount of growth in EU GDP from 2010 – 2030;
(2) EU resource efficiency: the amount of environmental impact per unit energy consumed in the EU by 2030;
(3) climate change in the Arctic: the change in degrees Celsius in the Arctic from 2010 – 2030 and other metrics such as extent of sea ice recession and extent of melting permafrost;
(4) management of environmental pressures in the Arctic: the degree of coordination among international actors, such as governments, NGOs, the private sector, and individuals to address climate change impacts and their derivatives in the Arctic by 2030, along with the effectiveness of multilevel governance.

EU drivers of climate change and other environmental impacts (determined by (1) the level of economic growth and (2) level of resource-efficiency) interact with the Arctic as a receiver of impacts, with its vulnerability to EU pressures determined by (3) the speed of onset of climate change and (4) the effectiveness of management of these pressures. In this way, these four parameters determine the overall EU footprint on the Arctic in 2030.

The scenarios explore possible ways these four variables may develop up to 2030. Selected combinations of these variable's outcomes could result in the EU's future Arctic footprint being relatively high, medium, or low-impact. For this exercise, the number of possible variable combinations has been distilled down to five, and the project team created narratives for the three "marker" scenarios among them (indentified in Table 1, below, with asterisks).[477] The scheme for generating these five scenarios from the crossing of four variables is presented in the table below, where 5 represents a "high" level and 1 represents

[477] These three marker scenarios were chosen because they exhibit the most distinct characteristics, giving sufficient overview of possible futures. The mid-level increments between them are not so distinct that the description of two additional scenarios (i.e. medium-high impact and medium-low impact) would add significant value to this exercise. Add sentence on "even these five scenarios do not represent the full spectrum of possible scenarios given that these four variables are assumed to be completely independent."

a “low” level of climate change, effective management, economic growth, or resource efficiency.

Table 1 Possible combinations of variables for the future EU Arctic footprint

FOOTPRINT SCENARIOS	ARCTIC PRESSURES AND RESILIENCE		DRIVERS OF EU FOOTPRINT	
5-High impact*	**5** climate	**1** management	**5** growth	**1** efficiency
4-Medium high impact	**4** climate	**2** management	**4** growth	**2** efficiency
3-Medium BAU impact*	**3** climate	**3** management	**3** growth	**3** efficiency
2-Medium low impact	**2** climate	**4** management	**2** growth	**4** efficiency
1-Low impact*	**1** climate	**5** management	**1** growth	**5** efficiency

The scenarios explore how changes in these variables would impact the same set of nine indicative issue areas assessed in the analysis of the current EU Arctic footprint:

1) biodiversity
2) chemicals and transboundary pollution
3) climate change
4) energy
5) fisheries
6) forestry
7) tourism
8) transport
9) Arctic indigenous and local livelihoods

The main purpose of developing these scenarios is to aid the discussion of long-term considerations for EU policy development to reduce its Arctic footprint. The three scenarios, ‘Race for Resources – High impact’, ‘Business as Usual – Medium impact’ and ‘Eased by Efficiency – Low impact’ are followed by a discussion of these long-term policy considerations. It is important to note that these scenarios focus on the EU contribution to overall pressures in the Arctic. For example, although the EU is responsible for a smaller fraction of the overall pressures in the Arctic in the low-impact scenario, total pressures are not necessarily universally reduced. Consequently, long-term policy options must touch on the contribution of other countries to impacts in the Arctic, which the EU can strive to influence via bilateral or multilateral policy options.

Please note that through the choice of these particular scenario characteristics we do not mean to indicate that other combinations of variables are not likely to arise (e.g. both high economic growth and high efficiency). Our choice of scenarios and their corresponding variable combinations in fact do not indicate ‘likelihood’ of occurrence at all. Rather we have sought to illustrate the broadest range of possible futures which are useful for the purposes of policy development. Many other scenario elements could have been chosen, but we hope

the scenarios discussed here will nevertheless stimulate long-term discussions accounting for multiple future possibilities.

3.2 EU-Arctic scenarios up to 2030

Race for Resources – High impact

A high level of economic growth and a low level of resource efficiency in the EU interact with rapid climate change and a low level of effectiveness in management of Arctic pressures to result in a high impact EU footprint in the Arctic in 2030. EU input to overall pressures on the Arctic is larger than in 2010 and conditions in the Arctic, particularly due to an increasing rate of warming, make it more sensitive to these pressures.

In this high impact scenario, high EU economic growth allows for higher per capita consumption and thereby higher demand for natural resources, including those in the Arctic (e.g. minerals, timber, fisheries products, oil and gas, etc.). A relatively unchanged level of resource efficiency from the 2010 baseline means that increasing demand results in a nearly proportional increase in the EU's environmental footprint. Methods of extracting non-renewable resources show little regard for their finite availability, and their consumption generates a high level of emissions. The EU falls short of its Europe 2020[478] targets for GHG emissions reductions and energy efficiency, and there has been little development of more efficient technology, though EU governments and industry have devoted moderate funds to this research agenda. Consumption patterns have been largely unaffected by environmental concerns and growing average per capita wealth has allowed many consumer products to have short life cycles, which further enhances resource demands.

Furthermore, there are wide-scale ecosystem changes in the Arctic resulting from rapid loss of sea ice and permafrost. Accidents driven by increased economic activity (e.g. oil spills and shipping accidents) further stress the environment. Arctic biodiversity is threatened in many habitats, and efforts to protect large areas are 'too little too late'. Permafrost melt causes serious concerns for the foundational integrity of existing roads, pipelines and buildings and presents challenges to developing replacements.

Biodiversity

Drastic changes in Arctic ecosystems are having a devastating impact on biodiversity, and the Arctic Species Trend Index indicates there has been an additional 20% decline in terrestrial vertebrate populations since 2010. One major cause is melting permafrost, where the ecosystems associated with polygon and palsa mires are rapidly disappearing by 2030. The changed landscape has led to a loss of wetlands, which in turn has caused declines in many migratory bird populations. A less documented impact of climate change is occurring in marine ecosystems, in particular the ice-associated plankton communities, where ocean acidification is becoming a significant stressor. Though several biodiversity conservation programmes have been implemented to protect tundra ecosystems and particular species, such as remaining populations of polar bears, little effort has been made to protect marine ecosystems. For example, efforts to limit the introduction of invasive marine species from

[478] European Commission, Europe 2020, online.

increased Arctic shipping traffic have not been very effective. Moreover, conservation efforts lack international coordination and their limited geographic focus has made it difficult to help mammal and bird populations adapt to the impacts of climate change. Infrastructure development from oil and gas activities disrupts 40% of the Arctic landscape, severely limiting caribou and muskox habitat ranges.

Chemicals and transboundary pollution

Emissions of new POPs are increasing and greater amounts are deposited in the Arctic. In spite of environmental scientists becoming more and more skilful at identifying potential threats to the Arctic, no political action is taken because of poor international coordination and a lack of science-policy dialogue. As a result, new chemicals add to the contaminant burden of Arctic traditional foods. A negative effect on cognitive development of Arctic children is suspected but difficult to document, while the impacts on food habits is more apparent, resulting in an erosion of its positive role for cultural identity and nutrition. Traditional foods are also affected by mercury emissions, which are still unregulated by any global instrument, and have increased in fast-growing Asian and African economies by 20%, although Europe has reduced its mercury emissions by 20%. In addition, rapid onset of climate change has led to increased deposition of mercury in Arctic ecosystems. Thawing permafrost is compromising the structural integrity of landfills and other contaminant holding structures, which contaminates surface and ground water with hydrocarbons and other chemicals in certain localised areas. Forest fires have led to re-release of deposited contaminants to the atmosphere.

Climate change

The Arctic has warmed on average by 2.5°C since 2000, at the very high end of IPCC warming predictions. Methane emissions from thawing permafrost are also increasing and further exacerbating the rate of climate change. The Arctic Ocean is predicted to be ice-free for a period during late summer by 2035.

High economic growth and no global agreement on GHG emissions under the UNFCCC have resulted in very low rates of mitigation, especially in the US and China, in spite of domestic pledges of significant GHG reductions. The EU has been able to reduce emissions in the sectors covered by the ETS, aided by incremental efficiency gains in solar and wind energy, but black carbon and GHG emissions from the EU from personal vehicle transport, shipping, and international aviation are increasing by 1% per year. The EU has also not been successful in encouraging Member States to phase out subsidies for coal mines, and the fossil fuel industries remain a strong and successful presence in lobbying for less stringent ETS caps over time. For this reason, the price of carbon has not risen to incentivise many mitigation opportunities, and the rate of adoption of renewable energy has slowed drastically, though it has become cheaper.

Energy

EU oil and gas imports are increasing by at least 5% per year by 2025, and its reliance on Arctic hydrocarbon resources from Norway and Russia is growing steadily. Russia has been able to develop five new pipelines originating in East Siberia, two of which transport oil to the EU and the other three to China. This increased activity, compounded by climate change pressures, exerts an unprecedented amount of stress on infrastructure in the Arctic – roads, pipelines, ports, on- and offshore oil and gas platforms. The integrity of industrial

infrastructure in some Arctic regions is greatly compromised by coastal erosion, thawing permafrost, flood damage, sea level rise and increasingly extreme weather events. In the winter of 2022, an oil rig off the coast of Norway explodes, shocking the international community, which had looked to Norway as a leader in offshore drilling regulation and safety. The clean up process was executed quickly, but was highly complicated and expensive. This disaster stimulated new conversations about the need for further safety and environmental regulations, which have since died down and were not fully addressed by EU legislation. Business-as-usual in the energy sector continues.

Fisheries

Arctic fisheries are well-developed by 2020, and exhibit signs of decline, population instability and changes in the average size of fish caught. Although data gaps remain, scientific assessments estimate that 90% of Arctic fisheries are fully exploited, over exploited or recovering, and therefore incapable of meeting any increase in demand. There is great concern that overfishing of certain fish species is further impacting already threatened top predators. Although the EU fleet presence in the Arctic has not significantly increased, the EU is by far the largest consumer of Arctic fish, encouraged by economic growth and a shift in diets to leaner protein sources. Ineffective Arctic fisheries management, similar to what is seen in other parts of the world, has failed to address gaps in catch reporting and large quantities of illegal seafood continues to enter Europe, where it is estimated that 60% of all seafood sold is IUU (this is also due to the fact that quotas are becoming more strict as demand continues to rise).

Forestry

The Arctic timber industry has been growing since 2020, now accounting for nearly 1% share of total GDP of Arctic countries. This is due both to climate change, bringing about a greening of the Arctic tundra and an expansion of Arctic forest as well as an increase in EU demand for timber, particularly for energy production. Due to the increase in demand for bio-energy, timber of poorer quality has become economically viable. There has been little increase in the use or requirement of sustainable forestry certificates, resulting in a high share of non-certified timber being imported into the EU. Old boreal forests are almost absent, which threatens the genetic viability of native Arctic tree species and disrupts native habitat and biodiversity. Moreover, Arctic boreal forest is highly affected by forest fires and insect outbreaks, occurring in greater frequency due to climate change.

The oil and gas industry is also developing wells within boreal forests. As boreal forests are increasingly exploited by industry, biodiversity loss and soil erosion are exacerbated. In Finland and Sweden, land use conflicts worsen among reindeer husbandry stakeholders and logging companies.

Tourism

Increased demand for Arctic tourism brings the advantage of job creation, a market for indigenous and local goods, and the economic benefit of a longer tourist season. Fifty percent of Arctic tourists now come from the EU. The seasonality of Arctic tourism has become less extreme as tourists perceive that the winters are not as severe and that climate change is closing in on an “expiration date” for the Arctic as a tourist destination. In actuality, weather conditions are becoming increasingly unpredictable and there are concerns that the expansion of cruise ship traffic is exceeding infrastructure limits. GHG emissions associated

with inbound and outbound travel between the EU and the Arctic increase in direct proportion to the increase in tourism activity. The Arctic hosts about 1.5 million EU tourists per year whose travel emissions account for nearly 1% of total GHG emissions from the EU. The introduction of invasive species by increased tourist traffic comes on top of increased cargo shipping traffic and marine ecosystems already being heavily taxed by changes in the distribution of marine species due to climate change. The future viability of Arctic tourism is highly uncertain.

Transport

Arctic hydrocarbon and hard mineral resources are increasingly exploited, making shipping of oil more economically attractive in the Arctic region. Northeast and Northwest passages are available during most of July, August and September. Oil tanker shipping traffic has increased between Murmansk, Russia and the US and a new major trade route has been established in the Northeast between Murmansk and China, which is predicted to compete with the Suez Canal within the next two decades. However, this distance advantage is unavailable for at least 8-9 months of the year and oil from the Russian Arctic continues to be supplied primarily through pipelines. The development of an iron ore mine on Baffin Island has increased shipping traffic in Canadian Arctic waters.

EU demand for Arctic tourism and for fisheries products does contribute to increased maritime traffic. There is an urgent need for improved Arctic shipping infrastructure including communication systems, emergency response and cleanup, and ice information collection and distribution. Increased traffic, combined with weak infrastructure greatly increases the risk of accidents – the amount of oil spilled due to tanker accidents averages 8,000 tonnes per year from 2020-2030, in addition to increased oil pollution from tanker operational activities. This, compounded by the offshore oil spill disaster in the Norwegian Sea, has made hydrocarbon contamination a serious health risk for affected Arctic communities and ecosystems.

Arctic indigenous and local livelihoods

Lack of proper environmental and impact assessment combined with the pressure from the resource extraction industry results in environmental degradation of certain areas and high social tensions. Local communities gain certain benefits from the developments, including the construction of schools and hospitals in some areas; however the conflicts between various resource uses, e.g., tourism, reindeer herding (especially winter pastures), hunting/fishing, farming and extraction of fossil fuels and minerals, continue to be one of the most crucial problems of the region. Indigenous peoples have a stronger voice in EU and Arctic policymaking processes, but policy measures emerging in this context still fall far short of what is needed in the face of mounting environmental problems. Beyond efforts to protect areas of critical importance to local subsistence and the initiation of adaptation projects, there is little that can be done to buffer local Arctic communities from the wide-scale effects of changes in climate. As impacts of climate change worsen, local and indigenous communities for whom tourism became an additional source of income face major economic difficulties. The economic and social problems in the Arctic make more government transfers necessary. Changes in the availability of job opportunities, and the many threats to community infrastructure from warming in the Arctic are forcing many residents – especially women – to relocate away from the Arctic. Pollutant levels affect the cognitive development, immune response and reproductive health of several indigenous populations and health concerns

have forced some Arctic communities to abandon many of their traditional foods, with negative impacts on physical, mental and cultural well-being.

Business as Usual – Medium impact

A medium economic growth trajectory and a medium level of resource efficiency in the EU interact with a medium rate of climate change and a medium level of effectiveness in management of Arctic pressures to result in a gradually increasing EU footprint in the Arctic in 2030.

In this scenario, moderate EU economic growth (approximately 2% annual increase in GDP) is essentially counterbalanced by a nearly comparable increase in resource efficiency. Europe 2020 targets have all been met. However, efforts at managing pressures in the Arctic are not quite able to hold the effects of climate change in check and environmental conditions in the Arctic continue to deteriorate. The EU's impact on the Arctic continues to increase. However, the balance struck between variables in this scenario is very delicate and slight shifts in any of them could tip the balance in one direction or the other.

In the Arctic, sea ice extent and area of permafrost declines significantly. However, visible impacts drive significant public support and great strides are made for environmental protection. A network of marine and terrestrial areas helps halt the loss of biodiversity.

Biodiversity

A network of Arctic marine and terrestrial protected areas is implemented under the UN Convention on Biodiversity, intending to halt the loss of biodiversity. This does manage to protect some species from further decline, such as bowhead whales, whose migratory routes have been protected from seismic exploration. However, these initiatives are insufficient to stop the rate of ocean acidification and invasive colonisation in the Arctic Ocean, where native and economically valuable fish species are now competing with invasives from warmer waters. The shift in dominance of certain marine species results in the decline of several fishing communities in Greenland, creating concern that this trend will continue in other Arctic areas as ocean temperatures rise further. The EU develops a new strategy for supporting biodiversity in non-EU regions through cooperative research programmes, which has significant Arctic implications. However, the effort does not yet appear to be sufficient to halt biodiversity loss, mainly due to the inability to mitigate the disruptive impact of oil and gas infrastructure, acidification, shrinking habitats and changing food supplies. Due to the inertia of the climate systems, many climate change impacts are predicted to worsen over the coming decades though GHG emissions worldwide are slowly decreasing.

Chemicals and transboundary pollution

EU transboundary pollution emissions of SO_2 and NO_x continue to decrease but at a slowing rate, and with increasing amounts from the transport sector. The EU has dedicated large sums to cleanup projects in an effort to reduce the abundance of legacy POPs in the Arctic. It has also participated in international research coalitions to determine the extent and effects of chemicals and transboundary pollution in the Arctic. The results have been incorporated into EU chemicals policy and regulation. However, contaminant levels of POPs and mercury in Arctic food webs remain a concern for human health and the population stability of some wildlife species. A global agreement on mercury emissions was adopted in 2025, resulting in lower emissions but no evidence of lower levels in the Arctic.

Climate change

The rate of Arctic warming has not slowed and the Arctic Ocean is predicted to be ice-free in the summer by 2045. Slow progress is being made in reducing EU GHG emissions, and black carbon deposition in the Arctic is decreasing but still a major contributor to warming. The EU has reduced total black carbon emissions by 30% from 1990 levels by 2030 by implementing filter requirements for all diesel engines. Lower black carbon and GHG emissions is due both to steady mitigation efforts and a moderate rate of economic growth, which concerns analysts who believe efforts to stimulate the economy will duly result in a reversal of perceived emissions reductions.

The EU works with the Arctic Council to coordinate and fund adaptation efforts in the Arctic, including community-level consultations to determine specific needs and providing educational opportunities for locals and indigenous peoples who require new sources of income.

Energy

Steady economic growth in the EU creates continued demand for energy, but also provides substantial support for development of renewable energy technologies. Therefore, EU oil and gas imports are increasing steadily by 1.5% per year. The EU is still highly dependent on Russian and Norwegian Arctic hydrocarbon resources, resulting in expansion of offshore drilling in ice-covered waters. However, the EU seeks to abate the environmental impact of these developments by passing legislation that requires more stringent EIA requirements for imported oil and gas, building on its sustainability standards for imported biofuels. This was enabled by increasingly cooperative relationship with Russia on energy issues, facilitated by bilateral agreements and through Russia ratifying the Espoo Convention in 2025. The environmental impact assessments conducted by EU, Russian and Norway industries have mitigated some landscape fragmentation and habitat loss, yet the presence of oil and gas structures continues to grow.

Fisheries

The EU is a major consumer of Arctic fish, and EU ships retrieve 15% of all Arctic catch through an agreement with Norway allowing those ships access to the Norwegian Sea. Developments in technology have reduced by-catch, but have ultimately increased the efficiency of catch production. IUU fishing is gradually declining, especially because Arctic States adopt a multilateral agreement on fisheries monitoring and enforcement. Although data gaps remain, scientific assessments indicate that 75% of Arctic fisheries are fully exploited, over exploited or recovering; researchers predict a collapse of Arctic fisheries by 2050 if stricter quotas are not implemented and rigorously enforced. The EU has completely removed subsidies for fishing capacity and is cutting back its fleet size, in line with international agreements, but as a relatively small contributor to Arctic catch, this does not increase the sustainability of Arctic fisheries. Another threat to fisheries in the Arctic is perceived to be the northward shift of warmer waters and several invasive fish species, which are decreasing the viability of native stocks and are also less economically valuable, thereby frustrating the fishing community.

Forestry

The Arctic tree line is gradually expanding northwards due climate change, though this does not significantly affect timber resources. The demand for timber is relatively stable and

exploitation of Arctic forest is relatively low. The demand for bio-energy has stabilized and consequently the demand for wood as renewable energy resource and other wood products is stable. The EU has also been able to make great strides in reducing imports of illegally harvested wood, particularly from Russia. It now requires that all imported wood meet certain sustainability standards with a focus on preventing biodiversity loss from forests.

A series of severe forest fires have increased the concern over black carbon pollution in the Arctic, and have offset efforts to reduce such emissions in the EU and other regions. This may result in greater climate change impacts in the Arctic in the near future due to reduced albedo of snow and ice.

Tourism

The number of Arctic-bound tourists from the EU continues to increase, accompanied by greater cruise ship traffic. However, the Arctic landscape is now less 'iconic' in certain areas due to climate change. There are concerns that this may lead to lower tourist numbers in the future.

Emissions associated with EU inbound and outbound travel to and from the Arctic are still relatively high (0.5% of total EU GHG emissions). However, much stricter guidelines for sustainable tourism practices are observed at the local level within the Arctic, which is becoming known as one of the premier "eco-tourism" hotspots such as in the Swedish fells. Most of the tourism industry is dominated by non-locals, such that many "sustainable tourism" programmes are contentious in some Arctic communities. Introduction of non-native species to Arctic ecosystems remains an issue of great concern, however, especially as ecosystem stability is eroded by increasing changes in climate.

Transport

The EU contributes to the steady increase in maritime transport traffic in the Arctic through fishing vessels and cruise ships as well as its demand for Arctic natural resources. The environmental threats associated with Arctic shipping are relatively well-controlled due to the early adoption of the IMO's Polar Code by all Arctic States and the EU, resulting in better regulation of emissions, dumping and ballast exchange, and increased protection of sensitive wildlife areas. Surveillance, communication and search and rescue infrastructure in the Arctic is being developed, although it lags behind the needs of increasing traffic. The EU tanker fleet is both younger and producing fewer emissions. Accident-related oil spills are not increasing in frequency (averaging 2,000 tonnes of spilled oil per year from EU tankers) and cleanup happens more quickly and effectively. The development of new infrastructure to increase the safety of Arctic transport has not been sufficiently supported by Arctic states, other than Canada, who has continued to refine NORDREG. There is concern that a major economic boom would push Arctic transport capacities past their safety limits.

Arctic indigenous and local livelihoods

Intensifying climate change effects and a strong concern for managing pressures in the Arctic has turned much attention toward the sustainability of local and indigenous peoples' livelihoods in the Arctic due to increased efforts from local interest groups and NGOs to highlight their struggles. Thanks to a somewhat longer tourist season and increased economic activity in the Arctic, the economy of most Arctic regions is stable, but fragile. The strength of Arctic economies is also highly variable by region, with transfer payments remaining a major factor for the North American Arctic and Greenland. The EU has focused

on funding adaptation projects and increasing dialogue with Arctic communities to identify adaptation needs under a cooperative research initiative through the Northern Periphery Programme. Changes brought on by a warming climate cannot be controlled or halted and many are compelled to make major lifestyle changes. The economic and social changes continue to reshape the lifestyles and livelihoods of Arctic communities.

Eased by Efficiency – Low impact

A low level of economic growth and a high level of resource efficiency in the EU interact with slow onset of climate change and a high level of effectiveness in management of Arctic pressures to result in a low impact EU footprint in the Arctic in 2030. In particular, low economic growth in the EU coupled with high resource efficiency creates low demand for resources and products, allowing for greater strides towards sustainable rates of consumption and reducing GHG emissions levels. Though the momentum of climate change continues to create some pressures in the Arctic, these challenges are addressed through a high level of international cooperation on Arctic adaptation and ambitious regulation of black carbon and GHG emissions. Expansion of economic activity in the Arctic is limited because of the high costs associated with operating in the Arctic and because new developments are made with a high level of precaution and careful planning.

Changes in ecosystem and human health are primarily observed by scientists, but largely successful efforts are continually made to motivate the public to prepare for the anticipated impacts of climate change. International chemicals policy has been refined such that there is now a gradual decline in levels of POPs and mercury in the Arctic.

Biodiversity

Slow onset of climate change impacts results in a slowing of biodiversity loss in the Arctic, though many marine and terrestrial species are still impacted by human activities. The threat of climate change is less of a spectre in the public eye because few extreme impacts have been observed in the Arctic, so the public concern over polar bears and their habitats has waned. However, the EU has managed to form an effective partnership between CAFF and Natura 2000, which facilitates knowledge sharing on biodiversity protection strategies and protection for migratory species and their corridors. Nevertheless, there is little that can be done to prevent the mismatch in timing between food availability for certain species, like caribou, and their cycle of reproduction, a trend which exacerbates offspring mortality rates for several species of land mammals.

Chemicals and transboundary pollution

EU emissions of SO_2 and NO_x are decreased significantly and its percentage contribution to pollution in the Arctic is steadily decreasing, which results in fewer instances of Arctic haze. The Stockholm Convention on POPs has been an important cooperative mechanism: by developing regular field reviews of chemical contamination in the Arctic through AMAP and communicating these findings to REACH (which has established an Arctic desk) and the Stockholm Convention conferences, new POPs are discovered earlier and legislation regulating their production is more readily implemented. The EU achieves its emissions reductions mainly through regulation rather than technological improvement. Slow economic growth has allowed the EU to reduce emissions more easily, which has resulted in low incentive for adopting state-of-the-art emissions reduction technology. However, evidence of

mercury contamination in the Arctic is declining after successful implementation of a global mercury agreement under UNEP in 2015, resulting in a 50% reduction in global mercury emissions.

Climate change

The EU has been able to reduce black carbon emissions by 80% from 1990 levels by 2030, and the resulting lower black carbon deposition has reduced the rate of warming in the Arctic, such that there is on average 1°C additional warming from 2000-2030.

A global agreement on climate change which includes the US is adopted in 2017, and results in fairly ambitious global GHG emissions reductions of 45% from 2005 levels by 2030. The EU also forms an agreement with China on the control of pollution, including black carbon, from coal-burning power plants and tandem with cost-effective solar panel development. This results in a slowing of the rate of increase in black carbon and CO_2 emissions from China and a technological breakthrough in solar panel efficiency in 2025. The solar industry subsequently experiences a boom that encourages very optimistic attitudes that the world will achieve 80% GHG emissions cuts by 2050.

Energy

EU demand for oil and gas is decreasing by 1.5% per year due to the rapid increase in using renewable energy and lower demand for personal travel, though it is expected that if the EU economy is revived, demand for oil and gas may begin to rise again. SEAs are required for all oil and gas developments undertaken in the Arctic under a new convention (replacing Espoo) to which all Arctic states and the EU are Party. However, very little offshore hydrocarbon activity is occurring in the Arctic because these resources have not become cost effective to extract. China has not become the oil consumer predicted by many in the beginning of the 21st century due to its ability to revolutionise the renewable energy sector, along with the EU, in their development of low cost, highly efficient solar panels and the subsequent feasibility of widespread electric personal transport.

The cost of dismantling and rehabilitating decommissioned onshore energy infrastructure is prohibitive, but a slow rate of climate change results in less coastal erosion and sea level rise, putting these structures at lower risk of damage.

Fisheries

The EU has made significant headway in decreasing imports of IUU seafood through expansion of its catch certificate requirements, and has also implemented further "environmental sustainability" sourcing requirements for fish imports. As a consumer of 70% of Arctic fish catches, this policy has incentivised slow but notable progress toward sustainable fisheries management in the Arctic. The precautionary approach emphasised by many international environmental regimes has encouraged more ambitious data generation on Arctic fisheries. Fifty percent of Arctic fisheries are fully exploited or over exploited, which is generally a rosier picture than that painted in 2010. Furthermore, there is now incentive to keep fish stocks at a "sustainable level," otherwise they cannot be sold in many food store chains in the EU which have pledged to sell only fish which meet the sustainability requirements. Concerns remain that the sustainability requirements are poorly defined and do not adequately account for ecosystem health as a whole. Analysts predict that there is still significant room for expansion of Arctic fisheries, which have not rapidly developed, and

there are still some areas in the Arctic Ocean where data is lacking on fish population levels and ecosystem dynamics.

Forestry

Arctic forests have not been significantly developed from the 2010 baseline. Demand for wood as a renewable energy resource has decreased and demand for timber products, such as paper and pulp products decreases. Exploration of oil and natural gas reserves is restricted from forest areas. It is determined under the new international forest agreement that many forested areas are faced with too many stressors to cope with any level of exploitation, and are therefore protected in many areas. Sustainability certificates cover nearly 100% of EU timber imports, and Swedish and Finnish forests are regulated under a sustainable management scheme.

Tourism

EU demand for Arctic tourism is low and has taken a noticeable toll on the vitality of the industry. Of the 1 million EU tourists visiting the Arctic every year, growing numbers are patronising environmentally-friendly, locally-based companies and the local tourism industry in the Arctic has adopted strict sustainability standards in many areas. Small, local initiatives continue to increase the sustainability and viability of Arctic tourism, including benefit sharing programs between tourism providers and local communities. Some initiatives have been developed to coordinate these local initiatives in a larger network to increase their visibility and competitiveness, but larger corporations still dominate the industry. The bulk of Arctic tourism is still based on cruise ships and air travel, which have made only marginal improvement in their environmental impacts. Emissions associated with EU tourist travel accounts for less than 0.5% of total EU GHG emissions, largely due to decreases in emissions from shipping and aviation, but again, much of this simply stems from lower demand and not increases in efficiency or regulative pressure. Areas frequented by tourists are closely protected, especially at critical times for wildlife feeding and breeding.

Transport

As a result of decreased demand for oil and gas, the size of the EU tanker fleet has similarly declined. The amount of oil spilled by EU tankers averages less than 2,000 tonnes per year by 2030 and continues to decrease as tankers are decommissioned. Significant progress has been made in regulating emissions, discharge, and ballast water exchange, as well as in developing routing systems that protect sensitive wildlife areas through amendments to the IMO Polar Code, which is now largely binding because many of its provisions have been incorporated into existing international treaties. The area surrounding Svalbard has been designated a PSSA under MARPOL, setting a precedent for other Arctic areas. Arctic shipping infrastructure has not seen much development due to poor financing and low demand for Arctic resources, including hard minerals, oil and gas.

Arctic indigenous and local livelihoods

Limited access to resources due to strict regulation and slow climate change has resulted in conflicts among economic user groups in the Arctic, including forestry, reindeer herding, and resource extraction industries. However, slower economic development has also allowed more time for solving land claim and resource use issues in the North, and the process is indeed progressing slowly. The EU makes a pointed effort to consult local and indigenous peoples in its Arctic policy making processes and local and indigenous peoples are generally

more politically present in issues related to management of pressures in the Arctic, but lack of resources and gradual outmigration limits local capacities considerably. Small villages are increasingly rare as over time women have emigrated in increasing numbers to urban areas to pursue education and work opportunities. The pressure of the extraction industry is limited and a good regulatory framework allows communities to control the developments in their territories and benefit from the resource extraction activities. At the same time, however, many communities hoping for resource extraction development which have not happened or have been delayed (particularly in Greenland and Nunavut), are facing serious economic difficulties. Government transfers still constitute an important source of financial resources for many communities.

3.3 Long-term policy considerations

Introduction

The following long-term policy considerations are based both on the assessment of the current EU Arctic footprint, current policies as well as on the scenarios of the future EU Arctic footprint. The three scenarios show that the future of both the Arctic and the EU could face a broad spectrum of challenges, requiring integrated approaches and new ways of thinking of the EU's role in the region. Therefore, six themes discussing possible long-term policy responses, which cut across sectoral policy areas are presented below addressing ecosystem-based management, climate change adaptation and mitigation, resource efficiency, pollution reduction and the strengthening of policy process. The main focus is the possible positive and negative impacts of the EU on the vulnerable Arctic environment, but concerns for economic activities, Arctic communities and policy framework are included as well.

Utilise ecosystem-based management

The EU is actively promoting an ecosystem-based approach, for example, through its Integrated Maritime Policy. However, the need for further progress and stronger EU external action may be more evident in the future, depending on which scenario unfolds. Ecosystem-based management has the greatest chance for success in the *Eased by Efficiency – Low impact* scenario.

It is important to note that ecosystem-based management will not constitute a viable policy response in any scenario as long as various stakeholders do not genuinely participate in its design and implementation processes. Therefore, Arctic communities and various industries need to be engaged in the management process, and special attention should be paid to incorporating local and traditional knowledge. Co-management structures should be fully developed, regardless of the scenario. Awareness raising, capacity building, education and promotion of various advantages for communities will be of crucial importance for effective and meaningful participation and co-management.

At the international scale, the EU could advocate integrating ecosystem-based management into the design of marine protected area networks, or IMO Particularly Sensitive Sea Areas (PSSA). In a longer term perspective, the EU may consider trade mechanisms that give special treatment to products originating from regions where ecosystem based management

is in place. Across all scenarios, the EU could advance its leadership role in the Arctic by supporting capacity building in Russia and Greenland, for example, by disseminating best practices and supporting management structures.

Assist in Arctic climate change adaptation efforts

Together with the rising impacts of climate change in the Arctic, there is a need for the EU to adopt an ambitious integrated policy approach across all scenarios to support climate change adaptation in the North. This would encompass concerns related to biodiversity and the environment, local communities and economic activities (e.g. tourism, transport, fisheries, and energy). The need for adaptation measures is relevant for all scenarios, but is most urgent under the *Race for Resources – High impact* scenario.

To address environmental and social needs, the EU could streamline adaptation measures with conservation approaches (e.g. Natura2000). The health of Natura2000 sites could serve as a vital indicator of increasing adaptation challenges and as a platform for developing new approaches to conservation.

EU action to upgrade existing infrastructure with new technologies, e.g. to further enhance the safety and security of various offshore and land installations is necessary across all scenarios. This could include supporting projects or enhancing the quality and performance of maritime infrastructure in Russia and Greenland. The EU-Russia Agreement may evolve into one of the vital instruments for EU action. Moreover, the EU's regional policy and cross-border cooperation may be utilized in response to climate change impacts, as they adversely affect economic, social and territorial cohesion within the EU, EEA, Russia and Greenland. In the following decades, development of new programmes or new objectives addressing adaptation challenges may be considered. Such programmes would allow EU funding to respond to multiple challenges, such as adaptation of local and indigenous communities and lack of infrastructure for economic activities.

Mitigate climate change

Impacts of climate change will be felt in varying degrees across the three scenarios. One of the priorities for the EU in relation to domestic mitigation policies relies on the development of integrated networks for the production and distribution of renewable energy. The North-East Atlantic represents the most important opportunity for the development of such a network. Northern member states of the EU as well as their EEA partners could integrate offshore wind farms, hydropower projects and geothermal generation of electricity in one single renewable energy grid. This could also be supported by major research in relation to energy transportation and storage in order to make the development of energy generation in remote locations economically viable.

Reducing emissions from maritime transportation could also be a specific long-term policy focus for the EU, which could provide support through funding for research and introducing positive incentives for the most energy efficient vessels. The development of a new class of cargos that are designed for use through the northern sea routes provides a good opportunity for further energy efficiency in the sector. Moreover, reducing emissions from maritime transport would have co-benefits in the Arctic region, such as lower emission levels of black carbon.

Impacts of climate change in the Arctic are particularly relevant to the global climate system as they show the existence of powerful feedback mechanisms in the region. The EU could also invest in research related to the functioning of these feedback mechanisms and in opportunities for mitigation of their adverse impacts. It could work in close cooperation with the Arctic Council on this matter.

Increase resource efficiency

There is a need for increased resource efficiency across all scenarios, especially related to energy, transport and the exploitation of natural resources. Regarding energy, the EU could further enhance energy saving initiatives at the local level, as well as introduce new technology at the industrial level, e.g. green energy clusters. The EU could also support the development and the access to most advanced technology related to housing and building insulation, both in the field of construction and in relation to existing buildings. In the high and medium impact scenarios, the EU could allocate funds for research to increase fuel efficiency, which would benefit both the transportation sector and industries such as fisheries. More specifically, the issue of fuel efficiency in air transportation is particularly relevant considering the lack of alternatives to cut the environmental footprint of this form of transportation and the foreseen increase of air traffic. The EU could allocate specific funds to foster research in this area as well as to promote international cooperation in this field.

In both the *Race for Resources – High impact* and *Business as Usual - Medium impact* scenarios, the EU could improve the economic exploitation of natural resources and reduce its impact on ecosystems. In the field of fisheries policy, the EU could impose more stringent standards related to the harvesting of non-targeted species. With regards to the forestry sector, across all scenarios, the EU should implement a mandatory recycling scheme for bi-products from trees as well as take measures to support forest regeneration.

Reduce pollution

As highlighted in the Section on chemicals and transboundary pollution, there is an urgent need to reduce pollution in the Arctic environment. This includes addressing existing sources, such as emissions from used products, and production of new chemicals. The EU needs to work with Arctic nations to ensure tight regulations of pollution from off- and on-shore drilling, especially in the *Race for Resources – High impact* scenario.

Due to rising levels of pollutants in Arctic ecosystems, it becomes increasingly important to develop innovative policy means and assessment methods that take multiple stressors into account. The Arctic Council's AMAP working group as well as national research programmes could be valuable partners in implementing such ideas.

Across all scenarios, there is a need for open communication and dialogue about pollutant levels in species that are used as food. In addition to contributing to culturally appropriate measures to improve health and reduce intake of pollutants, such dialogues could be designed to strengthen the voices of Arctic people in international policy related to pollution.

Strengthen the policy process

There is a need for the EU to strengthen the policy process across all scenarios. In particular, in the high- and middle impact scenarios, the EU could strengthen the policy process by promoting more co-ordination between the existing multilateral agreements applicable in the Arctic. This would not be limited to current inter-secretariat co-ordination but also co-operation between working-groups (composed of representatives of states parties) between those multilateral agreements that have the most impact in the Arctic.

For example, the EU's Northern Dimension involves all relevant Arctic policy actors, but it lacks institutional strength. The EU could commit to shifting the main focus of the ND from the Baltic Sea to its already existing Arctic work, in particular trying to link with the Barents Euro-Arctic region, thereby creating synergies and avoiding overlaps, and maintaining the preparedness for action. Importantly, the ND and Barents Euro-Arctic Region could follow the precedent of the Arctic Council and grant the region's indigenous peoples the status of permanent participants, allowing these groups direct access and influence in the region's decision-making.

In particular, the *Race for Resources - High-impact* scenario would require more effective collaboration with the Arctic Council. For all EU policy decisions relevant for the Arctic, the EU could cooperate with the Arctic Council. This type of cooperation would affect all policy areas, streamline EU Arctic policies with trans-Arctic interests and raise the legitimacy of the EU in Arctic policy development.

4 Conclusion

The AFPA final report comprehensively indentifies EU and multilateral policies relevant to the EU's potential environment impacts on the Arctic and highlights policy gaps as well as suggestions for future policy development. The relevant policies are discussed within nine distinct issue areas, although many policies are cross-sectoral, and therefore, are discussed within multiple topics. Three future scenarios illustrate how the EU's Arctic footprint could change in the future, and long-term policy considerations are discussed within this future context. This examination makes clear that the EU is currently addressing many of the potential impacts to the Arctic environment, and is aware of the potential for more severe effects in the future. However, certain policy gaps must be addressed to decrease the EU's current and potential future Arctic impacts. As the EU moves forward, it is critical to present a consistent message and continue to work with the eight Arctic states, and across sectors, to implement policies that promote sustainable resource development and protect the Arctic environment.

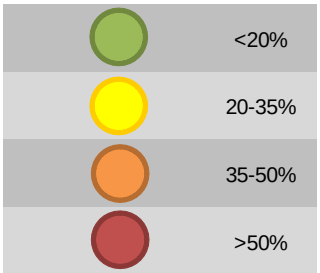
EU Arctic Footprint Scorecard

The results of the EU's Arctic footprint assessment, discussed within each policy area in Section 2, are presented here in the form of a scorecard, indicating the EU's share in each indicator as a percentage of the total global contribution to Arctic impacts. Lack of data prevented quantification of the EU's impact on forestry, transport and Arctic indigenous and local livelihoods. Further research is needed to address these information gaps.

The scorecard uses a basket approach, i.e. a collection of individual indicators presented separately, rather than creating a composite score, which would require a weighting scheme. Creating an ad-hoc weighting scheme was beyond the scope of this project and would not have delivered a broadly accepted result. The advantage of the basket approach over a composite score is that important detailed information that would be lost in aggregation is still available. Figure 25 shows the EU Arctic Footprint Scorecard with its flagship indicators.

Figure 25 EU Arctic footprint scorecard with flagship indicators

CATEGORY	FLAGSHIP INDICATOR	EU SHARE
Biodiversity	no flagship indicator	n.a.
Chemicals	PCB-153 emissions from Europe	57%
	Market demand for BFRs in Europe	17%
	EU-27's share of mercury emissions over the Arctic	24%
	EU-27's final demand for products from mercury-intensive Arctic industries	36%
	SO_2 emissions from the EU-27	42%
	EU-27's final demand for products from SO_2-intensive Arctic industries	38%
Climate change	GHG emissions from the EU	16%
	Europe's share of black carbon emissions to the Arctic	59%
Energy	EU-27's final demand for products from the Arctic oil and gas industry	24%
Fisheries	EU-27's share in fish imports from Arctic countries	39%
Forestry	EU-27's final demand for products from the Arctic forestry industry	n.a.
Tourism	Share of EU-27 tourists in the Arctic	27%
Transport	EU share of global shipping traffic in the Arctic	n.a.
Arctic livelihoods	EU impact on employment/income in the Arctic	n.a.



Source: Sustainable Environment Research Institute (SERI), 2010.

As concluded by the detailed analysis of each issue area, there are multiple Arctic impacts to which the EU contributes significantly (>35% of global contribution). The policy assessment indicates there are policies in place to address most of these impacts, both within the EU and globally. However, Table 2, which presents areas in which the EU's impact is greater than 35%, indicates that some of these major impacts are more completely addressed than others and makes very clear the policy gap in EU management over the infrastructure impacts from Arctic imports, black carbon emissions, and SO_2 emissions from imports.

Table 2 Major EU impacts on the Arctic and their relevant policies and trends.

IMPACT AREA	IMPACT TRENDS		POLICIES	
(EU % OF GLOBAL IMPACT)	EU source	Arctic indicator	EU	Multilateral
Imports from infrastructure-intensive industries (60%)	Likely to rise	Likely to rise	None	None[479]
Black carbon emissions deposited in Arctic (59%)	EU decreased PM10 emissions by 11% and PM2.5 emissions by 12%, 2000-2007[480] (this is only an indirect indicator of black carbon emissions)	Changes in black carbon deposition vary by Arctic region, with some areas exhibiting decreases since 1950 and others showing increases through 2000.[481]	None[482]	None
Import mercury emissions (36%)	Global mercury emissions have risen 20% 1990-2000[483]	No significant change in Arctic Hg levels	• EU Mercury Strategy (COM(2005)20) • Restriction on marketing of mercury-containing products (2007/51/EC)	• Convention on Long-Range Transboundary Pollutants
Import SO_2 emissions (38%)	Global SO_2 emissions peaked in 1980 and have generally fallen since in all regions[484]	Reductions in SO_2 air concentrations have been detected in some Arctic areas since 1990	None	• Convention on Long-Range Transboundary Pollutants (for some imports)
PCB-153 emissions (57%)	Low EU MS reporting, but general trend indicates emissions are decreasing[485]	Air concentrations are slowly decreasing while trends in bioaccumulation are less clear[486]	• On POPs (Regulation 850/2004) • On disposal of PCBs (96/95/EC)	• Stockholm Convention on POPs • Convention on Long-Range Transboundary Pollutants
SO_2 emissions (42%)	Down 60% since 1990[487]	Reductions in SO_2 air concentrations have been detected in some	• Integrated Pollution Prevention and Control (2008/1/EC) • Limiting Air Pollution from Large Combustion Plants (2001/80/EC)	• Convention on Long-Range Transboundary Pollutants

[479] While there are certain EU and multilateral policies that have implications for infrastructural impacts (e.g. the EU EIA and SEA directives, EU Fuel Quality Directive, UN World Cultural and Natural Heritage Convention), these policies do not target infrastructure impacts directly.
[480] EEA, 2009, p. 40, 43.
[481] Zender, 2007, p. 2.
[482] There is no direct black carbon regulation in place, though Air Quality Directives (2008/50/EC, 2004/224/EC) and Integrated Pollution Prevention and Control Directives (2008/1/EC, 2001/80/EC, 2000/76/EC) regulate PM emissions, which is a by-product of black carbon.
[483] European Commission, 2005, p. 15.
[484] Smith et al., 2004, p. 7.
[485] European Commission, 2009, p. 119-120.
[486] Hung et al., 2005, p. 129; Addison, et al., 2005, p. 351; Letcher et al., 2009.
[487] EEA, 2010.

IMPACT AREA	IMPACT TRENDS		POLICIES	
(EU % OF GLOBAL IMPACT)	EU source	Arctic indicator	EU	Multilateral
		Arctic areas since 1990[488]	• Fuel Quality Directive (2009/30/EC) • Directive on ship-source pollution and on the introduction of penalties for infringements (2005/35/EC) • EU National Emissions Ceiling Directive (2001/81/EC)	
Fish imports from Arctic countries (39%)	Increased by 14% since 2000	Arctic catches have generally remained consistent from 1975-2006,[489] but little stock data is available for new and developing Arctic fisheries	• EU Common Fisheries Policy • EU Integrated Maritime Policy • Fish import standards	• OSPAR Convention • UNCLOS • FAO Code of Conduct

Source: Table compiled by Ecologic Institute.

Further policy gaps have been identified in Section 2, which are necessary to address because, as illustrated by the future scenarios in Section 3, changes in the Arctic due to climate change and level of international management will most likely require adaptation of existing policies as well as development of new policies to address new gaps.

Climate change is a driver in many of the policy issues addressed in this assessment. While the EU cannot address this challenge and its Arctic impacts alone, it can act as an international leader in emissions reductions and create pressure for the necessary reductions from other developed regions.

The EU is currently addressing many of the potential impacts to the Arctic environment, and is aware of the potential for more severe effects in the future. However, to decrease the EU's current and potential Arctic footprint, key policy gaps must be addressed. By developing an environmental strategy specifically for the Arctic, using multilateral fora to reduce the environmental impacts from imported goods and services, and adapting its policies to international standards in Arctic management, the EU could effectively contribute to Arctic policy making and reduce its Arctic footprint.

[488] Hole et al., 2009, p. 934.
[489] Rudloff, 2010, p. 11.

5 References (organised by report section)

5.1 Introduction

ACIA (2004): Impacts of a warming Arctic: Arctic Climate Impact Assessment. Cambridge University Press. Available online at: http://www.amap.no/acia/.

ACIA (2005): Arctic Climate Impact Assessment. Cambridge University Press. Available online at: http://www.acia.uaf.edu.

Arctic Monitoring and Assessment Program (AMAP) (2009): AMAP Assessment 2009: Human health in the Arctic. Arctic Monitoring and Assessment Programme (AMAP), Oslo, Norway. xiv+256 pp.

Best, A., Cavalieri, S., Jariabka, M., Koivurova, T., Mehling, M., Molenaar, E. (2009). Transatlantic Policy Options for Supporting Adaptations in the Marine Arctic: Summary for Policy Makers. Arctic Transform. Available at: http://arctic-transform.org/download/Sum.pdf (viewed 7 October 2010)

Council of the European Union (EU Council) (2009). Council conclusions on Arctic Issues. 2985th Foreign Affairs Council meeting. Brussels, 8 December 2009.

Downie, D.L. and Fenge, T.(2003): *Northern Lights against POPs.* Montreal-Kingston. McGill-Queen's University Press.

European Commission (2007). An Integrated Maritime Policy for the European Union. COM(2007) 575 final.

European Commission (2008). The European Union and the Arctic Region. COM(2008) 763 final.

European Parliament, Committee on Foreign Affairs (2010). Draft Report on a sustainable EU policy for the High North (2009(2214(INI)). Available online at: http://www.europarl.europa.eu/oeil/FindByProcnum.do?lang=2&procnum=INI/2009/2214

High Representative and European Commission (2008). Climate change and international security. Joint paper to the European Council. S113/08. Available online at: http://www.consilium.europa.eu/uedocs/cms_data/docs/pressdata/en/reports/99387.pdf

Intergovernmental Panel on Climate Change, Core Writing Team, Pachauri, R.K and Reisinger, A. (eds.) (2007): Climate Change 2007: Synthesis Report. Contribution of Working Groups I, II and III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change . IPCC, Geneva, Switzerland.

Pintér, L., Swanson, D., Chenje, J. (eds.) (2007). GEO Resource Book: A training manual on integrated environmental assessment and reporting. United Nations Environment Programme, Institute for Sustainable Development. Available at: http://www.iisd.org/pdf/2007/geo_resource.pdf (viewed 7 October 2010)

Smeets, E., Weterings, R. (1999). Environmental indicators: typology and overview, Technical report No. 25, European Environment Agency, Copenhagen.

5.2 Arctic Footprint and Policy Assessment (and corresponding sections of Annex C)

Biodiversity

ACIA, (2005): Arctic climate impact assessment. Cambridge University Press, Available online at: http://www.acia.uaf.edu.

Arctic Monitoring and Assessment Program (AMAP) (2002): Arctic pollution 2002. Arctic Monitoring and Assessment Programme (AMAP), Oslo.

Arctic Monitoring and Assessment Program (AMAP) (2007): Arctic Oil and Gas 2007. Arctic Monitoring and Assessment Programme (AMAP), Oslo.

Arctic Monitoring and Assessment Program (AMAP) (2009): Arctic Pollution 2009. Arctic Monitoring and Assessment Programme (AMAP), Oslo.

Barry, T. (2009): *Biodiversity and the Arctic: CAFF's View* in The Circle 2009, 2:26-27. WWF International Arctic Programme.

CAFF (Conservation of Arctic Flora and Fauna) (2010): Arctic Biodiversity Trends 2010. Selected Indicators of Change. Conservation of Arctic Flora and Fauna (CAFF) International Secretariat, Akureyri, Iceland.

CAFF (Conservation of Arctic Flora and Fauna) (2001): Arctic Flora and Fauna: Status and Conservation. Edita, Helsinki.

Chapin, S.F. et al. (2005): Polar systems. In: Hassan, R. schools, R. Ash, N. (eds). *Ecosystems and Human Well-being: Current Status and Trends*. Island Press, Washington, DC.

Chapin, S.F. III (2009): *Resilience-building to Conserve a Rapidly Changing Future* in The Circle 2009, 2:14-15. WWF International Arctic Programme.

CITES, Convention on International Trade in Endangered Species of Wild Fauna and Flora, available at: http://www.cites.org/eng/disc/what.shtml (viewed 14 July 2010).

Convention on Biological Diversity, available at: www.cbd.int (viewed 14 July 2010).

Convention on Biological Diversity, Ecosystem Approach, available at: http://www.cbd.int/ecosystem/ (viewed 15 July 2010).

Convention on Migratory Species, Introduction to the Convention on Migratory Species, Online at http://www.cms.int/about/intro.htm (viewed 14 July 2010).

European Commission (2009): Directive 2009/147/EC of the European Parliament and the Council on the Conservation of Wild Birds, available at: http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2010:020:0007:0025:EN:PDF (viewed 14 July 2010).

European Environmental Agency (EEA) (2009): Progress Towards the European 2010 Biodiversity Target. EEA Report 4/2009. European Environment Agency, Copenhagen.

European Commission, EU Biodiversity Policy Development, available at: http://ec.europa.eu/environment/nature/biodiversity/policy/index_en.htm (viewed 14 July 2010).

European Commission, EU Nature Legislation, available at: http://ec.europa.eu/environment/nature/legislation/index_en.htm (viewed 14 July 2010).

European Commission (2010): 4 Final. Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee, and the Committee of the Regions. Options for an EU vision and targets for biodiversity beyond 2010, COM (2010) 4, available at: http://ec.europa.eu/environment/nature/biodiversity/policy/pdf/communication_2010_0004.pdf (viewed 14 July 2010).

European Commission, Global Biodiversity, available at: http://ec.europa.eu/environment/biodiversity/international/index_en.htm (viewed 14 July 2010).

European Commission, Halting the Loss of Biodiversity 2010 – and Beyond. (2006): SEC (2006) 621, available at: http://ec.europa.eu/environment/nature/biodiversity/comm2006/pdf/sec_2006_621.pdf (viewed 14 July 2010).

European Commission. The European Community and Trade in Wild Flora and Fauna, available at: http://ec.europa.eu/environment/cites/home_en.htm (viewed 14.07.10).

European Commission: Environment (2010): Natura 2000 network, available at: http://ec.europa.eu/environment/nature/natura2000/index_en.htm (viewed 29 July 2010).

European Council (1982): Council Decision of 24 June 1982 on the Conclusion of the Convention on the Conservation of Migratory Species of Wild Animals, 82/461/EEC.

European Council (2010): EUCO 7/11, available at: http://www.consilium.europa.eu/ueDocs/cms_Data/docs/pressData/en/ec/113591.pdf (viewed 14 July 2010).

European Council (1982): Council Decision 82/461/EEC of 24 June 1982 on the conclusion of the Convention on the conservation of migratory species of wild animals, available at: http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:31982D0461:EN:HTML (viewed 14 July 2010)

European Council (2009): European Council Directive 2009/147/EC of the European Parliament and of the Council of 30 November 2009 on the conservation of wild birds, available at: http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2010:020:0007:0025:EN: PDF (viewed 14 July 2010).

European Council (1992): European Council Directive 92/43/EEC of 21 May 1992 on the Conservation of Natural Habitats of Wild Fauna and Flora, available at: http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:31992L0043:EN:HTML (viewed 14 July 2010)

Fagre, D.B. (2009): *Thresholds of Climate Change in Arctic Ecosystems* in The Circle 2009, 2:10-11. WWF International Arctic Programme.

Geitz, M. (2009): *Arctic Conservation – Where Do We Go From Here and How Fast Do We Get There?* in The Circle 2009, 2:22-25. WWF International Arctic Programme.

Hoel, A. H., von Quilfeldt.Cecilie H., and Olsen, E. (2009): Norway and Integrated Ocean Management - the Case of the Barents Sea in *Best Practices in Ecosystem-Based Ocean Management in the Arctic*. Norsk Polarinstitutt Rapportserie 129, Norsk Polarinstitutt, Tromso, pp. 43-52.

Intergovernmental Science Policy Platform on Biodiversity and Ecosystem Services (IPBES), available at: http://www.ipbes.net/home/60-breakthrough-in-international-year-of-biodiversity-as-governments-give-green-light-to-new-gold-standard-science-policy-body.html (viewed 2 September 2010)

Koivurova, T. and Molenaar, E.J. (2009): International Governance of the Marine Arctic. Overview and Gap Analysis. WWF International Arctic Programme, Oslo.

McGlade, J. (2009): *The European Environment Agency and the Arctic* in The Circle 2009, 2:27-28. WWF International Arctic Programme.

McLennan, D. (2009): *Protecting Arctic Biodiversity in a Rapidly Changing* W*orld – Issues for the Canadian Arctic* in The Circle 2009, 2:22-25. WWF International Arctic Programme.

Millennium Ecosystem Assessment (2005): Ecosystems and Human Well-being. Biodiversity Synthesis. World Resources Institute, Washington, DC.

Nuttall, M. (2009): *Conservation in an Age of Urgency* in The Circle 2009, 2:8-10. WWF International Arctic Programme.

Ramsar Convention on Wetlands, The Ramsar Convention and its Mission, available at: http://www.ramsar.org/cda/en/ramsar-about-mission/main/ramsar/1-36-53_4000_0__ (viewed 14 July 2010)

Sakrar, S. (2009): *Climate Change and the Prospects for Biodiversity Conservation in the Arctic* in: The Circle 2009, 2:12-13. WWF International Arctic Programme.The Circle (2009): The Future of Arctic Conservation. 2009, 2. WWF International Arctic Programme.

Turi, E.I. (2009): *Resilience in Reindeer Husbandry* in The Circle 2009, 2:18-19. WWF International Arctic Programme.

Chemicals and transboundary pollution

Albemarle (2009): Albemarle announces phase-out of Decabrom. Press release 17 December 2009. Available at: http://www.albemarle.com/News_and_events/index.asp?news=text&releaseID=1367378 (viewed15 July 2010).

Arctic Council (2005): Arctic Climate Impact Assessment (ACIA). Available at: http://www.acia.uaf.edu/pages/scientific.html (viewed 28 September 2010).

Arctic Monitoring and Assessment Program (AMAP) (1997): Arctic pollution issues. A state of the Arctic environment report. Oslo.

Arctic Monitoring and Assessment Program (AMAP) (2002): Persistent Organic Pollutants in the Arctic. Oslo.

Arctic Monitoring and Assessment Program (AMAP) (2004): AMAP Assessment 2002: Persistent organic pollutants in the Arctic. Oslo.

Arctic Monitoring and Assessment Program (AMAP) (2005): AMAP Assessment 2002: Heavy metals in the Arctic. Oslo.

Arctic Monitoring and Assessment Program (AMAP) (2006): AMAP Assessment 2006: Acidifying pollutants, Arctic haze, and acidification in the Arctic. Oslo.

Arctic Monitoring and Assessment Program (AMAP) (2009): Arctic pollution 2009. Oslo.

Arctic Monitoring and Assessment Program (AMAP) /United Nations Environment Programme Chemicals Branch (2008): Technical background report to the global atmospheric mercury assessment.

Arctic Monitoring and Assessment Program (AMAP) (2010): Minutes of the 23rd AMAP WG Meeting. AMAP Report 2010:2. Available at: www.amap.no. (viewed 8 November 2010).

Breivik, K., Alcock, R., Li, Y.F., Bailey, R.E., Fielder, H. & Pacyna, J.M. (2004): *Primary sources of selected POPs: regional and global scale emission inventories* in Environmental Pollution, 128:3-16.

Butt, C.M. Berger, U., Bossi, R., & Tomy, G.T. (2010): *Levels and trends of poly and perfluorinated compounds in the Arctic environment* in Science of the Total Environment, 408:2936-2965.

Chemtura (2009): Chemtura Corporation announces phase-out of DecaBDE. Press release 17 December 2009. Available at: http://phx.corporate-ir.net/phoenix.zhtml?c=68079&p=irol-newsArticle&ID=1367410&highlight= (viewed 15 July 2010).

Convention on Long-range Transboundary Air Pollution (1998): Protocol on heavy metals. Available at: http://www.unece.org/env/lrtap/hm_h1.htm (viewed 15 July 2010).

Convention on Longrange Transboundary Air Pollution (1979): Available at: http://www.unece.org/env/lrtap/TaskForce/popsxg/welcome.html. (viewed 15 July 2010).

Cox, P. & Efthymiou, P. (2003): *Directive 2003/11/EC of the European Parliament and of the Council of February 6, 2003 amending for the 24th time Council Directive 76/669/EEC relating to restrictions on the marketing and use of certain dangerous substances and preparations (pentabromodiphenyl ether, octabromodephenyl ether)* in Official Journal of the European Union 2003, 42:46-6.

de Wit, C.A., Herzke, D., & Vorkamp, K. (2010): *Brominated flame retardants in the Arctic – trends and new candidates* in Science of the Total Environment, 408:2885-2918.

van der Gon, H.D., van het Bolscher, M., Visschedijk, A., & Zandveld, P. (2007): *Emissions of persistent organic pollutants and eight candidate POPs from UNECE-Europe in 2000, 2010 and 2020 and the emission reduction resulting from the implementation of the UNECE POP protocol* in Atmospheric Environment, 41:9245-9261.

Durhaime, G., Lemelin, A., Didyk, V., Goldsmith, O., Winther, G., Caron, A., Bernard, N. & Godmaire, A. (2004): Economic Systems. In Einarsson, Niels et al. Arctic Human Development Report. Akureyri, Stefansson Arctic Institute, pp. 69–84.

DW-World (2007): Despite climate concerns, Germany plans coal power plants. Available at: http://www.dw-world.de/dw/article/0,,2396828,00.html (viewed 1 September 2010).

Europa (2008): Questions and answers on the EU mercury strategy. Press release 22 December 2008. Available at: http://europa.eu/rapid/pressReleasesAction.do?reference=MEMO/08/808&format=HTML&aged=0&language=EN&guiLanguage=en (viewed 15 September 2010).

EUBusiness (2010): EU seeks to end coal subsidies by 2014. Available at: http://www.eubusiness.com/news-eu/energy-coal.5mh/ (viewed 1 September 2010).

European Commission (2002): EUR 20402 EN-European Union risk assessment report Bis(pentabromophenyl) ether. Volume 17. Joint Research Center.

European Commission (2008): Questions and answers on the EU mercury strategy. MEMO/08/808. Available at: http://europa.eu/rapid/pressReleasesAction.do?reference=MEMO/08/808&format=HTML&aged=0&language=EN&guiLanguage=en (viewed 15 July 2010).

European Commission: Environment (2010): Mercury. Available at: http://ec.europa.eu/environment/chemicals/mercury/index.htm. (viewed 15 July 2010).

European Commission: Environment (2010): REACH. Available at: http://ec.europa.eu/environment/chemicals/reach/reach_intro.htm. (viewed 15 July 2010).

European Court of Justice (2008): Case C-14/06.

European Environment Agency – EEA (2004): Arctic environment: European perspectives. Why should Europe care? Copenhagen.

European Environment Agency (EEA) (2009): European Community emission inventory report 1990–2007 under the UNECE Convention on Long-range Transboundary Air Pollution (LRTAP). No. 8/2009. Available at: http://www.eea.europa.eu/publications/lrtap-emission-inventory-report-1990-2007/at_download/file (viewed 28 June 2010).

European Union @ United Nations – EU@UN (2005): EU and China partnership on climate change. Press release, 2 September 2005. Ref. EC05-292EN. Available at: http://www.europa-eu-un.org/articles/en/article_5000_en.htm (viewed 20 September 2010).

Gusev, A.et al. (2007): EMEP Status Report 3/2007. Persistent organic pollutants in the environment.

Hess, G. (2009): *Industry to phase out decaBDE* in Chemical Engineering News. Available at: http://pubs.acs.org/cen/news/87/i51/8751notw12.html (viewed 15 July 2010).

Johansson. A.K., Sellström, U., Lindberg, P., Bignert, A. & de Wit, C.A. (2010): *Temporal trends of polybrominated dephenyl ethers and hexabromocyclododecane in Swedish peregrine falcon (Falco peregrinus peregrinus) eggs* in Environment International (forthcoming, accepted).

Introduction to the Convention on Migratory Species, Convention on Migratory Species. Available at: http://www.cms.int/about/intro.htm (viewed 14 July 2010).

Kortenkamp, A., Backhaus, T. and Faust, M. (2009): State of the art report on mixture toxicity. Final report, Executive summary. Available at: http://ec.europa.eu/environment/chemicals/pdf/report_Mixture%20toxicity.pdf (viewed 15 July 2010).

Organisation for Economic Co-operation and Development – OECD (2009): Input-Output tables (edition 2009) 1995–2005. Available at: http:/www.oecd.org/sti/inputoutput/ (viewed 15 September 2010).

Organisation for Economic Co-operation and Development – OECD (2006): STAN bilateral trade data (2006 edition). Available at: http://www.oecd.org/sti/btd (viewed 15 September 2010).

Resolution of cooperation between the Secretariats of the Convention on Biological Diversity and the Conservation of Arctic Flora and Fauna working Group (2009): Available at: http://arcticcouncil.org/filearchive/Memorandum%20of%20Cooperation%20between%20CAFF%20and%20the%20CBD.pdf. (viewed 14 September 2010).

Selin, N.E. (2009): *Global biogeochemical cycling of mercury: A review* in Annual Review of Environmental Resources, 34:43-63.

Schultz, S. (2010): Green Visions: Merkel's master plan for a German energy revolution. Spiegel Online, 9 September 2010. Available at: http://www.spiegel.de/international/germany/0,1518,716221-3,00.html (viewed 15 September 2010).

Shindell, D., Chin, M., Dentener, F., Doherty, R.M., Faluvegi, G., Fiore, A.M., Hess, P., Koch, D.M., MacKenzie, I.A., Sanderson, M.G., Schultz, M.G., Schulz, M., Stevenson, D.S., Teich, H., Textor, C., Wild, O., Bergmann, D.J., Bey, I., Bian, H., Cuvelier, C., Duncan, B.N., Folberth, G., Horowitz, L.W., Jonson, J., Kaminski, J.W., Marmer, E., Park, R., Pringle, K.J., Schroeder, S., Szopa, S., Takemura, T., Zeng, G., Keating, T.J., & Zuber, A. (2008): *A multi-model assessment of pollution transport to the Arctic* in Atmospheric Chemistry and Physics, 8:5353-5372.

Stockholm Convention on Persistent Organic Pollutants (2010): Adoption of amendments to Annex A, B, and C. Ref C.N. 524.2009.TREATIES-4. Available at: http://chm.pops.int/Convention/tabid/54/language/en-US/Default.aspx#convtext (viewed 15 September 2010).

Stockholm Convention on Persistent Organic Pollutants (2010): Status of ratification. Available at: http://chm.pops.int/Countries/StatusofRatification/tabid/252/language/en-US/Default.aspx (viewed 15 September 2010).

Stockholm Convention on Persistent Organic Pollutants (2001): Preamble. Available at: http://chm.pops.int/Convention/tabid/54/language/en-US/Default.aspx#convtext (viewed 15 September 2010).

Sundseth, K., Pacyna, J.M., Pacyna, E.G., Munthe, J., Mohammed, B., & Astrom, S. (2010): *Economic benefits from decreased mercury emissions: Projections for 2020* in Journal of Cleaner Production 18, 4:386-394.

Travnikov, O. (2005): Contribution of the intercontinental atmospheric transport to mercury pollution in the Northern Hemisphere. Atmospheric Environment, 39:7541–7548.

United Nations Economic Commission for Europe (1979): Convention on Long Range Transboundary Air Pollution. Available at: http://www.unece.org/env/lrtap/lrtap_h1.htm (viewed 28 September 2010).

United Nations Environment Programme – UNEP (2010): Mercury Programme. Available at: http://www.unep.org/hazardoussubstances/Mercury/tabid/434/language/en-US/Default.aspx (viewed 14 September 2010).

United Nations Environment Programme – UNEP (2009): Assessment of excess mercury in Asia. Available at: http://hqweb.unep.org/hazardoussubstances/LinkClick.aspx?fileticket=h2jiw-CKCA0%3d&tabid=3593&language=en-US (viewed 1 September 2010).

United Nations Environment Programme – UNEP (2001): Final act of the Conference of Plenipotentiaries on the Stockholm Convention on Persistent Organic Pollutants. Geneva, Switzerland.

United Nations Environment Programme – UNEP (2002): Global mercury assessment. UNEP Chemicals. Geneva, Switzerland.

United Nations Environment Programme – UNEP (2008): Global atmospheric mercury assessment: Sources, emissions and eransport. UNEP Chemicals. Geneva, Switzerland.

United Nations Environment Programme – UNEP. UNEP GC decision 25/5 III Chemicals management, including mercury. Available at: http://www.chem.unep.ch/mercury/GC25/GC25Report_English_25_5.pdf (viewed 15 September 2010).

United States Geological Survey – USGS (2010): Mercury-emissions from china. Available at: http://energy.er.usgs.gov/health_environment/mercury/mercury_china_emissions.html (viewed 1 September 2010).

Climate change

Arctic Monitoring and Assessment Program (AMAP) United Nations Environment Programme Chemicals Branch (2008): Technical background report to the global atmospheric mercury assessment.

Arctic Monitoring and Assessment Programme (2009): Update on selected climate issues of concern: observations, short-lived climate forcers, Arctic carbon cycle and predictive capability. Available at: http://amap.no/documents/index.cfm?action=getfile&dirsub=&filename=Climate%5FUpdate%5F2009.pdf&sort=default (viewed 27 September 2010).

Barry, J., Edmunds, P.J., Gates, R.D., Hutchins, D.A., Klinger, T. & Sewell, M.A. (2010): *The effect of ocean acidification on calcifying organisms in marine ecosystems: An organism to ecosystem perspective* in Annual Review of Ecology, Evolution, and Systematics, 41.

Baum, E. (2010): Current domestic/international programs on ozone precursors and black carbon. US Environmental Protection Agency, Clean Air Task Force. Available online: *http://www.catf.us/resources/presentations/files/20100303-Current_Domestic-International_Control_Programs_on_Ozone_Precursors_and_Black_Carbon.pdf (viewed 9 September 2010).*

Carr, M. (2010): Rhodia says emissions credits it gets for nitrous oxide are 'not phantom'. Bloomberg, 18 October 2010. Available at: http://www.bloomberg.com/news/2010-10-17/rhodia-says-emissions-credits-it-gets-for-nitrous-oxide-are-not-phantom-.html (viewed 19 October 2010).

Chen, W.-T., Lee, Y.H., Adams, P.J., Nenes, A. & Seinfeld, J.H. (2010): Will *black carbon mitigation dampen aerosol indirect forcing?* in Geophysical Research Letters, 37, L09801, doi:10.1029/2010GL042886.

DAMOCLES (2009): Declaration from the DAMOCLES symposium in Brussels 2009. Available at: http://www.damocles-eu.org/research/The_scientists_attending_the_symposium_have_worked_out_a_declaration_summarizing_the_key_findings_from_the_project_as_well_as_future_projections_and_scenarios.shtml (viewed 26 July 2010).

DAMOCLES (2010): Arctic sea ice does not recover. Research, 24 June 2010. Available at: http://www.damocles-eu.org/research/Sea_ice_in_the_Arctic_does_not_recover.shtml (viewed 26 July 2010).

Durhaime, G., Lemelin, A., Didyk, V., Goldsmith, O., Winther, G., Caron, A., Bernard, N. & Godmaire, A. (2004): Economic Systems. In Einarsson, Niels et al. Arctic Human Development Report. Akureyri, Stefansson Arctic Institute, pp. 69–84.

DW-World (2007): Despite climate concerns, Germany plans coal power plants. Available at: http://www.dw-world.de/dw/article/0,,2396828,00.html (viewed 1 September 2010).

ENDS (2010): Brussels seeks to end coal subsidies by 2014. Available at: http://www.eceee.org/news/news_2010/2010-07-20/ (viewed 28 September 2010).

EurActiv (2010): Black carbon's global warming role 'still unproven'. Available online: http://www.euractiv.com/en/climate-environment/experts-call-action-black-carbon-news-495488 (viewed 12 September 2010).

Europa (2009): Press release: Emissions trading: EU ETS emissions fall 3 % in 2008. Available at: http://europa.eu/rapid/pressReleasesAction.do?reference=IP/09/794&format=HTML&aged=0&language=EN&guiLanguage=en (viewed 15 July 2010).

Europa (2008): Press release: Questions and answers on the revised EU Emissions Trading System. Available at: http://europa.eu/rapid/pressReleasesAction.do?reference=MEMO/08/796&format=HTML&aged=0&language=EN&guiLanguage=en (viewed 15 July 2010).

European Commission (2001): The Clean Air for Europe (CAFE) Programme:Towards a Thematic Strategy for Air Quality. COM(2001) 245.

European Commission (2008): Communication from the Commission to the European Parliament and the Council: The European Union and the Arctic region. COM(2008) 763.

European Commission (2009a): Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions. Stepping up international climate finance: A European blueprint for the Copenhagen deal. COM(2009)475.

European Commission (2009b): European Research Framework Programme – Research on Climate Change. Directorate-General for Research, Brussels. Available at: http://ec.europa.eu/research/environment/pdf/cop-15.pdf (viewed 8 December 2010).

European Commission (2010a): Commission staff working document accompanying the communication from the Commission to the European Parliament, the Council, the

European Economic and Social Committee and the Committee of the Regions: Analysis of options to move beyond 20% greenhouse gas emission reductions and assessing the risk of carbon leakage. Background information and analysis. SEC(2010) 650.

European Commission (2010b): Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions: Analysis of options to move beyond 20% greenhouse gas emission reductions and assessing the risk of carbon leakage. COM(2010)265.

European Commission: Environment (2010a): EU Emissions Trading System. Available at: http://ec.europa.eu/environment/climat/emission/ets_compliance2.htm (viewed 15 July 2010).

European Commission: Environment (2010b): Effort Sharing Decision. Available at: http://ec.europa.eu/environment/climat/effort_sharing/index.htm (viewed 15 July 2010).

European Commission: Environment (2010c): Reducing CO2 emissions from light-duty vehicles. Available at: http://ec.europa.eu/environment/air/transport/co2/co2_home.htm (viewed 15 July 2010).

European Commission: Environment (2010d): The EU climate and energy package. Available at: http://ec.europa.eu/environment/climat/climate_action.htm (viewed 15 July 2010).

European Environmental Agency (EEA) (2010a): Annual European Union greenhouse gas inventory 1990–2008 and inventory report 2010, Submission to the UNFCCC Secretariat. Technical report No. 6/2010. Available at: http://www.eea.europa.eu/publications/european-union-greenhouse-gas-inventory-2010 (viewed 15 July 2010).

European Environmental Agency (EEA) (2010b): GHG trends and projections in the EU-27. Available at: http://www.eea.europa.eu/themes/climate/ghg-country-profiles/tp-report-country-profiles/eu-27-greenhouse-gas-profile-summary-1990-2020.pdf (viewed 15 July 2010).

European Environment Agency (EEA) (2010c): Questions and answers on key facts about Kyoto targets. Available at: http://www.eea.europa.eu/pressroom/newsreleases/questions-and-answers-on-key (viewed 15 July 2010).

European Environment Agency (EEA) (2010d): Why did greenhouse gas emissions fall in the EU in 2008? EEA analysis in brief. Available at: http://www.eea.europa.eu/pressroom/newsreleases/why-did-greenhouse-gas-emissions (viewed 15 July 2010).

European Parliament (2003): Establishing a scheme for greenhouse gas emission allowance trading within the Community and amending Council Directive 96/61/EC. Directive 2003/87/EC.

European Parliament and Council (2003): Directive on the promotion of the use of biofuels or other renewable fuels for transport. 2003/30/EC.

European Parliament and Council (2009): Directive amending Directive 98/70/EC as regards

the specification of petrol, diesel and gas-oil and introducing a mechanism to monitor and reduce greenhouse gas emissions and amending Council Directive 1999/32/EC as regards the specification of fuel used by inland waterway vessels and repealing Directive 93/12/EEC. 2009/30/EC.

Hassol, S. (2005): Arctic Climate Impact Assessment, Executive Summary. Cambridge University Press, New York, available at: http://amap.no/workdocs/index.cfm?action=getfile&dirsub=%2FACIA%2Foverview&filename=ExecSummary.pdf&CFID=1017&CFTOKEN=5B233A4B-91AA-122B-DF10161D2CD5EDA9&sort=default (viewed 27 May 2010)

IEA – International Energy Agency (2007): World Energy Outlook 2007. Available online: http://www.iea.org/textbase/nppdf/free/2007/weo_2007.pdf (viewed 21 August 2010).

Intergovernmental Panel on Climate Change, Core Writing Team, Pachauri, R.K., Reisinger, A. (Eds.) (2007a): Climate Change 2007: Synthesis Report, Contribution of Working Groups I, II and III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change. Geneva, Switzerland. Available at: http://www.ipcc.ch/publications_and_data/publications_ipcc_fourth_assessment_report_synthesis_report.htm (viewed 15 July 2010).

Intergovernmental Panel on Climate Change, Parry, M.L., Canziani, O.F., Palutikof, J.P. van der Linden, P.J., Hanson, C.E. (eds) (2007b): Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge University Press, Cambridge. Available at: http://www.ipcc.ch/publications_and_data/ar4/wg2/en/contents.html (viewed 15 July 2010).

Jacobson, M. Z. (2010): Short-*term effects of controlling fossil-fuel soot, biofuel soot and gases, and methane on climate, Arctic ice, and air pollution health*, in Journal of Geophysical Research, 115, D14209, doi:10.1029/2009JD013795.

Netherlands Environmental Assessment Agency (MNP) (2005): Carbon dioxide emissions of Top-20 countries in 2006 and ranking of their per capita. Available at: http://www.pbl.nl/images/Top20-CO2andGHG-countries-in2006-2005(GB)_tcm61-36276.xls (viewed 15 July 2010).

OSPAR (2010): Quality Status Report, Region I – Arctic Waters. Available at: http://qsr2010.ospar.org/en/ch12_01.html (viewed 7 December 2010).

Schultz, S. (2010): Green Visions: Merkel's master plan for a German energy revolution. Spiegel Online, 9 September 2010. Available at: http://www.spiegel.de/international/germany/0,1518,716221-3,00.html (viewed 15 September 2010).

Sher, D. & Sauer, A. (2009): The Montreal Protocol and its implications for climate change. Environmental and Energy Study Institute. Available at: http://www.eesi.org/100609_montreal_brief (viewed 15 July 2010).

Shindell, D., Chin, M., Dentener, F., Doherty, R.M., Faluvegi, G., Fiore, A.M., Hess, P., Koch, D.M., MacKenzie, I.A., Sanderson, M.G., Schultz, M.G., Schulz, M., Stevenson, D.S., Teich, H., Textor, C., Wild, O., Bergmann, D.J., Bey, I., Bian, H., Cuvelier, C., Duncan, B.N., Folberth, G., Horowitz, L.W., Jonson, J., Kaminski, J.W., Marmer, E., Park, R., Pringle, K.J., Schroeder, S., Szopa, S., Takemura, T., Zeng, G., Keating,

T.J., & Zuber, A. (2008): *A multi-model assessment of pollution transport to the Arctic* in Atmospheric Chemistry and Physics, 8:5353-5372.

United Nations Framework Convention on Climate Change. Kyoto Protocol. Available at: http://unfccc.int/kyoto_protocol/items/2830.php (viewed 15 July 2010).

United Nations Framework Convention on Climate Change. Kyoto Protocol Adaptation Fund. Available at: http://unfccc.int/cooperation_and_support/financial_mechanism/adaptation_fund/items/3659.php (viewed 15 July 2010).

United Nations Framework Convention on Climate Change. List of Annex I Parties to the Convention. Available at: http://unfccc.int/parties_and_observers/parties/annex_i/items/2774.php (viewed 15 July 2010).

United Nations Framework Convention on Climate Change. The share of proceeds from the clean development mechanism project activities for the Adaptation Fund. Available at: http://cdm.unfccc.int/Issuance/SOPByProjectsTable.html (viewed 15 July 2010).

United Nations Framework Convention on Climate Change (2009): Greenhouse gas inventory data – detailed data by Party. Available at: http://unfccc.int/di/DetailedByParty.do (viewed 28 September 2010).

US Congress. House. American Clean Energy and Security Act of 2009. H.R. 2454. 111th Congress, 15 May 2009.

US Congress. Senate. Clean Energy Jobs and American Power Act. S. 1733. 111th Congress, 30 September 2009.

Webster, V. (2009): Black carbon reduction: a short term means to combat climate change. Bellona. Available online: http://www.bellona.org/articles/articles_2009/black_carbon (viewed 9 September 2010).

Energy

Arctic Energy Agenda (2005): Shared by Norway, the Russian Federation, the United States, and the European Union. Kirkenes, 7 July 2005. Available at: http://www.regjeringen.no/upload/kilde/oed/prm/2005/0179/ddd/pdfv/252695-artic_energy_agenda_felleserklaering_kirkenes2.pdf (viewed 9 July 2010).

Arctic Monitoring and Assessment Programme (AMAP) (2008): Arctic Oil and Gas 2007. Oslo.

Árran (2007): Annual Report 2006 and Annual Work Plan 2007. Available at: http://www.arran.no/arsmelding-2006-og-arbeidsplan-2007-nordomraadenettverket.562840-70802.html (viewed 14 December 2010).

BarentsObserver.com (2010a): Norway announces drilling boom in Barents Sea. 23 June 2010. Available at: http://www.barentsobserver.com/norway-announces-drilling-boom-in-barents-sea.4796086.html (viewed 9 July 2010).

BarentsObserver.com (2010b): Norway stalls all deep-water drilling. 8 June 2010. Available at: http://barentsobserver.custompublish.com/norway-stalls-all-deep-water-drilling.4791064-16149.html (viewed 9 July 2010).

Bøhmer, N., Nikitin, A., Kudrik, I., Nilsen, T., McGovern, M.H., and Zolotkov, A. (2001): The Arctic Nuclear Challenge. The Bellona Foundation, Oslo. Available at: www.bellona.org/filearchive/fil_The_Arctic_Nuclear_Challenge.pdf (viewed 7 December 2010).

Bogoyavlenskiy, D. (2004): Arctic Demography. In: Einarsson, N., Larsen, J.N., Nilsson, A., & Young, O.R. (eds.)Arctic Human Development Report. Akureyri, Stefansson Arctic Institute, pp. 69–84.

CBC News (2010): Arctic oil spill cleanup research cancelled. 19 May 2010. Available at: http://www.cbc.ca/canada/north/story/2010/05/19/arctic-oil-spill-research.html (viewed 19 October 2010).

Cleveland, C., O'Carroll, K. (2009): Policy options for Arctic environmental governance. Offshore Hydrocarbon Working Group, Arctic TRANSFORM. Available at: http://Arctic-transform.org/download/OffsEX.pdf (viewed 9 July 2010).

Conference of Parliamentarians of the Arctic Region (CPAR) (2004): Conference Statement, 5 September 2004. Available at: http://www.arcticparl.org/_res/site/File/static/conf6_statement.pdf (viewed 14 December 2010).

Conservation of Arctic Flora and Fauna (2001): Arctic flora and fauna: status and conservation. Arctic Council Program for the Conservation of Arctic Flora and Fauna, Helsinki, Finland.

Corrêa, I.C.S., Toldo Jr., E.E. and Toledo, F.A.L. (2009): *Seafloor geological impacts associated with drilling disturbance* in Deep Sea Research Part II: Topical Studies in Oceanography, 56(1-2):4-11.

Council conclusions of Arctic issues, 2985th Foreign Affairs Council meeting, Brussels, 8 December 2009, Available at: http://www.consilium.europa.eu/uedocs/cms_data/docs/pressdata/EN/foraff/111814.pdf.

Council of the European Union (1997): On the assessment of the effects of certain public and private projects on the environment. Directive 85/337/EEC (as amended by Directive 97/11/EC).

Durhaime, Gérard et al. (2004): Economic systems. In Einarsson, N., Larsen, J.N., Nilsson, A., & Young, O.R. (eds.) Arctic Human Development Report. Akureyri, Stefansson Arctic Institute, pp. 69–84.

Eickhout, B., et al. (2008): Local and global consequences of the EU renewable directive for biofuels: testing the sustainability criteria. Milieu en Natuur Planbureau Report 500143001/2008. Available at: http://www.mnp.nl/bibliotheek/rapporten/500143001.pdf (viewed 9 July 2010).

ENDS Europe Daily (2010a): RE Supplies 20% of Power Needs Last Year. 5 July 2010.

ENDS Europe Daily (2010b): Austria's RE plan 'unambitious,' says Minister. 2 July 2010.

ENDS Europe Daily (2010c): MEPs may block Fuel Quality plans over tar sands. 5 July 2010.

Euractiv (2010): EU plans to strengthen rules for offshore drilling. 15 July 2010. Available at: http://www.euractiv.com/en/climate-environment/eu-plans-strengthen-rules-offshore-drilling-news-496378 (viewed 15 September 2010).

Europa (2007): Summaries of legislation: Environmental inspections: minimum criteria. Available at: http://europa.eu/legislation_summaries/environment/general_provisions/l28080_en.htm (viewed 9 July 2010).

Europa (2009): Press release: Gas Coordination Group discusses the gas supply outlook and the emergency preparedness in the EU. 14 December 2009, IP/09/1917. Available at: http://europa.eu/rapid/pressReleasesAction.do?reference=IP/09/1917&format=HTML&aged=0&language=EN (viewed 9 July 2010).

Europe's Energy Portal (2010): Oil platforms: Commission convenes second safety talks with industry. Available online: http://www.energy.eu/DG-TREN-releases/IP-10-779_EN.pdf (viewed 14 September 2010).

European Commission (2001): Green Paper: Towards a European strategy for the security of energy supply. COM(2000) 769.

European Commission (2006): Green Paper: A European strategy for sustainable, competitive and secure energy. COM(2006) 105.

European Commission (2008a): Communication from the Commission: Energy efficiency: delivering the 20% target. COM(2008) 772.

European Commission (2008b): Communication from the Commission to the European Parliament and the Council: The European Union and the Arctic region. COM(2008) 763.

European Commission (2008c): Proposal for a Directive of the European Parliament and of the Council on the indication by labelling and standard product information of the consumption of energy and other resources by energy-related products {SEC(2008) 2862} {SEC(2008) 2863}. COM(2008) 778.

European Commission (2009a): Communication from the Commission to the Council and the European Parliament: The renewable energy progress report: Commission report in accordance with Article 3 of Directive 2001/77/EC, Article 4(2) of Directive 2003/30/EC and on the implementation of the EU Biomass Action Plan, COM(2005)628. COM(2009) 192.

European Commission (2009b): Report from the Commission to the Council and the European Parliament, the European Economic and Social Committee and the Committee of the Regions: On the application and effectiveness of the Directive on Strategic Environmental Assessment (Directive 2001/42/EC). COM(2009) 469.

European Commission (2009c): Report from the Commission to the Council, The European Parliament, the European Economic and Social Committee and the Committee of the Regions: on the application and effectiveness of the EIA Directive (Directive 85/337/EEC, as amended by Directives 97/11/EC and 2003/35/EC). COM(2009) 378.

European Commission: Energy (2009): Market observatory, EU Crude oil imports. Available at: http://ec.europa.eu/energy/observatory/oil/import_export_en.htm (viewed 9 July 2010).

European Commission (2010): Communication from the Commission to the European Parliament and the Council: Facing the challenge of the safety of offshore oil and gas activities. COM(2010) 560.

European Commission (2010): Eurostat, Main tables, Energy. Available at: http://epp.eurostat.ec.europa.eu/portal/page/portal/energy/data/main_tables (viewed 9 July 2010).

European Energy Forum (2000): EU-Russia Energy Partnership. Available at: http://www.europeanenergyforum.eu/archives/european-union/eu-major-international-relations/eu-russia-energy-partnership (viewed 9 July 2010).

European Energy Forum (2006): Russia and EU agree to join efforts to promote energy efficiency. Available at: http://www.europeanenergyforum.eu/archives/european-union/eu-major-international-relations/eu-russia-energy-partnership/russia-and-the-eu-agree-to-join-efforts-to-promote-energy-efficiency (viewed 9 July 2010).

European Environment Agency (EEA) (2004): Arctic environment: European perspectives. Why should Europe care? Copenhagen.

European Parliament (2002): On the energy performance of buildings. Directive 2002/91/EC.

European Parliament (2008): Resolution on the review of Recommendation 2001/331/EC providing for minimum criteria for environmental inspections in the Member States. P6 TA(2008) 568.

European Parliament (2004): On the promotion of cogeneration based on a useful heat demand in the internal energy market and amending Directive 92/42/EEC. Directive 2004/8/EC.

European Parliament (2010): Resolution of 17 June 2010 on the conclusions of the EU/Russia Summit (31 May – 1 June 2010). Available at: http://www.europarl.europa.eu/sides/getDoc.do?type=TA&reference=P7-TA-2010-0234&language=EN&ring=B7-2010-0297 (viewed 7 December 2010).

European Parliament and Council (2001): Directive on the assessment of the effects of certain plans and programmes on the environment. 2001/42/EC.

European Union External Action (2010): Available online: http://eeas.europa.eu/russia/index_en.htm. (viewed 14 September 2010).

Eurostat (2010): Main tables, Energy. Available at: http://epp.eurostat.ec.europa.eu/portal/page/portal/energy/data/main_tables (viewed 28 September 2010).

Fissel, D., Chave, R., Buermans, J. (2009): Real-time measurement of sea ice thickness, keel sizes and distributions and ice velocities using upward looking sonar instruments. Marine Technology for Our Future: Global and Local Challenges:1-6. Biloxi, MS, USA. 26-29 October 2009.

Green Energy News (2010): BP plans new offshore drilling exploit in Arctic. 25 June 2010. Available at: http://www.renewable-energy-news.info/bp-plans-new-offshore-drilling-exploit-in-Arctic/ (viewed 9 July 2010).

Hasle, J.R., Kjellén, U., Haugerud, O. (2009): Decision on oil and gas exploration in an Arctic area: Case study from the Norwegian Barents Sea. Safety Science, 47(6):832-842.

Huntington, H. et al. (2007): Arctic Oil and Gas 2007. Arctic Monitoring and Assessment Programme. Available online: http://www.amap.no/oga/ (viewed 14 September 2010).

IHS (2009): EC, Norway energy dialogue focuses on markets, security, climate change. 28 May 2009. Available at: http://energy.ihs.com/News/markets/2009/eu-en-norway-energy-dialog-052809.htm (viewed 9 July 2010).

International Whaling Commission, Scientific Committee (IWC-SC) (2004): Annex K: Report of the Standing Working Group on Environmental Concerns. Submitted at the IWC56 meeting, July 2004. Available at: www.acousticecology.org/docs/IWC56-noisesymposium.doc (viewed 20 October 2010).

James, T. (2010): Drilling for oil and gas in the Arctic Sea. Institution of Engineering and Technology, 2 July 2010. Available at: http://kn.theiet.org/magazine/issues/1010/taming-the-ice-1010.cfm (viewed October 19 2010).

Jeníček, V. and Krepl, V. (2009): *Energy and the European Union* in Agricultural Economics Czech, 55(1):1-11.

Joling, D. (2010): Drilling critics warn of spill in Arctic Ocean. ABC News, 16 May 2010. Available at: http://abcnews.go.com/Business/wireStory?id=10661183 (viewed 9 July 2010).

Keener, C., Allan, R. (2009): A Seasonal Solution for Offshore Drilling in an Ice Environment. SPE/IADC Drilling Conference and Exhibition, Amsterdam, 17-19 March 2009.

Koivurova, T. and Hossain, K. (2008): Background paper: Offshore hydrocarbon: Current policy context in the marine Arctic. Arctic TRANSFORM. Available at: http://Arctic-transform.org/download/OffHydBP.pdf (viewed 5 July 2010).

Kovačovská, L. (2007): *European Union's energy (in)security – Dependence on Russia* in Defence and Strategy, 2.

McCarthy, S. (2010): Norway seeks lessons from BP spill, but won't halt drilling. Globe and Mail, 14 July 2010. Available at: http://www.theglobeandmail.com/report-on-business/industry-news/energy-and-resources/norway-seeks-lessons-from-bp-spill-but-wont-halt-drilling/article1640441/ (viewed 15 September 2010).

Nations, C., Blackwell, S., Kim, K., Thode, Thode, A., Greene, C., Macrander, A.M., McDonald T. (2009): Effects of seismic exploration in the Beaufort Sea on bowhead whale call distributions. Journal of the Acoustical Society of America, 126(4):2230-2230.

National Academy of Sciences (2003): Cumulative environmental effects of oil and gas activities on Alaska's North Slope, report in brief. Available at: http://*dels-old.nas.edu/dels/rpt_briefs/north_slope_final.pdf (viewed 9 July 2010).*

Norwegian Ministry of Foreign Affairs (2009): New Building Blocks in the North. The next step in the Government's High North Strategy. Available at: http://www.regjeringen.no/upload/UD/Vedlegg/Nordområdene/new_building_blocks_in_the_north.pdf (viewed 14 December 2010).

Nystø, S. (2010): Governance in the Arctic - Sharing Best Practises - Indigenous Peoples, Address at the 1017th Wilton Park Conference "The High North: Challenges and Opportunities", 18-20 February, 2010 in Stayning, United Kingdom. Available at: http://img7.custompublish.com/getfile.php/1210750.927.ractxcyefx/WPC+190210+Final.pdf?return=arran.custompublish.com (viewed 14 December 2010).

O'Halloran, B. (2010): EU to discuss toughening safety rules for offshore oil drilling. Irish Times, 25 June 2010. Available at: http://www.irishtimes.com/newspaper/finance/2010/0625/1224273269837.html (viewed 9 July 2010).

Organisation for Economic Co-operation and Development – OECD (2009): Input-Output tables (edition 2009) 1995–2005. Available at: http:/www.oecd.org/sti/inputoutput/ (viewed 15 September 2010).

Organisation for Economic Co-operation and Development – OECD (2006): STAN bilateral trade data (2006 edition). Available at: http://www.oecd.org/sti/btd (viewed 15 September 2010).

OSPAR (2004): OPSAR guidelines for monitoring the environmental impact of offshore oil and gas activities. Agreement 2004-11. Reykjavik, Iceland.

Pembina Institute (2008): Arctic energy solutions: renewable energy. Available at: http://Arctic.pembina.org/renewable-energy (viewed 9 July 2010).

Rankin, S., Evans, W. (1998): Effect of low-frequency seismic exploration signals on the cetaceans of the Gulf of Mexico. Journal of the Acoustical Society of America, 103(5):2908-2908.

Schmidt, C. (2010): Cold Hard Cache: The Arctic Drilling Controversy. Environmental Health Perspectives, 118:394-397. Available at: http://ehp03.niehs.nih.gov/article/fetchArticle.action?articleURI=info%3Adoi%2F10.1289%2Fehp.118-a394#r3 (viewed 19 October 2010).

Siku News (2010): Oil spill could have Arctic consequences. 11 June 2010. Available at: http://www.sikunews.com/News/International/7673 (viewed 9 July 2010).

Spencer, P., Masterson, D., Barker, A., Timco, G., Wright, B. (2007): Can Ice Barriers around Oil and Gas Drilling Structures Reduce System Cost? National Research Council Canada.

Timco, G., Weeks, W. (2010): A review of the engineering properties of sea ice. Cold Regions Science and Technology, 60(2):107-129.

UNECE (2003): Protocol on Strategic Environmental Assessment to the Convention on Environmental Impact Assessment in a Transboundary Context. Available at: http://www.unece.org/env/eia/documents/legaltexts/protocolenglish.pdf (viewed 9 July 2010).

UNEP/GRID-Arendal Maps and Graphics Library. (2007): Available at: http://maps.grida.no/go/graphic/fossil-fuel-resources-and-oil-and-gas-production-in-the-arctic (viewed September 03, 2010).

US Energy Information Administration (2006): International total primary energy production. Available at: http://www.eia.doe.gov/emeu/international/energyproduction.html (viewed 9 July 2010).

US Fish and Wildlife Service (US FWS) (2008): Arctic National Wildlife Refuge: Seismic Trails. Available at: http://arctic.fws.gov/seismic.htm (viewed 20 October 2010).

US Geological Survey (2008): Circum-Arctic resource appraisal: Estimates of undiscovered oil and gas north of the Arctic Circle. Available at: http://energy.usgs.gov/Arctic/ (viewed 9 July 2010).

Webb, T. (2010): Greenland wants $2bn bond from oil firms keen to drill in its Arctic waters. The Guardian, 12 November 2010. Available at: http://www.guardian.co.uk/business/2010/nov/12/greenland-oil-drilling-bond (viewed 9 December 2010).

Wilbert, M., Thomson, J., Culver, N. (2008): Analysis of habitat fragmentation from oil and gas development and its impact on wildlife. The Wilderness Society. Available at: wilderness.org/files/Oil-Gas-Fragmentation-Scoping-Brief.pdf (viewed 20 October 2010).

Williams, D. et al. (2009): Environmental impact statement for offshore drilling. Licences PL032 and PL033, The Falkland Islands on behalf of Rockhopper Exploration PLC. RPS Energy.

Fisheries

Arctic Portal (2010): Maps. Available at: http://portal.inter-map.com/#mapID=26&groupID=&z=1.0&up=0.0&left=0.0 (viewed 23 September 2010).

Burnett, M., Dronova, N., Esmark, M., Nelson, S., Rønning, A. & Spiridonov, V. (2008): Illegal fishing in Arctic waters. WWF International Arctic Programme, Oslo.

Council of the European Union (2002): EU Council Regulation (EC) No 2371/2002. On the conservation and sustainable exploitation of fisheries resources under the Common Fisheries Policy. Available at: http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2002:358:0059:0080:EN:PDF (viewed 7 June 2010).

Council of the European Union (2008): EU Council Regulation (EC) No 1005/2008. Establishing a Community system to prevent, deter and eliminate illegal, unreported and unregulated fishing, amending Regulations (EEC) No 2847/93, (EC) No 1936/2001 and (EC) No 601/2004 and repealing Regulations (EC) No 1093/94 and (EC) No 1447/1999. Available at: http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2008:286:0001:0032:EN:PDF (viewed 7 June 2010).

Ecolex (1993): Agreement to Promote Compliance with International Conservation and Management Measures by Fishing Vessels on the High Seas Available at: http://www.ecolex.org/ecolex/ledge/view/RecordDetails;document_Agreement%20to%20Promote%20Compliance%20with%20International%20Conservation%20and%20Management%20Measures%20by%20Fishing%20Vessels%20on%20the%20High%20Seas.html?DIDPFDSIjsessionid=4EE7472575E98A46A59F11CE28451F0B?id=TRE-001183&index=treaties (viewed 2 June 2010).

European Commission. EU import conditions for seafood and other fishery products. Available at: ec.europa.eu/food/international/trade/im_cond_fish_en.pdf (viewed 7 June 2010).

European Commission (2008): Amending Annex II to Regulation (EC) No 2076/2005 as regards imports of fishery products from Fiji. (EC) No 439/2008.

European Commission (2008): The European Union and the Arctic Region. COM(2008) 763.

European Commission (2009): The Common Fisheries Policy: A user's guide. Luxembourg. Available at: http://ec.europa.eu/fisheries/publications/other_publications_en.htm#cfp (viewed 3 June 2010).

European Commission (2010a): EU-Russia common spaces, progress report 2009. Available at: *ec.europa.eu/external.../russia/.../commonspaces_prog_report_2009_en.pdf (viewed 7 June 2010).*

European Commission (2010b): Marine Strategy Framework Directive leaflet. Available at: http://ec.europa.eu/environment/water/marine/pdf/leaflet091117.pdf (viewed 7 June 2010).

European Commission Fisheries (2010): Fisheries agreements with countries outside the EU. Available at: http://ec.europa.eu/fisheries/cfp/international/agreements/index_en.htm. Accessed 23 September 2010.

FAO (1995). FAO code of conduct for responsible fisheries (1995): Available at: http://www.fao.org/DOCREP/005/v9878e/v9878e00.htm#2 (viewed 1 June 2010).

FAO (2010a): FAO Major Fishing Areas. Fisheries and Aquaculture Department. Available at: http://www.fao.org/fishery/area/search/en (viewed 22 September 2010).

FAO (2010b): Global Capture Production 1950-2008. Available at: http://www.fao.org/fishery/statistics/global-capture-production/en (viewed 10 July 2010).

FAO (2010c): Implementation of the 1995 FAO Code of Conduct for Responsible Fisheries, Strategies. Available at: http://www.fao.org/fishery/ccrf/3/en (viewed 1 June 2010).

FAO Legal Office (2010): Agreement on Port State Measures to Prevent, Deter and Eliminate Illegal, Unreported and Unregulated Fishing. Available at: http://www.fao.org/Legal/treaties/037s-e.htm. Accessed 25 September 2010.

FishBase (2009): Gadus morhua, computer generated map. Available at: http://www.fishbase.org/Summary/speciesSummary.php?ID=69&genusname=Gadus &speciesname=morhua&lang=English# (viewed 7 June 2010).

Freitas, B., Delegran, L., Griffin, E., Miller, K.L. & Hirschfield, M. (2008): Too few fish: A regional assessment of the world's fisheries. Oceana. Available at: http://na.oceana.org/sites/default/files/reports/toofewfish41.pdf (viewed 3 June 2010).

Hosch, G. (2009): Analysis of the implementation and impact of the FAO Code of Conduct for Responsible Fisheries since 1995 in FAO Fisheries and Aquaculture Circular. No. 1038. Rome, FAO. Available at: ftp://ftp.fao.org/docrep/fao/011/i0604e/i0604e00.pdf (viewed 3 June 2010).

Memorandum of Understanding between the North East Atlantic Fisheries Commission and the OSPAR Commission (2008): 5 September 2008. Available at: www.ospar.org/html_documents/ospar/html/mou_neafc_ospar.pdf (viewed 16 September 2010).

Molenaar, E. and Corell, R. (2009): Arctic Transform: Arctic Fisheries. Available at: http://arctic-transform.org/download/FishBP.pdf (viewed 28 September 2010).

North East Atlantic Fisheries Commission – NEAFC (2007): Declaration on the interpretation and implementation of the convention on the future multilateral cooperation in North-

East Atlantic Fisheries. Office of the Commission. Available at: http://www.neafc.org/system/files/%252Fhome/neafc/drupal2_files/london-declarlation_and_new_convention.pdf (viewed 3 June 2010).

National Oceanic and Atmospheric Administration – NOAA (2009): Arctic fishery management in Alaska. National Marine Fisheries Service, Alaska Regional Office. Available at: http://www.fakr.noaa.gov/sustainablefisheries/arctic/ (viewed 16 September 2010).

Norwegian Ministry of Fisheries and Coastal Affairs (2010): No IUU fishing of cod in the Barents Sea in 2009. Available at: http://www.fisheries.no/management_control/recourse_management_control/Overfishing_of_cod_2008/ (viewed 23 September 2010).

Oceans North (2010): Arctic Fisheries Management Plan. Available at: http://www.oceansnorth.org/Arctic-fishery-management-plan (viewed 15 June 2010).

OSPAR Commission. Decisions, Recommendations and Other Agreements Applicable within the Framework of the OSPAR Convention. Available at: www.ospar.org/html_documents/ospar/html/ospar_list_of_decsrecs.pdf (viewed 28 September 2010).

OSPAR Commission (2009): Annual Report 2008/09. Available at: http://www.ospar.org/documents%5Cdbase%5Cpublications%5Cp00458_OSPAR%20Annual%20Report.pdf (viewed 28 September 2010).

Rudloff, B. (2010a): The Case of Fisheries. Paper presented at the GeoNor Stakeholder Seminar, The EU and the Arctic: Stocktaking and Interests. 27 May 2010.

Rudloff, B. (2010b): The EU as a fishing actor in the Arctic: Stocktaking of institutional involvement and existing conflicts. Working paper, German Institute for International and Security Affairs. Stiftung Wissenschaft und Politik, Berlin.

United Nations (2010): Oceans and the law of the sea. Available at: http://www.un.org/Depts/los/convention_agreements/convention_overview_fish_stocks.htm

UN Comtrade Database (2010): Available at http://data.un.org/Explorer.aspx?d=ComTrade (viewed 25 September 2010).

UN Review Conference on the Agreement for the Implementation of the Provisions of the United Nations Convention on the Law of the Sea of 10 December 1982 relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks. (2010): Compilation of the recommendations adopted at the Review Conference in 2006 and information on the extent to which the recommendations have been implemented by States and regional fisheries management organizations and arrangements. 24-28 May 2010. Available at: http://daccess-ods.un.org/access.nsf/Get?Open&DS=A/CONF.210/2010/INF/1&Lang=E (viewed 7 June 2010).

Forestry

ACIA, (2005): Arctic Climate Impact Assessment. Cambridge University Press, available at: http://www.acia.uaf.edu.

Arctic Centre (1998): Economic Structure of North-West Russia, available at: http://arcticcentre.ulapland.fi/barentsinfo/economic/04/yla_osa4.html (viewed 15 September 2010).

Barents Euro-Arctic Council (2010): Barents Forest Sector Task Force, available at: http://www.beac.st/?DeptID=8834 (viewed 8 December 2010).

Beurskens,L.W.M. & Hekkenberg, M. (2010): Renewable Energy Projections as Published in the National Renewable Energy Action Plans of the European Member States, available at: http://www.ecn.nl/publications/PdfFetch.aspx?nr=ECN-E--10-069 (viewed 15 September 2010).

Council of the European Union (1992): The Habitats Directive, 92/43/EEC on the conservation of natural habitats and of wild fauna and flora, 21 May 1992.

EU Parliament (2010): Press release: MEPs vote to cut illegal timber out of the EU market 07.07.2010, available at: http://www.europarl.europa.eu/news/expert/infopress_page/064-77921-186-07-28-911-20100706IPR77920-05-07-2010-2010-false/default_en.htm (viewed 14 July 2010).

Europa, European Union – External action: Norway, available at: http://ec.europa.eu/external_relations/norway/index_en.htm.

European Commission (2003): 251 final. Communication from the Commission to the Council and the European Parliament. Forest law enforcement, governance and trade (flegt) Proposal for an EU action plan.

European Commission (2005a): 628 final, Communication from the Commission, Biomass action plan, 7.12.2005.

European Commission (2005b): Natura 2000 in the Boreal region, available at: http://ec.europa.eu/environment/nature/info/pubs/docs/brochures/nat2000_boreal.pdf.

European Commission (2006): 302 final, Communication from the Commission to the Council and the European Parliament on an EU Forest Action Plan. 15.6.2006

European Commission (2008): 113 final, Communication from the Commission to the Council and the European Parliament on innovative and sustainable forest-based industries in the EU, 27.2.2008.

Lloyd, A.H., T.S. Rupp, C.L. Fastie, and A.M. Starfield, (2003): Patterns and dynamics of treeline 18 advance on the Seward Peninsula, Alaska in Journal of Geophysical Research, 107(8161).

Natural Resources Canada (2005): The State of Canada's Forests 2004-2005: The boreal forest. Canadian Forest Service, Headquarters, Planning, Operations and Information Branch, Ottawa.

Rametsteiner, E., Nilsson, S., Böttcher, H., Havlik, P., Kraxner, F., Leduc, S., Obersteiner, M., Rydzak, F., Schneider, U., Schwab, D. & Willmore, L. (2008): Study of the Effects of Globalization on the Economic Viability of EU Forestry, International Institute for Applied Systems Analysis.

Sheridan, P. and Dussler, F. (2008): Controlling the wood value chain is the critical success factor for being part of the re-dimensioned European industry- Wood sourcing in Europe – Which way forward? Available at:

http://www.stepchange.com/files/SSC_WoodPPI_May08_p29-34.pdf (viewed 22 September 2010).

The Council of European Union (1999): Council Resolution of 15 December 1998 on a forestry strategy for the European Union. Resolution 1999 / C56 / 01.

The Council of European Union (2003): Council Conclusions: Forest Law Enforcement, Governance and Trade (FLEGT). 2003/C 268/01.

The Council of European Union (2005): Council Regulation (EC) No 1698/2005 of 20 September 2005 on support for rural development by the European Agricultural Fund for Rural Development.

The Council of the European Communities (1992): Council Regulation No 2080/92 of 30 June 1992 on a Community aid scheme for forestry measures in agriculture.

The European Parliament and the Council of the European Union (2009): Directive 2009/28/EC of the European Parliament and of the Council of 23 April 2009 on the promotion of the use of energy from renewable sources.

The European Parliament and the Council of the European Union (2003): Regulation (EC) No 2152/2003 European Parliament and Council of 17 November 2003 concerning monitoring of forests and environmental interactions in the EC.

Third Ministerial Conference on the Protection of Forests in Europe (MCPFE) (1998a): ANNEX 1 OF THE RESOLUTION L2: Pan-European Criteria and Indicators for Sustainable Forest Management.

Third Ministerial Conference on the Protection of Forests in Europe (MCPFE) (1998b): ANNEX 2 OF THE RESOLUTION L2: Pan-European Operational Level Guidelines for Sustainable Forest Management.

United Nations, United Nations Forum on Forests, available at: http://www.un.org/esa/forests/.

United Nations Framework Convention on Climate Change (1997): Kyoto Protocol to the United Nations Framework Convention on Climate Change. Available online at: http://unfccc.int/resource/docs/convkp/kpeng.pdf.

UNECE Timber Committee (2009): UNECE Timber Committee Statement on Forest Products Markets in 2009 and 2010. Available at: http://www.unece.org/press/pr2009/09tim_p06/StatementForPressRel.E.pdf (viewed 22 September 2010).

Välkky, E., Nousiainen, H., and Karjalainen, T. (2008): Facts and Figures of the Barents Forest Sector. Working Papers of the Finnish Forest Research Institute, 78. Available at: http://www.metla.fi/julkaisut/workingpapers/2008/mwp078.pdf (viewed 8 December 2010).

White, A., Cannell, M.R.G. and Friend, A.D. (2000): The high latitude terrestrial carbon sink: a model analysis in Global Change Biology, 6:227–246.

Wilmking, M., Juday, G.P., Barber, V. & Zald, H. (2004): Recent climate warming forces contrasting growth responses of white spruce at treeline in Alaska through temperature thresholds in Global Change Biology, 10: 1-13.

Tourism

Akureyri's Regional Growth Agreement, available at: http://www.klasar.is/files/36/20071018144704434.pdf (viewed 14 September 2010).

Alaska Office of Tourism Development (2007a): Alaska visitor volume and profile, Summer 2006, State of Alaska, Department of Commerce, Community and Economic Development, available at http://www.commerce.state.ak.us/oed/toubus/pub/4VisitorProfile.pdf, pp.46f.

Alaska Office of Tourism Development (2007b): Alaska visitor volume and profile, Fall/Winter 2006-07, State of Alaska, Department of Commerce, Community and Economic Development, available at http://www.commerce.state.ak.us/oed/toubus/pub/4FW_Visitor_Profile.pdf, pp.19 and 44.

Alaska Office of Tourism Development (2007c): Alaska visitor volume and profile, Summer 2006, State of Alaska, Department of Commerce, Community and Economic Development, available at http://www.commerce.state.ak.us/oed/toubus/pub/AVSPSummer2006Final.pdf.

Alaska Office of Tourism Development (2006): Alaska visitor volume and profile, Summer 2006, available at http://www.commerce.state.ak.us/oed/toubus/pub/4VisitorProfile.pdf, pp.46f.

Arctic Marine Shipping Assessment (AMSA) (2009): Arctic Council, Protection of Arctic Marine Environment. Available at: http://www.pame.is/amsa/amsa-2009-report (viewed 28 June 2010).

CAFF (Conservation of Arctic Flora and Fauna) (2002): Protected Areas of the Arctic: Conserving a Full Range of Values. Ottawa.

Canadian Tourism Commission (2010): Tourism snapshot. 2009 year-in-review. Facts & figures, 4th edition. Available at http://www.tcr.gov.nl.ca/tcr/publications/2009/Tourism_Snapshot_Year_In_Review_2009.pdf.

Couvrette, M. "RE: Information request on Sustainable Arctic Tourism Association." Email to the author. 31 May 2010.

Daily Mail (2007): Cruise holidays to top fastest-growing travel market sector. Mail Online, 19 November 2007, available at: http://www.dailymail.co.uk/travel/article-600432/Cruise-holidays-fastest-growing-br-travel-market-sector.html (viewed 28 May 2010).

Dawson, J., Stewart, E.J., Lemelin, H., Scott, D. (2010): The carbon cost of polar bear viewing tourism in Churchill, Canada in Journal of Sustainable Tourism, 18(3):319-336.

Department of Tourism and Culture Yukon (2010): Yukon visitor statistics. Year-end report 2009. Whitehorse, Yukon, available at http://www.tc.gov.yk.ca/pdf/Year_End_Report_2009.pdf.

Duhaime, G. (2004): Arctic Human Development Report: Economic Systems. Stefansson Arctic Institute, Akureyri.

EC Enterprise and Industry: Tourism, European Tourism Forum, available at: http://ec.europa.eu/enterprise/sectors/tourism/promoting-eu-tourism/european-tourism-forum/european-tourism-forum-2007/index_en.htm (viewed 26 May 2010).

EC Enterprise and Industry (2008): Annual Tourism Reports – 2008 Finland, available online: http://ec.europa.eu/enterprise/sectors/tourism/files/annual_reports/fi_2008_en.pdf. (viewed 8 September 2010).

EC Enterprise and Industry (2009): Survey on the attitudes of Europeans towards Tourism. Directorate General Communication, available at: http://ec.europa.eu/enterprise/newsroom/cf/itemlongdetail.cfm?item_id=3729&tpa_id=136&lang=en (viewed 27 May 2010).

Europa (2009a): European policies for tourism, available at: http://ec.europa.eu/enterprise/sectors/tourism/promoting-eu-tourism/tourism-related-policies/index_en.htm (viewed 26 May 2010).

Europa (2009b): EU Tourism Policy, available at: http://ec.europa.eu/enterprise/sectors/tourism/promoting-eu-tourism/tourism-policy/index_en.htm (viewed 26 May 2010).

European Commission (2006): A renewed EU Tourism Policy - Towards a stronger partnership for European Tourism. Communication (2006) 134, available at: http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2006:0134:FIN:en:PDF (viewed 26 May 2010).

European Commission (2007): Agenda for a sustainable and competitive European tourism. Communication (2007)621, available at: http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:52007DC0621:en:HTML (viewed 26 May 2010).

European Commission (2010): Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions: Europe, the world's No 1 tourist destination – a new political framework for tourism in Europe. COM(2010) 352.

European Environment Agency (EEA) (2004): Arctic Environment: European Perspectives – Why Should Europe Care? Environmental Issue Report No. 38. Copenhagen, UNEP and European Environment Agency.

Geitz, M., Norris, S., and Lier, M. (2004): Cruise tourism on Svalbard—Risky business? WWF International Arctic Programme, available at: http://assets.panda.org/downloads/wwfcruisetourismonsvalbard2004_v5p3.pdf (viewed 26 May 2010).

Gössling, S., Hall, C.M., Peeters, P., and Scott, D. (2009): Future of tourism: Can tourism growth and climate policy be reconciled? A climate change mitigation perspective, available at: http://canterbury-nz.academia.edu/documents/0029/9318/TRR_2009.pdf (viewed 27 May 2010).

Guðmundsdóttir, A.M., and Sæþórsdóttir, A.D. (2009): Tourism Management in Wilderness Areas—Svalbard. í I. Hannibalsson (ritstj.) Rannsóknir í félagsvísindum 10: 41-53. Reykjavík.

Hall, C.M., Saarinen, J. (2009): Last chance to see? Future issues for polar tourism and change, in: Hall, C.M., Saarinen, J. (eds.) Tourism and change in polar regions: climate, environment and experiences. Routledge, Oxon.

Háskólaútgáfan. available at: www.rmf.is/thjodarspegill/pdf/greinar%202009/Tourism%20Management.pdf (viewed 26 May 2010).

Hassol, S. (2005): Arctic Climate Impact Assessment, Executive Summary. Cambridge University Press, New York, available at: http://amap.no/workdocs/index.cfm?action=getfile&dirsub=%2FACIA%2Foverview&filename=ExecSummary.pdf&CFID=1017&CFTOKEN=5B233A4B-91AA-122B-DF10161D2CD5EDA9&sort=default (viewed 27 May 2010).

Heberlein, T., Fredman, P., and Vuorlo, T. (2002): *Current Tourism Patterns in the Swedish Mountain Regions* in Mountain Research and Development, 22, 2: 142-149. International Mountain Society.

Innovation Norway, (2007): Key Figures. Norwegian tourism 2006, available at http://www.innovasjonnorge.no/Reiseliv_fs/Key%20Figures%202006.pdf..

Lapland – Vitality for Life; An Abstract of Lapland Tourism Strategy 2007-2010, available at: http://www.lapinliitto.fi/c/document_library/get_file?folderId=21330&name=DLFE-677.pdf (viewed 14.09.2010).

Laponia World Heritage: Ecotourism, available at http://www.laponia.nu/eng/default.asp?ID=107&menu_item=107 (viewed 13 September 2010).

National Parks of North Europe, SummitPost.org, available at: http://www.summitpost.org/list/256005/national-parks-of-north-europe.html (viewed 27 September 2010).

Nature's Best: Probably the best nature tours in Europe, web-page, available at http://www.naturesbestsweden.com/nb/index.asp (viewed 14 September 2010).

NPP: Northern Periphery Programme (2004), available at: http://www.northernperiphery.net/strategic-documents-g.asp (viewed 28 May 2010).

NPP: Northern Periphery Programme (2010), available at: http://www.northernperiphery.eu/en/content/show/&tid=180 (viewed 28 May 2010).

Nutek (2008): Tourism and the Travel and Tourism Industry in Sweden, 2008 edition, Nutek, Swedish Agency for Economic and Regional Growth, Stockholm, available at http://publikationer.tillvaxtverket.se/Download.aspx?ID=879, pp.39f.

On a renewed EU Tourism Policy: Towards a stronger partnership for European Tourism. EU Parliament Resolution A6-0399/2007, available at: http://www.europarl.europa.eu/sides/getDoc.do?language=EN&reference=A6-0399/2007 (viewed 27 May 2010).

OSPAR Commission (2008): Assessment of impacts of tourism and recreational activities. Biodiversity Series. Available at: http://www.ospar.org/documents/dbase/publications/p00369_Tourism%20and%20recreation.pdf (viewed 22 September 2010).

Peeters, P., Szimba, E. and Duijnisveld, M. (2007): Major environmental impacts of European tourist transport. Journal of Transport Geography, 15:83-93.

Probably the best nature tours in Europe, Nature's Best web-page, available at: http://www.naturesbestsweden.com/nb/index.asp (viewed 14 September 2010).

Rennie, S (2010): Industrial waste trashes Arctic dumps: report. The Canadian Press, Metro. 12 September 2010. Available at: http://www.metronews.ca/toronto/life/article/629714--industrial-waste-trashes-arctic-dumps-report--page1 (viewed 22 September 2010).

SMART (2005): Sustainable Model for Arctic Regional Tourism, Best Practices: Respects and involves the local community, available at: http://www.Arctictourism.net/best_company/4.htm (viewed 28 May 2010).

SMART (2006): Sustainable Model for Arctic Regional Tourism, Final Report, available at: http://www.Arctictourism.net/tavara/SMARTFINAL_e%20version.pdf (viewed 26 May 2010).

Snyder, J. (2007a): Tourism in the Arctic: Past, Present and Future. Coastal Response Research Center, available at: http://www.crrc.unh.edu/workshops/arctic_spill_summit/presentations/snyder.pdf (viewed 27 May 2010).

Snyder, J. (2007b): Tourism in the Polar Regions: the Sustainability Challenge. United Nations Environment Programme, GRID/Arendal. Available at: http://www.unep.fr/shared/publications/pdf/DTIx0938xPA-PolarTourismEN.pdf (viewed 22 September 2010).

Statistics Canada (2010): Trips by Canadians in Canada, by province and territory 2000-2004, available at http://www40.statcan.gc.ca/l01/cst01/arts26a-eng.htm.

Statistics Finland (2010): Tourism statistics Lapland 2007-2009, available at http://pxweb2.stat.fi/Dialog/varval.asp?ma=040_matk_tau_104_en&ti=Visitor+arrivals+and+nights+spend+in+all+accommodation+establishments&path=../Database/StatFin/lii/matk/&lang=1&multilang=en.

Statistics Greenland (2009): Greenland in figures 2009, 6th revised edition, available at http://www.stat.gl/LinkClick.aspx?link=Intranet%2FGIF_2009_WEB.pdf&tabid=36&mid=391&language=en-US.

Statistics Iceland (2010): Overnight stays, arrivals and average length of stay in all types of accommodation 2007-2009, available at http://www.statice.is/?PageID=1234&src=/temp_en/Dialog/varval.asp?ma=SAM01601%26ti=Overnight+stays%2C+arrivals+and+average+length+of+stay+in+all+types+of+accommodation+1998-2009%26path=../Database/ferdamal/GiAllir/%26lang=1%26units=Number.

Statistics Norway (2009): The Arctic – increasingly popular with tourists, p. 17, available at http://www.ssb.no/this_is_svalbard/turisme.pdf (viewed 14 September 2010).

Stewart, E.J., Draper, D. and Johnston, M.E. (2005): A Review of Tourism Research in the Polar Regions in Arctic, 58(4):383-394.

Sustainable Tourism Case Studies: Arctic Tourism, available at: http://www.biodiversity.ru/coastlearn/tourism-eng/casestudies_Arctic.html (viewed 26 May 2010).

TSG. Tourism Sustainability Group Final Report (2007): Action for more sustainable European tourism, available at: http://ec.europa.eu/enterprise/sectors/tourism/files/docs/tsg/tsg_final_report_en.pdf (viewed 27 May 2010).

UNESCO Focal Points for 'Coastal and Marine Resources' in SIDS Regions, available at: http://portal.unesco.org/en/ev.php-URL_ID=43011&URL_DO=DO_TOPIC&URL_SECTION=201.html (viewed 29 May 2010).

UNESCO Partnership on Coastal and Marine Protected Areas, available at: http://portal.unesco.org/en/ev.php-URL_ID=42963&URL_DO=DO_TOPIC&URL_SECTION=201.html (viewed 29 May 2010).

UNESCO World Heritage Convention (1972): Convention Concerning the Protection of the World Cultural and Natural Heritage, available at: http://whc.unesco.org/en/conventiontext/ (viewed 27 May 2010).

UNESCO World Heritage, Tentative Lists, available at: http://whc.unesco.org/en/tentativelists/ (viewed 14 June 2010).

UN News Centre (2010): UN agency spotlights tourism's potential to promote conservation, available at http://www.un.org/apps/news/story.asp?NewsID=35622&Cr=tourism&Cr1= (viewed 14 September 2010).

Working Group D Final Report (2001): available at: http://ec.europa.eu/enterprise/sectors/tourism/documents/working-groups-reports/index_en.htm#h2-working-group-d---promoting-environmental-protection-and-sustainable-development-in-tourism (viewed 28 May 2010).

World Travel and Tourism Council (WTTC) (2007): Environment Initiative, Leading the Challenge on Climate Change, available at: http://www.wttc.org/eng/Tourism_Initiatives/Environment_Initiative/ (viewed 29 July 2010).

World Heritage Reports, Periodic Report and Action Plan: Europe (2007): UNESCO World Heritage Convention, available at: http://whc.unesco.org/documents/publi_wh_papers_20_en.pdf (viewed 27 May 2010).

WWF: Ten Principles for Arctic Tourism, available at: http://assets.panda.org/downloads/10principlesforarctictourism%28eng%29_f6l2.pdf, (viewed 13.09.2010).

Transport

Arctic Marine Shipping Assessment (2009): Arctic Council, Protection of Arctic Marine Environment. Available at: http://www.pame.is/amsa/amsa-2009-report (viewed 28 June 2010).

Bennett, M (2010): Canada introduces mandatory vessel-tracking for ships in Arctic waters. The Arctic, The World Affairs Blog Network. Available at: http://arctic.foreignpolicyblogs.com/2010/06/25/canada-introduces-mandatory-vessel-tracking-for-ships-in-arctic-waters/ (viewed 15 September 2010).

Birnie, P., Boyle, A., & Redgwell, C. (2009): International Law and the Environment, 3rd edition. Oxford University Press. United Kingdom.

Breaking the Ice: Arctic Development and Maritime Transportation (2007): Conference organized by the Icelandic Government, 27-28 March 2007. Conference Report. Available at: http://www.mfa.is/media/Utgafa/Breaking_The_Ice_Conference_Report.pdf (viewed 28 June 2010).

Chircop, A. (2009): The growth of international shipping in the Arctic: Is a regulatory review timely? in International Journal of Marine and Coastal Law 24(2): 355-380.

Common Wadden Sea Secretariat. PSSA: The Wadden Sea Designated as Particularly Sensitive Sea Area (PSSA), available at: http://www.waddensea-secretariat.org/tgc/pssa/pssa-designation.html (viewed 1 September 2010).

EC Environment (2010): EU policy on ship emissions. Available at: http://ec.europa.eu/environment/air/transport/ships.htm (viewed 29 June 2010).

EC Mobility and Transport (2009): Adoption of the Third Maritime Safety Package. Available at: http://ec.europa.eu/transport/maritime/safety/third_maritime_safety_package_en.htm (viewed 28 June 2010).

EC Mobility and Transport, Motorways of the Sea, available at http://ec.europa.eu/transport/maritime/motorways_sea/motorways_sea_en.htm (viewed 5 July 2010).

European Environment Agency (EEA) (2009): European Community emission inventory report 1990–2007 under the UNECE Convention on Long-range Transboundary Air Pollution (LRTAP). No. 8/2009. Available at: http://www.eea.europa.eu/publications/lrtap-emission-inventory-report-1990-2007/at_download/file (viewed 28 June 2010).

European Commission (2000a): On the safety of the seaborne oil trade. COM(2000) 142 final. Available at: http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2000:0142:FIN:EN:PDF (viewed 28 June 2010).

European Commission (2000b): On a second set of Community measures on maritime safety following the sinking of the oil tanker Erika. COM(2000) 802 final. Available at: http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2000:0802:FIN:EN:PDF (viewed 28 June 2010).

European Commission (2001): The Clean Air for Europe (CAFE) Programme: Towards a Thematic Strategy for Air Quality. COM(2001) 245 final. Available at: http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2001:0245:FIN:EN:PDF (viewed 29 June 2010).

European Commission (2004): Oil Tanker Phase Out and the Ship Scrapping Industry. Directorate General Energy and Transport. Available at:

ec.europa.eu/transport/maritime/safety/doc/prestige/2004_06_scrapping_study_en.pdf. Accessed 15 September 2010.

European Commission (2007): An Integrated Maritime Policy for the European Union. COM(2007) 575 final.

European Commission (2009a): Strategic goals and recommendations for the EU's maritime transport policy until 2018. COM(2009) 8 final.

European Commission (2009b): Tajani: Shaping transport policy for the future, Brussels, IP/09/936,.ąvailable at: http://europa.eu/rapid/pressReleasesAction.do?reference=IP/09/936#footnote-1 (viewed 18 June 2010).

European Commission (2009c): March 11, "3rd maritime safety package general framework, MEMO/09/105, Brussels [cited as 3rd maritime safety package]. Report of the Group of Senior Shipping Professionals (2008, September 22), available at http://ec.europa.eu/transport/maritime/studies/doc/2008_09_22_report_en.pdf (viewed 10 June 2010).

European Council and Commission (1997): Agreement on partnership and cooperation establishing a partnership between the European Communities and their Member States, of one part, and the Russian Federation, of the other part (97/800/ECSC, EC, Euratom) in Official Journal L 327, 28/11/1997 P. 0003 – 0069, art. 70.

European Maritime Safety Agency (EMSA) (2009): Annual Report 2008. Available at: https://extranet.emsa.europa.eu/index.php?option=com_joomdoc&task=doc_download&gid=342&Itemid=100005 (viewed 28 June 2010).

European Maritime Safety Agency (EMSA) (2010a): Chronological list of ships that were refused access to Community ports. Available at: https://extranet.emsa.europa.eu/index.php?option=com_joomdoc&task=doc_download&gid=563&Itemid=100005 (viewed 28 June 2010).

European Maritime Safety Agency (EMSA) (2010b): Maritime Accident Review 2009. Available at: https://extranet.emsa.europa.eu/index.php?option=com_joomdoc&task=doc_download&gid=1050&Itemid=100005 (viewed 28 June 2010).

European Parliament (2003): On a European Union strategy to reduce atmospheric emissions from seagoing ships (COM(2002) 595 – 2003/2064(INI)). A5-0400/2003. Available at: http://www.europarl.europa.eu/sides/getDoc.do?pubRef=-//EP//NONSGML+REPORT+A5-2003-0400+0+DOC+PDF+V0//EN (viewed 29 June 2010).

European Parliament (2009): Directive of the European Parliament and of the Council amending Directive 2005/35/EC on ship-source pollution and on the introduction of penalties for infringements. Directive 2008/0055 (COD). Available at: http://ec.europa.eu/justice_home/doc_centre/criminal/environmental/doc/com_2008_134_en.pdf (viewed 28 June 2010).

GESAMP (Joint Group of Experts on the Scientific Aspects of Marine Environmental Protection): Report of the 37th Session, Bankgok, 15-19 February 2010, available at: http://www.gesamp.org/data/gesamp/files/media/Publications/Reports_and_studies_81/gallery_1376/object_1530_large.pdf (viewed 1 September 2010).

Granier, C., Niemeier, U. et al. (2006): Ozone pollution from future ship traffic in the Arctic northern passages in Geophysical Research Letters 33(13).

IMO, Ships operating in Polar Regions, available at: http://www.imo.org/Newsroom/mainframe.asp?topic_id=1773&doc_id=11041 (viewed 30 August 2010).

IMO (1990): International Convention on Oil Pollution Preparedness Response and Cooperation (OPRC), available at: http://www.imo.org/conventions/mainframe.asp?topic_id=258&doc_id=682 (viewed 29 September 2010).

IMO (2002a): Guidelines for ships operating in Arctic ice-covered waters. MSC/Circ.1056/MEPC/Circ.399. Available at: http://www.imo.org/includes/blastDataOnly.asp/data_id%3D6629/1056-MEPC-Circ399.pdf (viewed 28 June 2010).

IMO (2002b): Prevention of Pollution by oil. Available at: http://www.imo.org/environment/mainframe.asp?topic_id=231 (viewed 28 June 2010).

IMO (2004): International Convention for the Control and Management of Ships' Ballast Water and Sediments (BWM convention). Available at: http://www.imo.org/environment/mainframe.asp?topic_id=548 (viewed 28 June 2010).

IMO (2005): Revised Guidelines for the Identification and Designation of Particularly Sensitive Sea Areas, Resolution A.982(24), 1 December 2005, A 24/Res.982 Title 4.

IMO (2006): Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter, 1972 (London Convention). Available at: http://www.imo.org/Conventions/contents.asp?topic_id=258&doc_id=681 (viewed 28 June 2010).

IMO (2007): Particularly Sensitive Sea Areas (PSSAs). Available at: http://www.imo.org/Environment/mainframe.asp?topic_id=1357 (viewed 28 June 2010).

IMO (2009a): International Convention for the Prevention of Pollution from Ships, 1973, as modified by the Protocol of 1978 relating thereto (MARPOL), 2004 amendments. Available at: http://www.imo.org/conventions/contents.asp?doc_id=678&topic_id=258#revisedoneandtwo (viewed 28 June 2010).

IMO (2009b): Reporting on dumping and incineration at sea under the London Convention 1972 and its 1996 Protocol. Available at: http://www.imo.org/includes/blastData.asp/doc_id=12779/OVERVIEW-Dumping%20percentages.pdf (viewed 28 June 2010).

IMO (2010): Status of Conventions by country. Available at: http://www.imo.org/conventions/mainframe.asp?topic_id=248 (viewed 28 June 2010).

IMO, MARPOL (2009): 1992 amendments. Available at: http://www.imo.org/conventions/contents.asp?doc_id=678&topic_id=258#1 (viewed 28 June 2010).

International Tanker Owners Pollution Federation Limited (ITOPF) (2010): Information Services- Statistics. Available at: http://www.itopf.com/information-services/data-and-statistics/statistics/ (viewed 28 June 2010).

Kitagawa, H. (2009): Sustainable development and marine transport in the Arctic ocean - A perspective and cold regions technology. 19th (2009) International Offshore and Polar Engineering Conference, Osaka, Japan.

Liu, M. and Kronbak, J. (2010): The potential economic viability of using the Northern Sea Route (NSR) as an alternative route between Asia and Europe in Journal of Transport Geography 18(3): 434-444.

Maritime Safety: Erika I package (2007): EUROPA: Summaries of EU legislation. Available at: http://europa.eu/legislation_summaries/transport/waterborne_transport/l24230_en.htm (viewed 28 June 2010).

Mattson, G. (2006): MARPOL 73/78 and Annex I: An Assessment of its Effectiveness in Journal of International Wildlife Law & Policy, 9(2):175-194.

Molenaar, E.J. (2009): Arctic marine shipping: Overview of the international legal framework, gaps and options in Journal of Transnational Law and Policy 18(2); 289-325.

Molenaar, E., and Corell, R. (2009): Background Paper: Arctic Shipping. Arctic TRANSFORM. Available at: http://Arctic-transform.org/download/ShipBP.pdf (viewed 28 June 2010).

Molenaar, E., Hodgson, S., VanderZwaag, D., Hallsson, H.H., Henriksen, T., Holm-Peterson, L., Korel'skiy, M.V., Kraska, J., Magnússon, B.M., Rolston, S. & Serdy, A. (2010): Legal aspects of Arctic shipping: Summary report. European Commission, Directorate-General for Maritime Affairs and Fisheries, available at: http://ec.europa.eu/maritimeaffairs/pdf/legal_aspects_arctic_shipping_summary_en.pdf

National Snow and Ice Data Center (2010): Arctic Sea Ice News and Analysis, available at: http://nsidc.org/arcticseaicenews/ (viewed 8 September 2010)

Norwegian Maritime Directorate (2003): Arctic Shipping Activities into the Next Decade. Available at: http://www.uwinnipeg.ca/index/cms-filesystem-action?file=pdfs/quest/north/shippingactivitess.pdf (viewed 28 June 2010).

OSPAR (2009): Marine litter in the North-East Atlantic Region: Assessment and priorities for response. London, United Kingdom.

Somanathan, S., Flynn, P. and Szymanski, J. (2009): *The Northwest Passage: A simulation* in Transportation Research Part A: Policy and Practice 43(2): 127-135.

Southampton Institute (2001): PSSA Wadden Sea feasibility study: Advice to trilateral Wadden Sea cooperation: Final report, available at http://www.waddensea-secretariat.org/news/documents/pssa/PSSA-report.pdf (viewed 1 September 2010).

UNECE (2007): Hemispheric Transport of Air Pollution. Air Pollution Studies No. 16. Available at: http://www.unece.org/env/lrtap/ExecutiveBureau/Air.Pollution%20Studies.No.16.Hemispheric%20Transport.pdf (viewed 28, June 2010)

UNEP/GRID-Arendal (2010): Current marine shipping uses in the Arctic. UNEP/GRID-Arendal Maps and Graphics Library, May 2010, available at http://maps.grida.no/go/graphic/current-marine-shipping-uses-in-the-arctic. (viewed 20 September 2010).

US Department of State, Arctic search and rescue, available at: http://www.state.gov/g/oes/ocns/opa/arc/c29382.htm (viewed 1 September 2010).

VanderZwaag, D.L., Chircop, A., Franckx, E., Kindred, H., MacInnis, K., McConnell, M., McDonald, A., McDormand, T.L., Mills, S., Puthucherril, T., Rolston, S., Saunders, P., & Spears, K.J. (2008): Governance of Arctic Marine Shipping. Halifax: Dalhousie University.

Arctic indigenous and local livelihoods

ArcticStat (2010): Statistics. Available at: http://www.arcticstat.org/Statistics.aspx/Indicator/%5BPopulation%5DMobility!Migration/ (viewed 20 October 2010).

ArcticStat (2010): Statistics, Greenland. Available at: http://www.arcticstat.org/TableViewer.aspx?S=2&ID=13967 (viewed 20 October 2010).

Aslaksen, I., Dallmann, W., Holen, D., Høydeah, E., Kruse, J., Poppel, B., Stapleton, M., & Turi, E.I. (2008): Interdependency of subsistence and market economies in the Arctic in The Economy of the North 2008. Statistics Norway.

AMAP Assessment 2002: Human Health in the Arctic. Arctic Monitoring and Assessment Programme (AMAP), Oslo, Norway available at http://www.amap.no/documents/index.cfm?dirsub=/AMAP%20Assessment%202002%20-%20Human%20Health%20in%20the%20Arctic (viewed 9 September 2010).

Arctic Climate Impact Assessment (ACIA) (2005): Arctic Council, Cambridge University Press, available at: http://www.acia.uaf.edu/pages/scientific.html. pp. 652-658.

Arctic Council (2001): Indigenous Peoples' Secretariat, Terms of Reference and Procedural Guidelines. Adopted in Espoo, 3 November 2001. Available at http://Arctic-council.org/filearchive/IPS%20Terms%20of%20Reference%20and%20Guidelines.pdf (retrieved 7 June 2010).

Arctic Council (2008): SDWG Work Plan for 2009-2011. Available at http://Arctic-council.org/filearchive/sdwg_work_plan_for_2009-2011_final.pdf (viewed 8 June 2010).

Arctic Human Development Report (AHDR) (2004): Stefansson Arctic Institute, Akureyri.

Arctic Marine Shipping Assessment (AMSA) (2007): Arctic Council.

BEAR Working Group of Indigenous Peoples (2010): Available at http://www.barentsindigenous.org/information-and-members.130878.en.html (viewed 3 June 2010).

Bille Larsen, P. (2006): Reconciling indigenous peoples and protected areas: rights, governance and equitable costs and benefits sharing, Discussion Paper, IUCN, Gland.

Bogoyavlenskiy, D. and Siggner, A. (2004): Arctic Human Development Report: Arctic Demography. Stefansson Arctic Institute, Akureyri.

Charters, C. and Stavenhagen, R. (eds.) (2009): Making the Declaration Work: the United Nations Declaration on the Rights of Indigenous Peoples. Eks-Skolens Trykkeri. Copenhagen.

Convention concerning Indigenous and Tribal Peoples in Independent Countries, No 169. International Labour Organisation (ILO Convention No. 169). Geneva, 27 June 1989.

Convention on Biological Diversity Secretariat (2000): Cartagena Protocol on Biosafety to the Convention on Biological Diversity: text and annexes. Montreal: Secretariat of the Convention on Biological Diversity.

Council of the European Union (1998): Resolution of 30 November 1998 on Indigenous peoples within the framework of development cooperation of the Community and the Member States. Available at: http://ec.europa.eu/external_relations/human_rights/ip/index_en.htm (viewed 29 July 2010).

Council of the European Union (2002): General Affairs and External Relations, Council Conclusions on Indigenous Peoples. Council meeting document 14183/02 (Presse 350), Brussels, 18 November 2002, available at http://register.consilium.europa.eu/pdf/en/02/st14/st14183.en02.pdf (viewed 7 September 2010).

Council of the European Union (2009): Council conclusions on the Arctic issues, 2985th Foreign Affairs Council Meeting, Brussels, 8 December 2009.

Council of the European Union: EU Annual Reports on Human Rights. Available at: http://www.consilium.europa.eu/showPage.aspx?id=970&lang=en (viewed 7 June 2010).

Council of the European Union (2006): Council Decision on relationship between the European Community on the one hand and Greenland and the Kingdom of Denmark on the other, 9802/06, Brussels, 20 June 2006.

Delegation of the European Commission to Russia (2008): IBpP Civil Society and Local Initiatives, Project Summaries. Projects selected as a result of the CfP 2008.

Delegation of the European Commission to Russia (2009): European Instrument for Democracy & Human Rights (EIDHR) New Projects 2009.

Duhaime, G. (2004): Arctic Human Development Report: Economic Systems. Stefansson Arctic Institute, Akureyri.

Europa, Summaries of EU legislation: Whaling, available at http://europa.eu/legislation_summaries/maritime_affairs_and_fisheries/fisheries_resources_and_environment/l28198_en.htm (viewed 9 September 2010).

European Commission (1998): Working Document of the Commission of May 1998 on support for indigenous peoples in the development co-operation of the Community and the Member States. Available at: http://ec.europa.eu/external_relations/human_rights/ip/index_en.htm (viewed 29 July 2010).

European Commission (2005): Integrated management of Natura 2000 sites. The contribution of LIFE-nature projects. Available at: http://ec.europa.eu/environment/life/publications/lifepublications/lifefocus/documents/managingnatura_lr.pdf (viewed 3 June 2010).

European Commission (2006): Annexes to the Communication Halting the loss of biodiversity by 2010 and beyond SEC(2006)621, Brussels, 22 May 2006.

European Commission (2008a): Commission staff working document accompanying document to the Proposal for a Regulation of the European Parliament and of the Council concerning trade in seal products. SEC(2008)2290.

European Commission (2008b): Communication from the Commission to the European Parliament and the Council: The European Union and the Arctic region. COM(2008) 763.

European Commission (2010): Draft Commission Regulation laying down detailed rules of the implementation of Regulation (EC) No 1007/2009 of the European Parliament and of the Council on trade in seal products. D009538/02.

European Commission: Country Strategy Paper 2007-2013 Russian Federation. Available at: http://ec.europa.eu/external_relations/russia/docs/2007-2013_en.pdf (viewed 4 June 2010).

European Commission, EU Policy on Indigenous Peoples, available at: http://ec.europa.eu/external_relations/human_rights/ip/index_en.htm (viewed 9 September 2010).

European Commission: EU Relations with Greenland, available at: http://ec.europa.eu/development/geographical/regionscountries/countries/country_profile.cfm?cid=gl&type=short&lng=en (viewed 21 September 2010).

European Commission: Programming document for the sustainable development of Greenland, available at http://ec.europa.eu/development/icenter/repository/Greenland-PDSD-and-annexesfinal.pdf (viewed 8 June 2010).

European Commission: “Seal hunting” available online at http://ec.europa.eu/environment/biodiversity/animal_welfare/seals/seal_hunting.htm (viewed 18 July 2010).

European Commission: Summary of the “Arctic Dialogue” Workshop, Brussels, 9 March 2010, MARE.C1/EH/ZB/2010, available at http://ec.europa.eu/maritimeaffairs/pdf/Arctic_workshop_090310_summary_en.pdf (retrieved 7 June 2010).

European Commission: The Northern Dimension Policy, available at: http://ec.europa.eu/external_relations/north_dim/index_en.htm (viewed 20 September 2010).

European Community, Greenland, Denmark (2006a): Fisheries Partnership Agreement between the European Community, on one hand, and the Government of Denmark and the Home Rule Government of Greenland, on the other, Brussels, 21 December 2006

European Community, Greenland, Denmark (2006b): Joint declaration by the European Community, on the one hand, and the Home Rule Government of Greenland and the Government of Denmark, on the other, on the partnership between the European Community and Greenland, OJ I.208, 29 July 2006, Luxembourg, 27 June 2006.

European Community, Greenland, Denmark (2006c): Joint declaration by the European Community, on the one hand, and the Home Rule Government of Greenland and the Government of Denmark, on the other, on partnership between the European Community and Greenland, 27 July 2006, L 208/32, available at http://eu.nanoq.gl/Emner/EuGl/~/media/3D3BA49458F545A3AEAC6AFCEC4CFE9A.ashx (viewed 9 September 2010).

European Parliament (1994): On action required internationally to provide effective protection for indigenous peoples. Resolution A3-0059/93. 9 February 1994.

European Parliament (2009a): On trade in seal products. Regulation (EC) No 1007/2009 of 16 September 2009, Strasbourg, OJ I. 286, 31 October 2009.

European Parliament (2009b): Indigenous Peoples and Climate Change, Human Rights, available at http://cmsdata.iucn.org/downloads/european_parliament_study_on_indigenous_peoples_and_climate_change.pdf (retrieved 8 June 2010).

Glomsrød, S. and I. Aslaksen (eds) (2006): The Economy of the North. Statistics Norway, Oslo–Kongsvinger.

Hall, C.M., Saarinen, J. (2009): Last Chance to See? Future Issues for Polar Tourism and Change, in: Hall, C.M., Saarinen, J. (eds.) Tourism and change in polar regions: climate, environment and experiences. Routledge, Oxon.

Heinämäki, L. (2009): *Protecting the Rights of Indigenous Peoples – Promoting the Sustainability of the Global Environment?* in International Community Law Review Vol. 11, no. 1:3-68.

Helander, E. (2005): Climate Change and the Saami in: Arctic Climate Impact Assessment (ACIA). Cambridge: Cambridge University Press, pp. 86-87.

Hossain, K. (2008): Protection of Sami Reindeer Herding in the Context of Finnish Mining Legislations: A Reflection from Article 27 of the ICCPR in T. Koivurova and A. Stepien (eds) Reforming Mining Law in a Changing World, with Special Reference to Finland. Proceedings from the Mining Law Seminar, Rovaniemi, 25-26 September 2008, Rovaniemi: University of Lapland, pp. 91-105.

Indigenous Peoples Working Group (chaired P. Cochran, Nuttall, M.) (2008): Policy Options for Arctic Environmental Governance. Arctic Transform, available at http://Arctic-transform.org/download/IndPeEX.pdf (viewed 10 June 2010).

International Labor Organization: ILO Convention 169, ratification status. Available at: http://www.ilo.org/ilolex/cgi-lex/ratifce.pl?C169 (retrieved 5 June 2010).

International Labor Organization: ILO Convention no. 107 concerning the Protection and integration of indigenous and Other Tribal and Semi-Tribal Population s in Independent States, Geneva, 26 June 1957; ILO Convention no. 107 ratification status at http://www.ilo.org/ilolex/cgi-lex/ratifce.pl?C107 (retrieved 5 June 2010).

Information Centre of Saami Parliament in Sweden: The Sami in figures, available at: http://www.eng.samer.se/servlet/GetDoc?meta_id=1536 (viewed 18 July 2010).

Interreg IV A North 2007-2013 (2008): Operational programme between Finland, Sweden and Norway Press Release, MEMO/08/414, Brussels, 17 June 2008. Available at: http://europa.eu/rapid/pressReleasesAction.do?reference=MEMO/08/414&format=HTML&aged=0&language=EN&guiLanguage=en (viewed 3 June 2010).

IUCN (2008): Indigenous and Traditional Peoples and Climate Change – Issues Paper. available at: http://cmsdata.iucn.org/downloads/indigenous_peoples_climate_change.pdf (viewed 8 September 2010).

Jernsletten, J-L. and Klokov, K. (2002): Sustainable Reindeer Husbandry. Centre for Saami Studies, University of Tromso.

Kofinas, G.: Subsistence Hunting in a Global Economy, available at: http://arcticcircle.uconn.edu/NatResources/subsistglobal.html (viewed 29 September 2010).

Koivurova, T., Tervo, H., and Stepien, A. (2008): Background Paper: Indigenous Peoples in the Arctic. Arctic TRANSFORM. Available at: http://Arctic-transform.org/ (viewed 5 July 2010).

Kyllönen, S., Colpaert, A., Heikkinen, H., Marttunen, M., Muje K., & Raitio, K. (2006): Conflict Management as Means to the Sustainable Use of Natural Resources in Silva Fennica 40(4), pp. 687-728.

Luxembourg Presidency of the Council of the European Union (2005): Road map for the common economic space: available at: http://www.eu2005.lu/en/actualites/documents_travail/2005/05/10-4spaces/4spaces.pdf (viewed 20 September 2010).

Memorandum of Understanding setting out the modalities of establishing the Northern Dimension Partnership on Culture (2010).

Metsahallitus (2010): Natura 2000 Areas Available at: http://www.metsa.fi/sivustot/metsa/en/NaturalHeritage/ProtectedAreas/Natura2000Sites/Sivut/Natura2000AreasEstablishedtoProtectBiotopesandSpecies.aspx (viewed 5 June 2010).

Nordic Council of Ministers (2010): Arctic Social Indicators - a follow-up to the Arctic Human Development Report. Copenhagen.

Northern Periphery Programme 2007-2013: European Territorial Cooperation Objective: Operational Programme, CCI:2007CB163PO027. Available at: http://www.northernperiphery.eu/files/archive/Downloads/About_NPP/Operational_Programme_NPP_2007-2013_Approved_Version.pdf (viewed 10 June 2010).

Northern Periphery Programme 2007-2013 (2009): Annual report 2008, CCI:2007CB1. Available at http://www.northernperiphery.eu/files/archive/Downloads/About_NPP/Annual_Reports/Annual_Report_2008.pdf (viewed 10 June 2010).

Official Journal of the European Communities (1997): Agreement on Partnership and Cooperation: establishing a partnership between the European Communities and

their Member States, of one part, and the Russian Federation, of the other part, 24 June 1994, OJ L 327, 28.11.1997, available at: http://ec.europa.eu/world/agreements/prepareCreateTreatiesWorkspace/treatiesGeneralData.do?step=0&redirect=true&treatyId=201&back=3021 (viewed 30 September 2010).

Official Journal of the European Union (1995): Act concerning the conditions of accession of the Republic of Austria, the Republic of Finland and the Kingdom of Sweden to the European Union, as amended, Protocol no. 3 on the Saami People, OJ 1995 LI, 10, 11 (I/I/95).Rees, W.G., et al. (2006): Vulnerability of European Reindeer Husbandry to Global Change, available at: http://www.springerlink.com/content/j2k1r1j1775r603p/fulltext.pdf (viewed 3 September 2010).

Sellheim, Nikolas. (2010): The Tradition and the State – Sámi Reindeer Husbandry and the Forestry Challenge in Northern Finland. In: Lögfræðingur, 2010. Vol. 1, Year 4. Akureyri: University of Akureyri. pp. 75-87, available at:

http://www.unak.is/static/files/Frettir/logfraedingur%20pdf%20skjal.PDF.

Sobrevila, Claudia. (2008): Role of Indigenous Peoples in Biodiversity Protection, World Bank.

Stammler, F and Forbes, B.C. (2006): *Oil and Gas Development in Western Siberia and Timan Pechora* in Indigenous Affairs 02-03/2006. Copenhagen: IWGIA, available at: http://www.iwgia.org/graphics/Synkron-Library/Documents/publications/Downloadpublications/IndigenousAffairs/IA%202-3_2006%20part%202.pdf, pp. 48-57 (viewed 7 September 2010).

Survey of Living Conditions in the Arctic (SLiCA) (2007): Index of Tables: Ties to Nature Table 1, available at: http://www.arcticlivingconditions.org/ (viewed 29 September 2010).

The Kolarctic ENPI CBC Programme 2007-2013 (2008): C(2008)8453.

The North Calotte Council – Well-established Nordic Cooperation. Brochure. Available at: http://www.nordkalottradet.nu/Brosjyre/Engelsk.pdf (viewed 6 June 2010).

Thornberry, P. (1994): On Some Implications of the UN Declaration on Minorities for Indigenous Peoples in E. Gayim and K. Myntti (eds.), Indigenous and Tribal Peoples Rights – 1993 and after, University of Lapland.

Toledo, V. M. (2001), “Indigenous Peoples and Biodiversity,” in S. Levin et al. (eds.) Encyclopedia of Biodiversity, vol. 3: 451-463, Academic Press.

Ulvevadet, B. and Klokov, K. (eds.). (2004): Family-Based Reindeer Herding and Hunting Economies, and the Status and Management of Wild Reindeer/Caribou Populations. Centre for Saami Studies. Tromsø.

United Nations (2007): Declaration on the Rights of Indigenous Peoples. New York, 13 September 2007, available at: www.un.org/esa/socdev/unpfii/en/declaration.html (viewed 8 September 2010).

United Nations Economic and Social Council (1989): Study of the Problem of Discrimination against Indigenous Populations. Final Report (supplementary part) submitted by the Special Rapporteur Mr. Jose R. Martinez Cobo, Chapter V, available at

http://www.un.org/esa/socdev/unpfii/documents/MCS_v_en.pdf (viewed 7 September 2010).

United Nations Environment Programme (1992): Convention on Biological Diversity. Rio de Janeiro, 5 June 1992.

United Nations Environment Programme (2009): Convention on Biological Diversity, Programme of Work on Article 8j. Available at: http://www.cbd.int/traditional/pow.shtml (viewed 29 July 2010).

United Nations Environment Programme (2004): Akwe:Kon. Voluntary guidelines for the conduct of cultural, environmental and social impact assessments regarding developments proposed to take place on, or which are likely to impact on, sacred sites and on lands and waters traditionally occupied or used by indigenous and local communities. Secretariat of the Convention on Biological Diversity. Available at http://www.cbd.int/doc/publications/akwe-brochure-en.pdf (retrieved 6 June 2010).

United Nations Environment Programme (2007): Introduction to the Convention on Biological Diversity. Available at: http://www.cbd.int/traditional/intro.shtml (viewed 29 July 2010).

World Bank (2005a): Operational Policy on Indigenous Peoples. Available at: http://web.worldbank.org/WBSITE/EXTERNAL/PROJECTS/EXTPOLICIES/EXTOPMANUAL/0,,contentMDK:20553653~menuPK:4564187~pagePK:64709096~piPK:64709108~theSitePK:502184~isCURL:Y,00.html (viewed 29 July 2010).

World Bank (2005b): Bank Policy 4.10 on Indigenous Peoples. Available at: http://web.worldbank.org/WBSITE/EXTERNAL/PROJECTS/EXTPOLICIES/EXTOPMANUAL/0,,contentMDK:20553664~menuPK:4564187~pagePK:64709096~piPK:64709108~theSitePK:502184~isCURL:Y~isCURL:Y,00.html (viewed 29 July 2010).

Young, O. and Einarsson, N. (2004): Arctic Human Development Report: Introduction. Stefansson Arctic Institute, Akureyri.

5.3 Future scenarios (and corresponding Annex B)

Arctic Monitoring and Assessment Programme (AMAP) (2009): AMAP Assessment 2009: Human Health in the Arctic. Oslo, Norway. xiv+256 pp.

Arctic Marine Shipping Assessment 2009 Report (2009): Arctic Council, April 2009. Available online at: http://www.pame.is/amsa

European Commission (2010): Europe 2020: A strategy for smart, sustainable and inclusive growth. Available at: http://ec.europa.eu/eu2020/index_en.htm (viewed 28 September 2010).

European Environment Agency (2007): Land-use scenarios for Europe: qualitative and quantitative analysis on a European scale. EEA Technical Report No 9/2007. Available online at: http://www.eea.europa.eu/themes/landuse/publications

Intergovernmental Panel on Climate Change (2000): IPCC Special Report Emission Scenarios: Summary for Policymakers. A Special Report of IPCC Working Group III. Available online at: http://www.ipcc.ch/pdf/special-reports/spm/sres-en.pdf

Jäger, J., Rothman, D., Anastasi, C., Kartha, S., & van Notten, P. (2007): GEO Resource Book: A training manual on integrated environmental assessment and reporting,

Training module 6: Scenario development and analysis. p. 20). United Nations Environment Programme.

Millennium Ecosystem Assessment (2005a): Ecosystems and Human Well-Being: Scenarios Volume 2. Island Press. Available online at: http://www.millenniumassessment.org/documents/document.771.aspx.pdf

Millennium Ecosystem Assessment (2005b): Ecosystems and Human Well-Being: Opportunities and Challenges for Business and Industry. World Resources Institute. Available online at: http://www.millenniumassessment.org/documents/document.353.aspx.pdf

Moss, R.H., Babiker, M., Brinkman, S., Calvo, E., Carter, T., Edmonds, J., Elgizouli, I., Emori, S., Erda, L., Hibbard, K., Jones, R., Kainuma, M., Kelleher, J., JLamarque, . F., Manning, M., Matthews, B., Meehl, J., Meyer, L., Mitchell, J., Nakicenovic, N., O'Neill, B., Pichs, R., Riahi, K., Rose, S., Runci, P., Stouffer, R., van Vuuren, D., Weyant, J., Wilbanks, T., van Ypersele, J.P., & Zurek M. (2008): Towards New Scenarios for Analysis of Emissions, Climate Change, Impacts, and Response Strategies. Intergovernmental Panel on Climate Change, Geneva, 132 pp. Available at: http://www.ipcc.ch/pdf/supporting-material/expert-meeting-ts-scenarios.pdf

Moss, R.H., Edmonds, J.A., Hibbard, K.A., Manning, M.R., Rose, S.K., Van Vuuren, D.P., Carter, T.R., Emori, S., Kainuma, M., Kram, T., Meehl, G.A., Mitchell, J.F.B., Nakicenovic, N., Riahi, K., Smith, S.J., Stouffer, R.J., Thomson, A.M., Weyant, J.P. & Wilbanks T.J., (2010): *The next generation of scenarios for climate change research and assessment* in Nature. Vol 463. pp 747-756.

UNEP (2007): Global Environment Outlook: GEO 4. Available at: http://www.unep.org/geo/geo4/media/

UNEP/RIVM (2003): Four scenarios for Europe. Based on UNEP's third Global Environment Outlook. UNEP/DEIA&EW/TR.03-10 and RIVM 402001021. Available at: http://www.unep.org/GEO/pdfs/four_scenarios_europe.pdf

5.4 Conclusion

Addison, R.F., Ikonomou, M.G., and Smith, T.G. (2005): *PCDD/F and PCB in harbor seals (Phoca vitulina) from British Columbia: response to exposure to pulp mill effluents* in Marine Environmental Research, 59(2):165-176.

European Commission (2005): Community Strategy Concerning Mercury. SEC(2005)101.

European Commission (EC) (2009): Support related to the international and Community work on Persistent Organic Pollutants. Updated Synthesis Report. Beratungsgesellschaft für integrierte Problemlösungen.

European Environment Agency (EEA) (2009): European Community emission inventory report 1990–2007 under the UNECE Convention on Long-range Transboundary Air Pollution (LRTAP). No. 8/2009. Available at: http://www.eea.europa.eu/publications/lrtap-emission-inventory-report-1990-2007/at_download/file (viewed 28 June 2010).

European Environment Agency (EEA) (2010): Emission trends of sulphur dioxide. Available at: http://www.eea.europa.eu/data-and-maps/figures/emission-trends-of-sulphur-dioxide-eea-member-countries-eu-27-member-states-2 (viewed 6 October 2010).

Hole, L.R., Christensen, J.H., Ruoho-Airola, T., Tørseth, K., Ginzburg, V. and Glowacki, P. (2009): *Past and future trends in concentrations of sulphur and nitrogen compounds in the Arctic* in Atmospheric Environment, 43(4):928-939.

Hung, H., Lee, S. C., Wania, F., Blanchard, P., and Brice K. (2005): *Measuring and simulating atmospheric concentration trends of polychlorinated biphenyls in the Northern Hemisphere* in Atmospheric Environment, 39:6502–6512.

Letcher, R.J., Gebbink, W.A., Sonne, C., Born, E., McKinney, M.A. and Dietz, R. (2009): *Bioaccumulation and biotransformation of brominated and chlorinated contaminants and their metabolites in ringed seals (Pusa hispida) and polar bears (Ursus maritimus) from East Greenland* in Environment International, 35(8):1118-1124.

Rudloff, B. (2010): The EU as a fishing actor in the Arctic: Stocktaking of institutional involvement and existing conflicts. Working paper, German Institute for International and Security Affairs. Stiftung Wissenschaft und Politik, Berlin.

Smith, S.J., Andres, R., Conception, E. and Lurz, J. (2004): Historical Sulfur Dioxide Emissions 1850-2000: Methods and Results. Pacific Northwest National Laboratory, US Department of Energy.

Zender, C. (2007): Arctic climate effects of black carbon. Written testimony to the Oversight and Government Reform Committee, United States House of Representatives. 18 October 2007.

6 Annexes

Annex A Methodology for the EU- Arctic Footprint

Methodology

Based on the DPSIR (Driving forces, Pressures, States, Impacts, Responses) framework, a well-established framework to analyse the different aspects of environmental problems, the methodology will follow from the understanding that EU member states' activities can affect the Arctic environment mainly in two ways:

1) **EU Production and Consumption:** During consumption and production activities within the EU territory greenhouse gases and other pollutants are set free which have direct or indirect impact on the Arctic environment. Underlying driving forces and pressures originate in the EU.
2) **Arctic Production:** Production of goods within the Arctic which are imported by EU member states cause pollution on the spot. In this case, the driving forces originate in the EU (i.e. EU demand for Arctic products), while the resulting pressure arises in the Arctic.

Note that there is no „double-counting" with this approach. For example, for oil extracted in the Arctic and consumed within the EU, CO_2 emitted within the Arctic during extraction and transportation of the oil is accounted for within the Arctic Production approach, while CO_2 emitted during consumption of Arctic oil within EU territory is accounted for within the EU Production and Consumption approach.

Data sources and calculations

This section outlines the data sources that are expected to contain the required data and proposes a clear procedure based on the list of indicators and the data availability, so far as already known. Furthermore, it elucidates the calculations that have to be made in order to determine the EU's share on the total impact.

EU production and consumption

In the case of the first part of the analysis, the EU consumption and production approach, environmental pressures such as emissions and pollutants occurring within European territory, but having impact on the Arctic region, will be accounted for. Data can simply be taken from supra-national statistical sources.

Greenhouse gas emissions

These are available for all countries from the UNFCCC:

UNFCCC 2009. National greenhouse gas inventory data for the period 1990-2007. FCCC/SBI/2009/12, 21 October 2009.

EPA 2002. Catalog of Global Emissions Inventories and Emissions Inventory Tools for Black Carbon, http://www.cleanairnet.org/caiasia/1412/articles-37073_resource_1.pdf.

Long-range transport pollutants

Data on long-range transport pollutants such as heavy metals, POPs, radioactivity, etc. can be taken from the Arctic Monitoring and Assessment Programme's (AMAP) recent reports and other sources including European and global emission inventories:

AMAP 2002. AMAP Assessment 2002: Persistent Organic Pollutants in the Arctic. Arctic Monitoring and Assessment Programme (AMAP), Oslo, Norway.

AMAP 2006. AMAP Assessment 2006: Acidifying Pollutants, Arctic Haze, and Acidification in the Arctic. Arctic Monitoring and Assessment Programme (AMAP), Oslo, Norway.

AMAP 2009. Arctic Pollution 2009. Arctic Monitoring and Assessment Programme (AMAP), Oslo, Norway.

AMAP/UNEP 2008. Technical Background Report to the Global Atmospheric Mercury Assessment. Arctic Monitoring and Assessment Programme / UNEP Chemicals Branch.

EEA 2009. EMEP/EEA air pollutant emission inventory guidebook – 2009. EEA Technical report No 9/2009, European Environment Agency. http://www.eea.europa.eu/publications/emep-eea-emission-inventory-guidebook-2009.

IIASA Atmospheric Pollution & economic Development program (APD), http://gains.iiasa.ac.at/index.php/home-page.

EDGAR 3.2 Fast Track 2000 dataset, http://www.mnp.nl/edgar/model/v32ft2000edgar/.

EMEP (European Monitoring and Evaluation Programme), http://www.emep.int/.

EMEP Centre on Emission Inventories and Projections, http://www.ceip.at/.

GEIA (Global Emissions Inventory Activity), http://www.geiacenter.org/.

The EU's proportion of the global emissions of these pollutants will be determined. Refinements to these estimates will be made if additional evidence is available (e.g. according to pathways of long-range transport pollutants).

Arctic production

Environmental pressures that occur within the Arctic may arise from EU driving forces (i.e. EU imports of goods and services produced within the Arctic). Therefore these Arctic pressures have to be quantified and related to their respective driving forces.

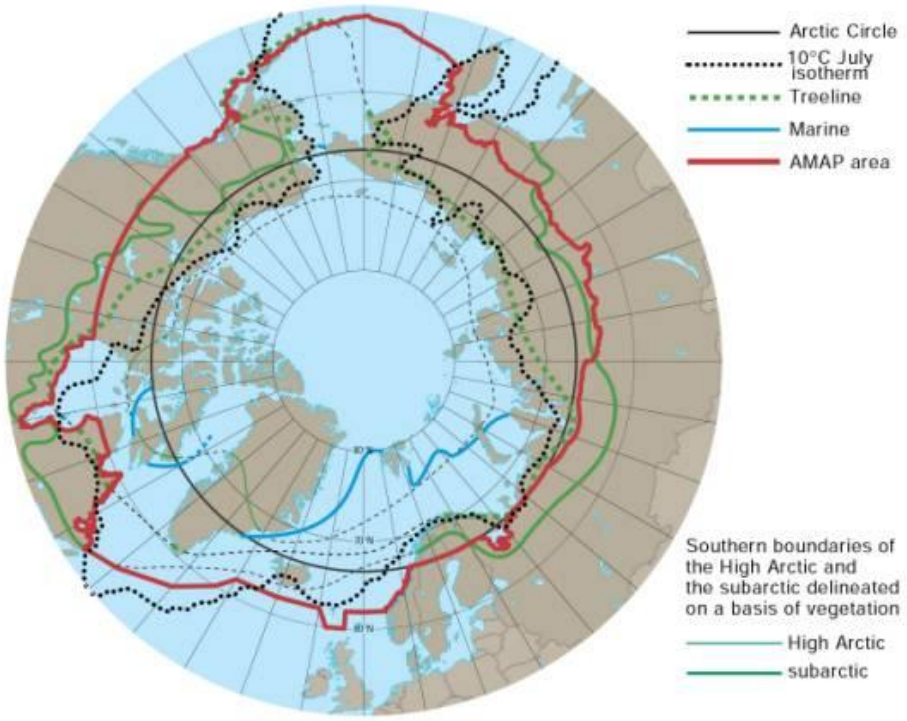
The Arctic economy is dominated by large-scale resource exploitation (e.g., oil, gas, metals, precious stones, timber) and family-based fishing, hunting and breeding activities (see Arctic Human Development Report, 2004). Raw materials and fishery products are mostly exported. The EU is one of the most important trading partners of the Arctic region. This is particularly true for the Eurasian part of the Arctic. To quantify the environmental impacts of these industries, a set of indicators is calculated. Wherever feasible, regional data on the industry level will be collected.

Arctic geography

Regarding the collection of regional data, the definition of the geographic coverage of the Arctic region is of great importance. These definitions vary substantially. Figure 26 shows the

boarders of the Arctic, according to a strictly geographic parameter, the Arctic Circle (the parallel of latitude that runs approximately 66.56083° north of the Equator), and to some scientific parameters (10°C July isotherm, treeline, marine, vegetation). It shows also the AMAP area (Arctic Monitoring and Assessment Programme, a working group of the Arctic Council), which does not correspond to any of the other parameters. The demarcation applied in the literature often considers further political parameters such as regional boarders and related data availabilities (see, e.g., the Arctic Human Development Report 2004).

Figure 26 Arctic geography, various approaches, 2004



Source: AMAP, 2004.

The Study Request defines the regional scope of the study as the Arctic Ocean and the area north of the Arctic Circle. We will try to gather economic and environmental data for the corresponding regions of the countries included, wherever possible. However, definition and coverage of the Arctic region may vary depending on data sources. A potential area of geographic coverage that considers the availability of economic data is shown by this list, based on the scope of the Arctic Human Development Report (AHDP 2004):

USA:	Alaska
Canada:	Yukon
	Northwest Territories
	Nunavut
	Nunavik
	Labrador
Denmark:	Greenland
	Faroe Islands
Iceland:	all
Norway:	Svalbard
	Finnmark
	Nordland

	Troms	
Sweden:	Västerbotten	
	Norrbotten	
Finland:	Lapland	
	Oulu	
Russia:	The republics of	Karelia
		Komi
		Sakha
	The oblasts of	Arkhangelsk
		Murmansk
		Tyumen
		Magadan
	The krais of	Krasnoyarsk
		Kamtchatka
	The autonomous okrugs of	Nenetsia Okrug
		Khantia-Mansia Okrug
		Yamalia Okrug
		Novaya Zemlya
		Taymyr
		Evenk
		Koryak
		Chukotka Okrug

Data sources

A large spectrum of economic and environmental data is regularly reported by National Statistical Institutes. System boundaries are usually defined according to national and regional borders/territories. The Arctic is by definition not a nation but rather a geographic region including parts of various countries but also international waters, as explained before. Especially data regarding the production of goods and the amount of waste and emissions produced in the Arctic need to be collected from various national and supra-national sources at a regional scale and re-combined in order to estimate the overall values for the region. The availability of data, however, is often limited to the national scale.

We certainly will obtain data for the exploitation of oil and gas, but it will be more difficult for other mineral resources, timber and fish production, and local emissions of pollutants like heavy metals and greenhouse gases. Data sources that will be used include:

Extraction of oil and gas

International Energy Agency, http://www.iea.org/

IHS Energy, http://energy.ihs.com/

US Energy Information Administration, http://www.eia.doe.gov/

Canadian National Energy Board, http://www.neb.gc.ca/

Norwegian Petroleum Directorate, http://www.npd.no/en/

AMAP 2007. Arctic Oil and Gas. Arctic Monitoring and Assessment Programme (AMAP), Oslo, Norway.

Extraction of metals and other minerals

US Geological Survey (USGS), http://www.usgs.gov/

British Geological Survey (BGS) 2009. World Mineral Production 2003-2007, http://www.bgs.ac.uk/

Extraction of timber and fish

FAOSTAT (Statistics Division of the Food and Agriculture Organization of the United Nations), http://faostat.fao.org/

FAO ForesSTAT, Forestry Statistics, http://faostat.fao.org/site/630/default.aspx

FAO Fisheries and Aquaculture Department, FishStat Plus, http://www.fao.org/fishery/statistics/software/fishstat/en

GHG emissions

UNFCCC 2009. National greenhouse gas inventory data for the period 1990-2007. FCCC/SBI/2009/12, 21 October 2009.

IIASA Atmospheric Pollution & economic Development program (APD), http://gains.iiasa.ac.at/index.php/home-page.

EDGAR 3.2 Fast Track 2000 dataset, http://www.mnp.nl/edgar/model/v32ft2000edgar/.

EMEP Centre on Emission Inventories and Projections, http://www.ceip.at/.

Emissions of toxic pollutants

AMAP 2002. AMAP Assessment 2002: Persistent Organic Pollutants in the Arctic. Arctic Monitoring and Assessment Programme (AMAP), Oslo, Norway.

AMAP 2006. AMAP Assessment 2006: Acidifying Pollutants, Arctic Haze, and Acidification in the Arctic. Arctic Monitoring and Assessment Programme (AMAP), Oslo, Norway.

AMAP 2009. Arctic Pollution 2009. Arctic Monitoring and Assessment Programme (AMAP), Oslo, Norway.

In the case of emission to air, data for the Arctic may be derived from global gridded emissions inventories, if not available from other sources. The feasibility of this approach has to be discussed within the team and with external experts. Also national sectoral averages of emissions per output combined with regional production data can be used for deriving these indicators. For reasons of consistency and the problem of differing technologies within the Arctic region we refrain from calculating indicators by using a life cycle assessment approach, as originally suggested in the proposal as one possibility, as far as other data sources are available.

Data on shipping and fishing activities will be taken mainly from reports and data bases provided by the several working groups of the Arctic Council. The EU's share in shipping activities will be estimated using trade data, considering the flag of the ships cruising the Arctic, or using data on ownership. Information on tourism and infrastructure (i.e. number of tourists, km of pipelines and streets) was not found yet by the project team. Further research will be done and data will be included to the extent possible.

Shipping and fishing activities

AMSA (Arctic Marine Shipping Assessment), http://www.pame.is/amsa

Norwegian Maritime Directorate 2000. PAME –Snap Shot Analysis of Maritime Activities in the Arctic, REPORT NO. 2000-3220, http://www.pame.is/images/stories/PDF_Files/AMS/Snapshot_analysis_final.pdf

AMSA 2006. North meets North. Navigation and the Future of the Arctic. Technical Report, Ministry for Foreign Affairs, Iceland, original version issued in February 2005, http://archive.arcticportal.org/253/01/North_Meets_North_netutg.pdf

Icelandic Government 2007. Breaking the Ice: Arctic Development and Maritime Transportation. In: Conference Report, Akureyri, http://www.mfa.is/media/Utgafa/Breaking_The_Ice_Conference_Report.pdf

ArcticData, Marine Activity Databases, http://www.arcticdata.is/data-download/category/13-country-databases

If no regional data is available, several approximation approaches come into question. In the case of the development of mineral resources, for example, regional sectoral output data can be used as a proxy to estimate the regionally caused environmental pressures. Therefore, an important task is to ascertain regional economic data. In some cases, these will be estimated, based on national data and additional information from the literature and expert interviews.

Regional production data

ArcticStat, http://www.arcticstat.org/

National Statistical Institutes

OECD, Statistics Portal, Organisation for Economic Co-operation and Development, http://www.oecd.org/statsportal/0,3352,en_2825_293564_1_1_1_1_1,00.html

OECD, Input-Output Tables 2009 edition, http://www.oecd.org/sti/inputoutput/

Expert interviews

Based on the prior collected data, the EU's share of the total environmental impacts on the Arctic region can be calculated for each environmental category. For this, however, data on traded goods from the Arctic to EU countries are indispensable. Only in a few cases are regional trade data available (i.e. Canada). Thus, a crucial element is to estimate regional trade based on national trade data and other sources.

Regional trade data

ArcticStat, http://www.arcticstat.org/

National Statistical Institutes

OECD, Statistics Portal, Organisation for Economic Co-operation and Development, http://www.oecd.org/statsportal/0,3352,en_2825_293564_1_1_1_1_1,00.html

OECD, STAN Bilateral Trade Database, http://www.oecd.org/sti/btd

United Nations Statistics Division (UNSD), UN Comtrade database, http://comtrade.un.org/

Expert interviews

In addition, economic data will be analysed to determine the EU's impact on socio-economic conditions and sustainable livelihoods.

Socio-economic data

ArcticStat, http://www.arcticstat.org/

National Statistical Institutes

Duhaime, G. et al. 2004. Economic Systems. Arctic Human Development Report 2004, Chapter 4. Akureyri: Stefansson Arctic Institute.

Arctic Social Indicators, http://www.svs.is/ASI/ASI.htm

Annex B AFPA Scenario workshop description and list of participants

AFPA Scenario Development Workshop

The one-day EU Arctic Footprint expert stakeholder workshop took place on 14 April 2010 at the offices of Ecologic Institute and IEEP in Brussels, Belgium. The event was attended by 16 stakeholders with expertise in a broad range of relevant issue areas and several members of the project team. A list of workshop participants is included in Annex B. The following section provides a brief summary of the workshop's activities and main outputs.

Workshop overview

The scenario development process followed in the workshop was based broadly on the scenario development process outlined by the Global Environment Outlook (GEO) Resource Book, as described above. Information on the scenario development process and a literature review of existing relevant scenarios was distributed to all participants to guide discussion during the workshop.

The workshop began with a remote presentation from Dr. Lawson Brigham, Distinguished Professor at the University of Alaska Fairbanks and Chair of the Arctic Council's 2009 Arctic Marine Shipping Assessment (AMSA), on the AMSA scenario creation process. This first session was dedicated to clarifying the purpose and structure of the EU Arctic Footprint scenario exercise. Next, the group identified the trends and dynamics driving the future of the EU's Arctic footprint. The idea was to freely brainstorm at first, without weighing which driving force may be more or less relevant. Later, each participant was asked to cast his or her votes on the most salient of the key drivers on the list.

The next session began in plenary, with a clustering and consolidating of the driving forces which received the most votes. Using the 'short list' of driving forces, small groups then mapped those driving forces along the axes of "importance" and "uncertainty". The session concluded with each group briefly presenting which two driving forces they found most important and uncertain – the so-called "critical uncertainties".

Based on the group presentations, consensus formed around the two most critical uncertainties shaping the future EU footprint in the Arctic. These two – climate change and governance – were plotted along two axes, creating four scenarios of the future. The remaining time was dedicated to defining the poles of the axes and sketching the outstanding characteristics of the scenarios created by their intersection.

Workshop results

The following subsections present the raw material produced by the workshop exercises. This includes the driving forces and critical uncertainties identified by the participants, a list of variables which should feature in the scenario storylines, and further explanation of how this material was used in developing the resulting storylines.

Driving forces

Table 3, below presents the 'short list' of driving forces that received the highest number of votes from participants. These were clustered and consolidated into a short list of succinct terms, in order to simplify the participants' subsequent task of selecting critical uncertainties.

Table 3 Clustering of driving forces into a 'short list'

DRIVING FORCES [# OF VOTES RECEIVED]	'SHORT LIST': DRIVING FORCE CLUSTERS
Rivalry (geopolitics / resources) [5]	**Rivalry / geopolitics**
Development of governance [7]	**Governance**
Respect for indigenous populations [4]	
EU impact on global environmental policy [5]	
EU-RF relations [2]	
EU accession of coastal zones [3]	
Demand for energy [6]	**Non-renewable resources**
Energy technology [5]	
(Consumer) lifestyles [5]	
Resource prices [10]	
Access to resources [8]	
Biodiversity change [5]	**Biodiversity**
Maritime transport patterns [6]	**Maritime transport**
Population changes, migration (indigenous / non-indigenous) [7]	**Demographic change (employment)**
Land use change [2]	
Pollution: LRTP, radioactivity, chemicals [5]	**Pollution**
Permafrost melting [4]	**Climate change (impacts)**
Retreat of sea ice [8]	
EU emissions of GHG (CO_2, …) [1]	
Sea level rise [3]	
Fisheries - changing fish stocks [3]	**Renewable resources (fish, forests)**
Demand for Arctic tourism (recreational activities) [unknown]	**Tourism**

Critical uncertainties

From the 'short list' of driving forces, four small groups produced maps to determine which two driving forces were the most critical and uncertain (note: two small groups produced one map). Three of the four small groups arrived at roughly the same two critical uncertainties.

Although one of the groups selected a different set of uncertainties, consensus was reached in plenary to use "climate change" and "governance" to form the axes of the scenario framework. However, in the interest of encompassing the full range of policy and regulatory challenges identified by the workshop participants, the project team re-labelled the "governance" axis "management". The definition of the framework's poles is retained, but indications of value judgement are removed to the extent possible (i.e. that one pole is "positive" and its opposite is "negative").

List of variables

Each of the following variables will differentiate the four scenario narratives, with emphasis placed on their relevance to the EU:

1) Arctic governance – How does it function, what is its composition, have alternative fora to the Arctic Council emerged?
2) EU and the Arctic – What is the nature of the EU's influence in the Arctic, how is its role viewed by others?
3) Local and indigenous peoples – What is their role in Arctic relations, how are they treated, how are they faring?
4) EU Arctic footprint(s) – What does the EU's environmental footprint in the Arctic look like, along both climate and non-climate indicators? How has EU economic growth and regulatory ambition changed?
5) Technology – How has it developed, what is the size and character of its impact?
6) Energy economy – What is the status of both the global and the Arctic energy economy? What is access to resources like?
7) Values and attitudes – How has consumer behaviour changed and what are its impacts? What is the nature of spiritual values, how wide-spread are they, and how influential?

Using the workshop results to develop scenarios

The following section describes how the project team utilised the material produced by stakeholders at the workshop to elaborate a set of four future scenarios of the EU's environmental footprint in the Arctic.

Themes, targets, indicators, and potential policies

The following table outlining the themes, targets, indicators, and potential policies reflects feedback from stakeholders and discussions at the workshop. An upward arrow indicates increase or improvement, a downward arrow reduction, and a sideways arrow maintenance or achievement of a given state or trend.

Table 4 Themes, targets, indicators, and potential policies

THEME	TARGET(S) "SUCCESS IN 2030"	INDICATORS	POTENTIAL POLICIES
Shipping / Transport	→ Safe marine transport system	Rates of incidents/fatalities at sea (numbers of collisions, allisions, groundings) Emissions of CO_2, black carbon, nitrous oxide, degassing	↑ Existing policies improved → ↑ New policies close gaps ↓ Problematic policies
Non-renewable Resources	↓ Extraction of hydrocarbons/ non-renewable resources → Affordable energy / resources	Extraction of minerals, oil and natural gas Energy economy of the Arctic, of the EU, of the world Energy prices Changes in protected areas	↑ Existing policies improved → ↑ New policies close gaps ↓ Problematic policies
Local and Indigenous Peoples	→ Sustainable livelihoods / indigenous rights ↑ Human health in at risk populations	Social and economic welfare / prosperity Level of political self-determination and development of capacity Participation and impact on decision-making in issues of Arctic governance and climate change adaptation Outmigration	↑ Existing policies improved → ↑ New policies close gaps ↓ Problematic policies
Biodiversity (marine and terrestrial ecosystems) and renewable resources	→ ↑ Biodiversity, ecosystem health and ecosystem services → Sustainable use of renewable resources	Ecosystem health Rate of biodiversity loss Stability of fish stocks Fish capture production by region in the North Atlantic and Arctic Oceans Rates of timber exploitation (and percentage harvested by sustainable forest management principles) Change in migration patterns Arctic Species Trend Index Changes in protected areas	↑ Existing policies improved → ↑ New policies close gaps ↓ Problematic policies

THEME	TARGET(S) "SUCCESS IN 2030"	INDICATORS	POTENTIAL POLICIES
		Healthy populations of animals and plants critical to local cultures and subsistence Globally important regulatory services, such as carbon storage Maintenance of aesthetic and spiritual value of landscapes and local environments	
Climate change	→ Capacity to adapt to climate change → Non-catastrophic climate change ↓ Emissions, long-range / chemicals ↑ Resilience and adaptability to climate change	Emissions of CO2, black carbon, methane, nitrous oxide Sea Ice Index Locally relevant adaptation strategies (including links to regional and national adaptation strategies, as well as to adaptation strategies within specific sectors)	↑ Existing policies improved → ↑ New policies close gaps ↓ Problematic policies
Tourism	→ Pollution-free Arctic activity	Disruption of ecosystems / wildlife attributed to tourist activity Portion of emissions attributed to Arctic expeditions / tourist activity	↑ Existing policies improved → ↑ New policies close gaps ↓ Problematic policies
Pollution	↓ Emissions, long-range transport pollutants ↓ Levels of pollutants in biota, including important food sources and animal species at risk ↓ Levels of pollutants in human tissue ↑ Human health in at risk populations	Emissions of POPs, black carbon, mercury, cadmium Contaminant levels in top predators and in important food sources	↑ Existing policies improved → ↑ New policies close gaps ↓ Problematic policies
Sustainable livelihoods (in EU and Arctic)	↑ Jobs and trade → Affordable energy / resources ↑ Public environmental	Employment rate, average income Nature and prevalence of values and attitudes, consumer trends	↑ Existing policies improved → ↑ New policies close gaps ↓ Problematic

THEME	TARGET(S) "SUCCESS IN 2030"	INDICATORS	POTENTIAL POLICIES
	concern ↑ Resilience and adaptability to climate change		policies
International relations / governance of the Arctic	→ Effective multilateral cooperation ↑ Environmental governance	Level of (perceived) accountability, transparency, legitimacy of governance system for the Arctic EU role in the Arctic (how it is viewed by others, financial contributions, Arctic research) Change in political climate Flexibility of policy response	↑ EU role in Arctic governance
Technology	↑ Accessibility to state of the art technology ↑ Efficiency of resource extraction and use	Distribution of newest technologies	↑ Existing policies improved → ↑ New policies close gaps ↓ Problematic policies

Themes and driving forces

Using the themes from the above table, the project team matched the driving forces identified at the workshop with their relevant themes. The table below presents the driving forces identified at the workshop, divided into three tiers. Tier 1 is made up of the driving forces which received the most votes from participants and were subsequently clustered and consolidated into a 'short list' (see Table 3: Clustering of driving forces into a 'short list', above). Tier 2 includes driving forces that received fewer votes. And Tier 3 comprises driving forces that received no votes, but will nonetheless be useful for rounding out the scenario storylines. The third column reflects discussions at the workshop to describe assumptions about the future development of the driving forces. The driving forces and assumptions about their development will be used to populate the scenario narratives and to ensure that they incorporate all of the themes identified for this scenario process.

Table 5 Themes, drivers, and assumptions about their development assuming 'Business as Usual'

THEMES	TIER	DRIVERS	ASSUMPTIONS ABOUT DEVELOPMENT
Shipping / Transport	**I**	**Maritime transport patterns**	Increasing rapidly in relation to Arctic resource exploitation; less quickly in relation to trans-Arctic transport Transport of oil in the Arctic region is likely to increase, making spills a greater possibility[490]
	II	Consumption patterns	Growing in the short term and gradually declining in the long term
Non-renewable Resources	**I**	**Demand for energy**	Expected to continue to grow
		(Consumer) lifestyles/preferences	Increasing level of consideration for environmental impacts, but actual behaviour change is uncertain as level of resource consumption continues to increase with growing economic wealth
		Resource prices	Fluctuating, possibly rising. Yet, due to increasingly easy access and use of modern technology, the market could be provided with a stable resource supply, thus reducing the fluctuating capacity of resource prices
		Access to resources	Increasing access to maritime resources (oil / gas).[491] Near-shore facilities construction already in progress. For the time being, lack of price-efficient technology to actually extract resources far offshore, but in the long run, also possible.
	II	Energy security concerns	EU's dependence on Russia's supply will probably increase. Russia's policies and regulation will probably have negative environmental impacts.
		New energy sources outside Arctic	Increasing availability of renewable energy, non-conventional oil and tar sands due to dwindling conventional oil reserves.
		Energy demand in the EU and the Arctic	Likely to increase, but the mitigation policies of the EU do not foster increased or accelerated use of fossil fuels

[490] AMAP, 2009, p. 17.
[491] 'Oil and gas exploration, extraction, and shipping are all likely to increase dramatically over the next 20 years based on the increasing demand for oil and gas worldwide combined with more interest in and access to Arctic resources' (AMAP, 2009, p. 16).

THEMES	TIER	DRIVERS	ASSUMPTIONS ABOUT DEVELOPMENT
		Russian difficulties to deliver	Difficulties may arise because of insufficient maintenance of infrastructure and the usage of old pipelines. Moreover, Russia's lack of stringent implementation of environmental standards may lead to difficulties
	III	*Search for resources*	*Fast development of oil and gas – onshore and near offshore facilities are already being developed; unlikely to happen far offshore in the near future*
		Renewable energy in the Arctic	*Possibly will increase because of climate change mitigation policies*
		Energy efficiency	*Possibly will increase because of climate change mitigation policies*
		National licensing policy for oil and gas (Russia))	*Supporting fast development of exploitation and export* *Although stricter regulations are expected in the future, oil and gas supply and the opening of new extraction areas are more likely to be determined by financial constraints are. However, licensing policies are likely to improve also because of EU pressure and other policy dimensions influencing licensing policies.*
Local and Indigenous Peoples	**I**	**Respect/support for indigenous populations**	Slowly advancing, also in the area of land rights. Russia potentially the only exception. Culture, livelihood and traditional practices will, however, gradually become gloomy.
		Population changes, migration/mobility patterns (indigenous / non-indigenous), labour market	Population change and migration in the North is developing differently in different areas. Rapid industrialisation, mining and mineral activities, tourism, etc. are expected to cause economic flow, migration and diminishing of traditional identity of the indigenous peoples. Rapid globalization is expected.
	II	Capacity of the communities in the North	Communities in different regions experience different difficulties. Generally, depopulation might hinder communities from utilizing their potentially acquired impact on decision-making processes.
		Environmental accidents	With increasing population, environmental health is increasingly degraded because of pollution, unsustainable land use etc. On the other hand, potential major environmental disasters such as oil spills, etc. may have great impact on the local population and are likely to increase with increasing resource extraction.

THEMES	TIER	DRIVERS	ASSUMPTIONS ABOUT DEVELOPMENT
Biodiversity (marine and terrestrial ecosystems) and renewable resources	**I**	**Biodiversity change**	Loss is increasing; Johannesburg targets have not been met; pressures are increasing.[492].Possibly increasing loss of biodiversity in the future, also strongly influenced by climate change.
		Changing fish stocks	Declining Likely to change because of overfishing, salinity and temperature changes. Global demand expected to increase as fish stocks in other parts of the world become depleted and global demand increase.
	II	Conservation policies	Likely to become stricter and more coherent in the EU than elsewhere.
		Overharvesting – marine and terrestrial	Visible regional differences; in some areas conservation measures potentially effective, in others overharvesting more severe
		Species change and affects on ecosystem services	Due to climate change, "traditional" ecosystem services are in jeopardy in the future. Risk for regime shifts, i.e. rapid changes that alter the dynamics of the whole ecosystem
		Animal welfare	Increase as people in US and Europe increasingly feel species are threatened by climate change and habitat loss.
		Global migratory linkages (marine mammals, birds)	Patterns are likely to change because of loss of sea-ice and biodiversity changes. Gradual increase of modifications of migratory patterns
		Invasive species	Likely to increase, unless problem is tackled efficiently
		Environmental accidents	Likely to increase with increasing economic activity
	III	*Ocean acidification*	*Very likely to increase, with risk of threshold effects on biodiversity*
		Government recognition of ecosystem services / integration into economy	*Increasing recognition of cost of inaction*
		Forests	*Under increasing pressure*
		EU subsidies to agriculture	*Increasing*

[492] GEO 3, 2002.

THEMES	TIER	DRIVERS	ASSUMPTIONS ABOUT DEVELOPMENT
Climate change	I	**Permafrost melting (including speed and feedback and impact of infrastructure development)**	Melting will go on slowly but at an increasing rate. Sudden, rapid and widespread melt down is possible. As permafrost melts, impacts increase with development of infrastructure to support Arctic resource extraction
		Retreat of sea ice	Increasing
		Sea level rise	Increasing
		EU emissions of GHG (CO_2, ...)	Two trends: Strict climate policy, but uncertainty as to whether it is effective
	III	*Ocean acidification (esp. if thresholds are crossed)*	*Very likely to increase, with risk of threshold effects on biodiversity*
		Changing trade winds and ocean currents	*Likely to increase as climate change increases, especially if thresholds are exceeded*
Tourism	I	**Demand for Arctic tourism**	Developing quickly
	III	*Spiritual need / yearning for wilderness experience*	*Developing quickly, with potential for further increase*
Pollution	I	**Pollution: LRTP, radioactivity, chemicals**	Increasing; Industry is likely to produce new compounds that will need to be regulated.
	II	International chemicals policy, esp. towards new chemicals	Increasing global cooperation to limit emissions, but difficulties addressing some sources, especially emissions from developing countries and re-emissions from previously deposited pollutants.
		Environmental accidents	The US incident in the Gulf of Mexico will perhaps have an influence on Arctic oil and gas extraction plans
	III	*Mercury negotiations (could affect CO_2)*	Increasing due to historical emissions still circulating in environment and rise of emissions in Asia.
		Ozone layer	*Continued recovery, but with some risk for setbacks because of interactions with climate change. Will likely remain stable.*
		Litter (in water and washed ashore by Gulf Stream)	*Differs from region to region (no data available for Arctic waters)* *Likely to increase with increasing marine traffic* *Demands for effective implementation of OSPAR convention*
Sustainable livelihoods (in EU and Arctic)	I	**Population changes, migration/mobility patterns (indigenous / non-indigenous), labour market**	EU likely to be larger in 2030 (more member states) Depopulation in rural areas and rising major cities populations In rural areas, mostly non-indigenous population is likely to move southward, but in the Arctic region as

THEMES	TIER	DRIVERS	ASSUMPTIONS ABOUT DEVELOPMENT
			a whole, the ratio is likely to shift towards a larger non-indigenous population
		Arctic land use change	Rapid industrialisation, mining and mineral activities, tourism, etc. will cause economic flow, migration and diminishing of traditional identity of the indigenous peoples. Rapid globalisation is expected. More conflicts between forestry, reindeer herding, conservation and mining; in the marine areas, conflicts between fisheries and extraction industry.
	III	*Climate change education (in the EU)*	Increasing
International relations / governance of the Arctic	**I**	**Development of governance (regime)**	Slow rate of development (and potential rift between coastal states and non-coastal states of Arctic Council)
		Rivalry / geopolitics	Open conflict not likely before the end of Law of the Sea convention process for continental shelf demarcation. Recent first step to resolution of Shtokman area issue between Norway and Russia shows rather cooperative attitude.
		EU impact on global environmental policy	Possibly increasing as climate change impacts increase and EU policy measures prove effective
		EU - Russian Federation relations	Possibly increasingly based on bilateral or multilateral agreements, rather than EU-Russia relations
	II	Change of mandate of Arctic Council (and EU role)	Trend toward more decision-making power is unlikely. Arctic Council is more of a forum of communication and advice than a decision-making body. Unlikely that littoral Arctic states would want Arctic Council to gain more power (cf. Ilulissat Declaration 2008)
		EU climate policy – influence on global regime	Possibly increasing as climate change impacts increase and EU policy measures prove effective
		China's economic development	Likely to increase and correlate with more weight in Arctic politics
		Weight of indigenous peoples rights arguments in international politics	Slowly increasing

THEMES	TIER	DRIVERS	ASSUMPTIONS ABOUT DEVELOPMENT
		Role of non-Arctic countries	Increasing
		Changing focus of EU from North to South	EU dynamics change with each accession
		EU companies operating in the Arctic	Likely increasing
	III	*US (and Canadian) support of EU involvement in Arctic*	*Not very strong and unlikely to increase. The more power the EU gains in the Arctic, the stronger the resistance, esp. from Canada (e.g. because of Northwest Passage)*
		Trade law (environmental restrictions)	*EU legislation on environmental ground probably will pose a challenge to trade law, which will likely cause some uncertainty.*
		Military security/incidents	*Might be sporadic, but unlikely to be serious*
		Devolution (not only in Greenland	*Gradually increasing*
		Trust in political institutions	*Fluctuates, could possibly decline*
		Science-policy interface	*Slowly gaining coherence*
		China's Arctic policy	*Likely to become increasingly important, because of trade routes (Northern Sea Route).* *Increase in Arctic research expeditions and increasing investments in developing polar technology (e.g. ice breakers).*
		Emergence of new alliances	*Likely, but subject to volatility of political events*
		Russian Arctic policy	*Expected to be stronger in the future. Currently, focus is increasingly on resources, but potential that this will change in the long term (question of Northern cities and environmental issues).*
		The structure of participation in policy-making (NGOs, IPs, industry, etc.)	*Gradually becoming more participatory and transparent*
Technology	**I**	**Energy technology (e.g. alternative, non-Arctic energy sources)**	Steadily developing, perhaps more quickly as climate change impacts increase and if oil spills become more frequent and severe
	III	*New / groundbreaking technologies (e.g. transport technology (fossil/non-fossil), like stern-first ice breakers))*	*Becoming increasingly important as oil prices rise. If there is a drop in oil prices, more focus will be on extraction of oil/gas in the Arctic than on new technologies. New technologies need time to develop and to be accepted by businesses and*

THEMES	TIER	DRIVERS	ASSUMPTIONS ABOUT DEVELOPMENT
			peoples.

Elaborating scenario narratives

Working with the scenario framework defined by the workshop participants, the project team elaborated a set of four future scenarios considering the themes and driving forces in the tables above.

One of the key challenges of the workshop was to brainstorm freely on driving forces and at the same time maintain a focus on the EU's environmental footprint in the Arctic, due largely to the novelty of the task at hand – namely, to consider the impact of one region on another specific region. As a result, the scenario framework produced by the workshop is focused primarily on the future of the Arctic. This provides a very solid basis for the scenarios to be developed in this project, but given that the ultimate function of the scenarios is to inform a policy analysis, the project team will highlight the implications for EU environmental and Arctic policy. Many of the themes and driving forces identified in the tables above –which will also appear in the scenario narratives – bring attention to issues relevant to the EU and its environmental and Arctic policy. In order to ensure that this dimension receives emphasis, each scenario includes details on how economic growth in the EU (whether larger or smaller) and level of regulatory ambition in the EU (whether higher or lower) interact with the prevailing Arctic trends in the scenario to impact the EU's environmental footprint in the Arctic (either increasing or reducing it). Conclusions from past scenario exercises – especially the Arctic Marine Shipping Assessment – inform the storylines.

List of workshop participants

14 April 2010 | EU Arctic Footprint Expert Stakeholder Workshop | Brussels

Ecologic Institute

Quai au Foin 55, 1000 Brussels

No.	Last Name	First Name	Organization
1	Barry	Tom	Conservation of Arctic Flora and Fauna Working Group of the Arctic Council
2	Best	Aaron	Ecologic Institute
3	Bianco	Nauja	Nordic Council of Ministers
4	Bock	Nikolaj	European Environment Agency
5	Brigham	Lawson	University of Alaska Fairbanks
6	de Korte	Jacobus	Oceanwide Expeditions
7	de Roo	Colette	Ecologic Institute
8	Dux	Thomas	European Commission - DG Maritime Affairs & Fisheries
9	Hermanson	Mark	University Centre in Svalbard (UNIS)
10	Kraemer	R. Andreas	Ecologic Institute
11	Ma	Mandy	Ecologic Institute
12	Minaeva	Tatiana	Wetlands International
13	Neumann	Antje	German Institute for International and Security Affairs
14	Nilsson	Annika	Stockholm Environment Institute (SEI)
15	O'Carroll	Kevin	UK Department of Energy and Climate Change (DECC)
16	Polzin	Christine	Sustainable Europe Research Institute (SERI)
17	Reiersen	Lars-Otto	Arctic Monitoring and Assessment Programme (AMAP)
18	Reynolds	Jaime	European Commission - DG Environment
19	Sander	Gunnar	Norwegian Polar Institute
20	Santer	Elena	European Environment Agency
21	Stepien	Adam	University of Lapland - Arctic Centre
22	Stoessel	Susanah	Ecologic Institute
23	Väyrynen	Raimo	University of Lapland
24	Wassmann	Paul	University of Tromsø

Annex C Detailed description of policies in Section 2

The following presents a detailed description of EU policies and multilateral agreements for each issue area covered in Section 2: biodiversity, chemicals, climate change, energy, fisheries, forestry, tourism transport, and Arctic indigenous and local livelihoods.

Biodiversity

EU policies

Existing EU legislation include the Habitat Directive and the Bird Directive, which form the cornerstone of Europe's nature conservation policy. The Habitat Directive is built around a strict system of species protection and the Natura 2000 network of protected areas.

Directive 2009/147/EC[493] of the European Parliament and of the Council of 30 November 2009 on the Conservation of Wild Birds ensures far-reaching protection for all of Europe's wild birds, identifying 194 species and sub-species among them as particularly threatened and in need of special conservation measures. Components to this scheme include that Member States are required to designate Special Protection Areas (SPAs) for particularly threatened species and all migratory bird species. SPAs are part of the Natura 2000 ecological network set up under the Habitats Directive 92/43/EEC. A second component bans activities that directly threaten birds, such as the deliberate killing or capture of birds, the destruction of their nests and taking of their eggs, and associated activities such as trading in live or dead birds (with a few exceptions). A third component establishes rules that limit the number of bird species that can be hunted and the periods during which they can be hunted. It also defines hunting methods which are permitted.

The Habitats Directive 92/43/EEC[494] was adopted in 1992. The main aim of this Directive is to promote the maintenance of biodiversity, taking account of economic, social, cultural and regional requirements. While the Directive makes a contribution to the general objective of sustainable development; it ensures the conservation of a wide range of rare, threatened or endemic species, including around 450 animals and 500 plants. Some 200 rare and characteristic habitat types are also targeted for conservation in their own right. The Directive provides for a ban on the downgrading of breeding and resting places for certain strictly protected animal species. The Habitats Directive also establishes the EU wide Natura 2000 ecological network[495] of protected areas. For these areas it provides a high level of safeguards against potentially damaging developments.

Multilateral Environmental Agreements

The following table presents the major biodiversity-related multilateral agreements and their objectives.

[493] European Council, 2009.
[494] European Council, 1992.
[495] For details, see European Commission: Environment, 2010.

Table 6 Major biodiversity-related multilateral agreements and their objectives

Multilateral agreement	Objectives	Status in relation to EU
Convention on Biological Diversity (CBD)	the conservation of biological diversity, the sustainable use of its components and the fair and equitable sharing of the benefits arising out of the utilization of genetic resources, including by appropriate access to genetic resources and by appropriate transfer of relevant technologies, taking into account all rights over those resources and to technologies, and by appropriate funding.[496]	EU is party to CBD and its Cartagena Protocol on Biosafety[497]
Convention on International Trade in Endangered Species and Wild Fauna and Flora (CITES)	to ensure that international trade in specimens of wild animals and plants does not threaten their survival[498]	Although the EU is not yet a Party to CITES, its provisions have been implemented in Community law since 1982, when the first Community-wide legislation implementing the Convention entered into force.[499]
Convention on Wetland of International Importance (RAMSAR)	to maintain the ecological character of their Wetlands of International Importance and to plan for the "wise use", or sustainable use, of all of the wetlands in their territories." The wise use of wetlands is defined as "the maintenance of their ecological character, achieved through the implementation of ecosystem approaches, within the context of sustainable development".[500]	Trends in nomination of RAMSAR sites listed as indicator of biodiversity in EU's biodiversity action plan.[501]
Bonn Convention on the Conservation of Migratory Species of Wild Animals (CMS)	to conserve terrestrial, marine and avian migratory species throughout their range. CMS Parties strive towards strictly protecting migratory species threatened with extinction, conserving or restoring the places where they live, mitigating obstacles to migration and controlling other factors that might endanger them. [502]	Approved on behalf of the European Economic Community, 1982.[503]

Chemicals and transboundary pollution

Use and emission of POPs are regulated at the global level by the Stockholm Convention on Persistent Organic Pollutants, which went into force in 2004. The European Council approved the POPs convention in 2004.[504] The Stockholm Convention explicitly acknowledges that "... Arctic ecosystems and indigenous communities are particularly at risk"

[496] Convention on Biological Diversity, Article 1.
[497] European Commission, Global biodiversity, online.
[498] CITES, online.
[499] European Commission. The European Community and trade in wild flora and fauna, online.
[500] Ramsar Convention on Wetlands, The Ramsar Convention and its mission, online.
[501] European Commission, 2006, p. 13.
[502] Convention on Migratory Species, Introduction to the Convention on Migratory Species, online.
[503] European Council, 1982.
[504] Stockholm Convention on Persistent Organic Pollutants ,Status of Ratification, online.

and has also identified the Arctic as an indicator region, i.e. that occurrence of chemicals in the Arctic can be evidence of their ability for long-range transport and environmental persistence.[505] In addition, the POPs Protocol of the UN-ECE agreement on Long-Range Transboundary Air Pollution provides regulation within the UN-ECE sphere. [506]

EU policies

Chemicals

REACH requires manufacturers and importers to gather information on the properties of their chemical substances, provided that certain volumes of the substances are placed on the EU market, and to register the information in a central database run by the European Chemicals Agency (ECHA) in Helsinki. Safety screening and registration takes place in three stages, based on volumes that are imported or produced (higher volumes= higher priority) and on risks. Highly hazardous substances that will be assessed in priority within the first three years are focusing on compounds that are *CMRs* (carcinogenic, mutagenic or toxic to reproduction), *PBTs* (persistent, bio-accumulative and toxic), *vPvBs* (very persistent and very bio-accumulative) and other substances "of equivalent concern." The assessments made by industry will be used to prepare proposals for restriction and authorization. If a company fails to register a substance, this company will no longer be allowed to manufacture or import the substance.

One goal of the legislation is to replace hazardous chemicals with safer alternatives. The most toxic substances (PBTs and vPvBs) are to be replaced whenever safer alternatives are available at an acceptable socio-economic cost. This means that the health and environmental benefits of withdrawing the substance outweigh those of keeping it on the market (for example in terms jobs or if they cannot be readily replaced). Conditions are less stringent for carcinogens and mutagenic chemicals**,** which will be authorised if producers can show that the risk they pose can be "adequately controlled". This means that scientists can agree on a "safe threshold" under which their presence in the human body is not considered to pose a health risk. If a safer alternative exists**,** they will need to submit a substitution plan so that they are eventually replaced. If a safer alternative is not readily available, companies will need to produce an R&D plan for substitution at a later stage. However, substances toxic to reproduction are exempted from the clause. A review will take place six years after the regulation comes into force to take account of new scientific developments on the subject;

While the Stockholm Convention and the UN-ECE LRTAP protocol addresses specific substances documented impacts or risks to the environment, REACH is mainly aimed at the large number of substances have been manufactured and placed on the market in Europe but where the information about potential hazards is insufficient to assess risks. REACH provisions will be phased-in over 11 years.

Mercury

Mercury is addressed in the **EU Mercury Strategy**, which provides the basis for international discussions in the context of UNEP. The strategy is currently under revision. The current

[505] Stockholm Convention on Persistent Organic Pollutants, Preamble, online.
[506] For a list of substances and their regulatory status, see AMAP, 2009, pp. 34-35.

strategy proposes an international initiative to reduce mercury supply, including the global phasing out of production of new mercury from cinnabar and measures to prevent mercury surpluses to go back into the market. Within the EU, the strategy calls for a phase-out of mercury exports from the EU by 2011 (EU has traditionally been a major producer); reducing EU's demand by prohibiting certain uses of mercury (e.g. thermometers); ensuring safe storage of surpluses, reducing mercury emissions, and protecting against mercury exposure.[507]

The EU mercury strategy has led to several specific policy measures.[508] They include that emissions of mercury from major industrial sources are now subject to the EU Directive (96/61/EC) on Integrated Pollution Prevention and Control (IPPC), which had to be implemented in Member States by October 1999. This Directive also covers the EU's chlor-alkali industry, which is phasing out the use of mercury in its production process. Mercury emissions have also been reduced by the application of sector-specific EU directives dealing with large combustion plants and waste incineration. Some EU Member States have introduced further emission controls, for instance on cremation. EU legislation also prohibits, or severely restricts, the use of mercury in the following applications: batteries; electrical and electronic equipment; pesticides and biocides; cosmetics; wood preservatives; textile treatment agents; anti-fouling agents for boat hulls; and switches in vehicles. Some Member States have introduced further controls, for example to restrict the use of mercury in dental amalgam.

Other areas of EU legislation set requirements for the management of waste that contains mercury, and for the protection or monitoring of the quality of the environment in respect of mercury (air, water, and groundwater). EU legislation also sets limits for the mercury content in drinking water and fishery products.

Since the adoption of the Community Strategy concerning Mercury in January 2005, EU legislators have adopted a Directive (2007/51/EC) relating to the restrictions on the marketing of certain measuring devices containing mercury (thermometers, barometers). In September 2008, legislation was adopted banning mercury exports from the European Union and requiring the safe storage of metallic mercury when the ban takes effect in March 2011.

Air pollution

Directive 2008/50/EC regulates ambient air quality in terms of levels of sulphur dioxide, nitrogen oxides, particulate matter (PM2.5 and PM10), lead, benzene, carbon monoxide and ozone. The protection of human health is the main driver behind this regulation and specifies that MS will ensure that levels of air pollutants do not exceed limit values for all "zones" and "agglomerations". MS are required to draw up action plans to meet air quality standards, and may utilize cooperative plans regarding transboundary pollution. Commission Decision 2004/224/EC requires MS to draw up plans for zones where air quality thresholds are exceeded.

Directive 2008/1/EC calls for an integrated approach to pollution control and prevention from industrial and agricultural activities with high pollution potential, including energy industries. To receive a permit in accordance with this Directive, installations must, inter alia, use all

[507] European Commission , Mercury, online.
[508] As listed by MEMO/08/808 Questions and Answers on the EU Mercury Strategy.

appropriate pollution control measures, prevent all large scale pollution, use energy efficiently and return sites to original state when the activity is over.

National Emissions Ceiling Directives (2001/81/EC, 2002/3/EC) seeks to reduce acidifying and eutrophying air pollutants, SO_2, NO_x, VOCs and ammonia (NH_3). It does not cover shipping or landing/take-off aviation emissions.

Directive 2001/80/EC places limits on air pollutants from large combustion facilities and applies to the energy industry by regulating combustion plants that produce energy, including petroleum refineries. Under this directive SOx, NOx and dust emissions are limited for plants with thermal input greater than 50 MW where solid, liquid or gaseous fuels are combusted.

Directive 2000/76/EC seeks to reduce, among other impacts, air pollution from waste incineration. It sets air emission limit values for dust, SO_2, NO_x, mercury and other pollutants.

The Fuel Quality Directive (2009/30/EC) requires that petroleum products meet quality requirements concerning sulfur and lead content, as well as potential for contributing certain vehicle emissions.

Multilateral agreements

Chemicals

Stockholm Convention on Persistent Organic Pollutants

Annexes A and B of the Stockholm Convention prohibit production, use, import and export of a list of intentionally produced POPs which are known to be harmful to humans and wildlife. Annex C specifies that unintentional sources of POPs, through combustion of wastes and petroleum, must also be reduced through action plans developed by each Party.

Several EU directives (96/61/EC, 2000/76/EC) incorporate the Stockholm Convention into EU law and outline measures for reducing unintentionally produced POPs from major industrial stationary sources and waste incineration facilities. Regulating POPs from transportation is not covered in these directives, though POPs from transportation are mentioned in the EU Community Implementation Plan for the Stockholm Convention.

Mercury

Mercury and other heavy metals have been subject to national legislation in many EU countries since the 1950s and internationally in regional water quality cooperations since the 1970s.[509] In 1998, the UN-ECE Convention on Long-Range Transboundary Air Pollution was amended with the Aarhus Protocol on Heavy Metals that targets cadmium, lead and mercury. The Protocol obliges the parties to reduce emissions for these three metals below their levels in 1990 and aims to cut emissions from industrial sources (iron and steel industry, non-ferrous metal industry), combustion processes (power generation, road transport) and waste incineration. It lays down stringent limit values for emissions from stationary sources and suggests best available techniques (BAT) for these sources, such as special filters or scrubbers for combustion sources or mercury-free processes. The Protocol requires Parties to phase out leaded petrol. It also introduces measures to lower heavy

[509] Selin, 2009.

metal emissions from other products, such as mercury in batteries, and proposes the introduction of management measures for other mercury-containing products, such as electrical components (thermostats, switches), measuring devices (thermometers, manometers, barometers), fluorescent lamps, dental amalgam, pesticides and paint. The protocol was approved by the European Community in 2001.[510]

UNEP is currently addressing the mercury problem through negotiations for a globally binding treaty which have started in 2010. The aim is to address atmospheric emissions as well as the use of mercury in products, processes, wastes, and international trade.[511] UNEP has previously addressed mercury in a specific program, established in 2003, to encourage countries to adopt goals and take action as appropriate in order to minimize exposure.

Mercury is also subject to discussion in the Basel Convention, which has developed draft technical guidelines on the environmentally sound management of mercury wastes. Moreover, the Rotterdam Convention contains provisions relating to mercury, where several compounds are subject to the prior informed consent procedure. While industrial uses of mercury in products and processes are not currently listed, they may be listed in Annex III in the future if they meet the criteria for inclusion.[512]

Air pollution

Convention on Long Range Transboundary Air Pollution (LRTAP)

LRTAP is mostly an EU-wide convention, but also includes Canada and the US. The original Convention is less specific than the Stockholm Convention, stating that state Parties must develop policies to reduce air pollution and should share information on their emissions, the control technology used, reduction plans, etc. Subsequent Protocols to the Convention specify which air pollutants must be reduced and establishes limit values in some instances for particular sources. The Protocols cover sulfur, nitrogen oxides, VOCs, heavy metals, POPs, and ground-level ozone, among other emissions.[513] Emissions from transportation are measured either by amount of fuel sold or amount of fuel consumed within a Party's geographic area (this is determined by the Party).[514]

Table 7 Regulatory status of BFRs and fluorinated compounds

CATEGORY	SUBSTANCES	LEGAL STATUS
Brominated Flame Retardants (BFRs)[515]	Polybrominated diphenyl ethers (PBDEs)	Penta- and OctaBDE were banned in the EU and in Norway in 2004, including a ban on import and export of products containing these BFRs.[516] As of 2009, they were added to the Stockholm Convention.[517]

[510] Convention on Transboundary Air Pollution, UN-ECE, Protocol on Heavy Metals, online.
[511] Selin, 2009; UNEP GC decision 25/5 III Chemicals management, including mercury.
[512] UNEP, Mercury Programme, online.
[513] EEA, 2009, p. 9.
[514] EEA, 2009, p. 8.
[515] For review of temporal trends and current legislation, see Johansson et al., 2010.
[516] Cox and Efthymiou, 2003.
[517] UNEP, 2001.

CATEGORY	SUBSTANCES	LEGAL STATUS
		DecaBDE is banned in the EU for use in electrical and electronic products since 2008,[518] but is still used in other products, e.g. textiles. In the US, production, importation and sales will be discontinued by end of 2013.[519] It is still produced in e.g. China.
	Hexabromocyclododecane (HBCD)	No restrictions on the production and use. It is undergoing an EU risk assessment and is under review for possible inclusion in the UN-ECE LRTAP and the Stockholm Convention.[520]
	Tetrabromobisphenol-A (TBBPA)	No restrictions on the production or use of TBBPA. A risk assessment has recently been performed within the EU with the conclusion that, generally, no health and environmental risks were identified with TBBPA when used reactively but that there is a need for specific measures to limit risks when TBBPA is used as an additive flame retardant.
Fluorinated compounds[521]	Perfluorooctane sulfonate (PFOS)	Production of products containing PFOS was substantially reduced in 2001, but PFOS continues to be produced in China. In 2009, PFOS and related compounds were included under the Stockholm Convention with bans taking effect as of August 2010.[522]
	Perfluorooctanate (PFOA) and other perfluorocarboxylates	Continues to be produced. Fluorinated substances can degrade to PFOA and other PFCAs. Canada is the only Arctic country so far to ban some import and manufacture of several products that are suspected to break down to PFOA and PFCAs.

Climate change

EU policies

GHG reduction initiatives

The EU's main initiatives to reduce GHG emissions are contained in its **Climate Action and Renewable Energy Package**, which was adopted on 23 January 2003.[523] It sets an objective of limiting the global average rise in temperature to below 2°C, in line with current United Nations Framework Convention on Climate Change (UNFCCC) agreements. In order

[518] European Court of Justice, 2008.
[519] Hess, 2009; Chemtura, 2009; Albemarle, 2009.
[520] Denier van der Gon et al., 2007; Convention on Longrange Transboundary Air Pollution, UN-ECE.
[521] For review, see AMAP 2009, pp. 15-20 and Butt et al., 2010.
[522] Stockholm Convention on Persistent Organic Pollutants, Adoption of amendments to Annex A, B, and C, online.
[523] EEA, 2010a, p. 6.

to contribute to meeting this goal, the EU has set a binding target of reducing its total GHG emissions by 20% from 1990 levels by 2020, with a conditional target of 30% if other developed nations also make reductions commitments through an international agreement.[524] This puts the EU on track to reduce emissions by 60-80% from 1990 levels by 2050, the higher range being closer to what is needed from developed countries for achieving the 2°C maximum. This policy package also contains renewable energy and energy efficiency initiatives, which, while closely linked to emissions reduction efforts, are discussed in Energy (section 2.4).

Council Decision No. 280/2004/EC ensures that the EU monitors all anthropogenic GHG emissions listed in the Kyoto Protocol, thereby allowing the EU to evaluate progress towards its Kyoto Protocol targets (discussed below). It also implements the Kyoto Protocol and other UNFCCC obligations in Member States, requiring GHG inventories, emitter registries and other national programmes.

These programmes are an integral part of the **EU Emissions Trading System** (EU ETS), which entered into force in 25 October 2003 through Directive 2003/87/EC.[525] The ETS covers over 11,000 industrial installations, which contribute approximately 43% of all EU GHG emissions.[526] The covered sectors are energy installations where fuel is combusted, production and processing of certain metals, cement and lime production, ceramics, bricks and glass manufacturing, pulp and paper plants, and biomass plants (with transport and agriculture being notable exceptions as major sources of EU emissions).[527] Aviation will be included beginning in 2012.[528]

The first trading period ran from 2005-2007 (the 'trial period'), the second 2008-2012, and the third will span 2013-2020. The sectors covered under the EU ETS must reduce CO_2 emissions by 21% from 2005 levels by 2020.[529] After 2013 N_2O emissions from certain sectors will be covered by all Member States, whereas now only the Netherlands and Norway have opted to cover N_2O emissions from nitric acid production.[530]

In order to meet their 'emissions budget', every year covered installations must submit one EU allowance (EUA) for every ton of CO2 emitted that year. Covered installations either receive EUAs for free from their Member State government, they can purchase EUAs at auction, or they can earn credits for emissions reduction projects in other Member States and developed countries (termed 'joint implementation' under the Kyoto Protocol) or developing countries (under the Kyoto Protocol's Clean Development Mechanism [CDM]). Sectors that are more exposed to 'carbon leakage', or are more exposed to international competition, receive more free allowances in order to prevent any EU emissions reductions being offset by higher emissions abroad.[531]

The EU ETS, while assisting Member States in meeting EU-wide emissions reduction goals, also provides certainty that at about 40% of EU emissions are covered by Kyoto units, and

[524] European Commission, 2010b, p. 2.
[525] Directive 2003/87/EC was subsequently amended by Directive 2004/101/EC, Directive 2008/101/EC, Regulation (EC) No 219/2009, and Directive 2009/29/EC.
[526] EEA, 2010c, p. 6.
[527] European Parliament, 2003, pp. 43-46.
[528] European Parliament, 2003, p. 43.
[529] EEA, 2010a, p. 6.
[530] Europa, 2008.
[531] European Parliament, 2003, p. 12.

helps Member States to achieve their Kyoto targets.[532] However, to ensure complete Kyoto compliance, as well as to ensure the EU meets its 20% reduction target by 2020, Member States must ensure emissions reductions in non-ETS sectors as well.

This is facilitated by the **Effort Sharing Decision** (406/2009/EC), which commits Member States to cutting non-ETS sector emissions by 10% from 2005 levels by 2020.[533] These non-ETS sectors include transport, buildings (heating in particular), services, small industrial installations, agriculture and waste, which comprise roughly the other 60% of EU emissions.[534]

To reduce GHGs from transport, Regulation (EC) No. 443/2009 sets fuel efficiency standards for passenger vehicles and light trucks, requiring them to meet emissions standards of 130gCO_2/km by 2015 and 95gCO_2/km by 2020. These vehicles contribute 12% of EU emissions, and about 60% of transport-related emissions (not including international aviation and shipping).[535] The EU also seeks to decrease the emissions-intensity of transport fuels by 10% by 2020, largely through the use of biofuels.[536] This is discussed further in Energy (section 2.4).

Other effort sharing emissions reductions may come from soil protection, waste management plans, and changes in agricultural practices. Many of these initiatives must be individually implemented by Member States, which leaves uncertainty as to whether the requirements will be fulfilled. However, the emissions reduction requirements allocated to each Member State under Decision 406/2009/EC are binding, and largely allow flexibility in how the targets are achieved. Member States are also allowed to transfer emissions reduction units, allowing reductions to occur where they are most cost effective.

Directive 2009/31/EC provides a legal framework for carbon capture and storage (CCS), stating that any emissions that are stored according to the conditions contained in this Directive are to be considered 'not emitted'. The EU's goal is to construct a network of up to 12 CCS demonstration plants by 2015, with a commercial update of CCS by 2020.[537] These projects are to be supported by auction revenues from ETS allowances. Revised EU guidelines on state aid for environmental protection now enable Member State governments to provide financial support for CCS as well.[538]

The EU National Emissions Ceiling Directive regulates the emissions of NO_X, NMVOCs and SO_2, considered 'indirect' GHG molecules due to the fact that they can create ground level ozone, which is a GHG. These emissions continue to be reduced in the EU, including under other various mechanisms discussed in Chemicals and Transboundary Pollution (section 2.2). It does not regulate particulate matter.

Black carbon contributes to particulate matter pollution, so any EU directives which limit $PM_{2.5}$ or PM_{10} emissions or air levels indirectly regulate black carbon (see Chemicals and Transboundary Pollution for a more complete description of these regulations). Black carbon is not, however, regulated directly in the EU.

[532] EEA, 2010c, p. 6, 7.
[533] EC: Environment, 2010d.
[534] EC: Environment, 2010b.
[535] EC: Environment, 2010c.
[536] Directives 2003/30/EC and 2009/30/EC.
[537] EC: Environment, 2010d; Europa, 2008.
[538] EC: Environment, 2010d.

Climate adaptation research and institutional support

The EU has programmes in place for climate adaptation research under Framework Programme 7 (FP7), and has funded several Arctic-focused projects, including:[539]

- DAMOCLES, an Arctic climate modelling programme
- Arctic Tipping Points, which focuses on changes in Arctic ecosystems and includes discussion of impacts on income and employment
- ArcRisk, which looks at the human health impacts of Arctic contaminants, and the impact of changes in the cycling of contaminants due to climate change

There have not yet been any FP7 projects focused specifically on the climate change adaptation needs of the Arctic, though other projects have touched on this issue and may be gathering information valuable for adaptation efforts.

The EU has been a vocal proponent of a global increase in public and private funding for climate adaptation, especially in developing countries. A recent EU communication states that total financing for climate adaptation in developing countries should reach approximately €100 billion per year by 2020.[540] It is unclear whether Arctic needs are included in this estimate, but it seems unlikely due to the heavy emphasis on developing countries, particularly least developed countries (LDCs) and small island developing states (SIDS).

The EU estimates private and public finance could cover 20-40% of this need, the international carbon market could cover 40%, or approximately €38 billion per year, and international public finance would have to cover the rest.[541] The EU ETS, which comprises 75% of the current international carbon market, generated €3.3 billion in finances for developing countries in 2008.[542]

The EU has also recommended that additional finance could be generated by regulating emissions from international aviation and maritime transport, a significant and growing source of emissions that could be taxed or addressed through market-based instruments (such as ETS), to provide a dedicated revenue stream for climate adaptation projects.[543]

Though climate adaptation funds are undoubtedly needed by developing countries, the EU mentioned in its 2008 communication that Arctic adaptation needs must also be assessed.[544] There does not seem to be any further discussion of new funding sources for supporting identified Arctic needs.

Multilateral agreements

The **UNFCCC** is the only international framework that explicitly deals with climate change, and seeks to coordinate climate adaptation and mitigation among countries. One of the most important components of the UNFCCC is the **Kyoto Protocol**, which entered into force on 16 February 2005 and is the first binding international agreement on emissions reductions.

[539] European Commission, 2009b, p. 64, 37, 244
[540] European Commission, 2009a, p. 4
[541] European Commission, 2009a, p. 3.
[542] European Commission, 2009a, p. 4.
[543] European Commission, 2009a, p. 9.
[544] European Commission, 2008, p. 5.

The Kyoto Protocol sets binding reduction targets for 37 developed countries and the European community (EU15) (specified in Annex I of the Protocol). Annex I entities must monitor and record emissions of all six GHG molecules specified under the Protocol and meet their assigned emissions reduction targets for the initial commitment period of 2008-2012.[545]

The EU-27 does not have a Kyoto Protocol target, but the EU15 and most other EU Member States (save Cyprus, which is not an Annex I country) must reduce emissions by 8% from 1990 levels throughout 2008-2012.[546] Parties to the Protocol can meet their emissions targets through four mechanisms:

- *Assigned amount units* (AAUs), which are obtained from each Party's original emissions budget
- Certified emissions reductions (CERs), which are generated by emissions reduction projects in developing countries, via the Kyoto Protocol's "Clean Development Mechanism"
- Emission reduction units (ERUs), which are generated by emissions reduction projects in other industrialized countries, via the Kyoto Protocol's "Joint Implementation" mechanism
- Removal units (RUs), which are generated by activities resulting in increasing carbon sink capacity, e.g. aforestry

The use of the flexible mechanisms (CERs, ERUs, and RUs) must be "supplemental" to domestic efforts, but a required percentage of each is not specified in the Kyoto Protocol.[547]

An **Adaptation Fund** was established under the Kyoto Protocol, which is funded through CDM project activities and other voluntary sources. Two percent of CERs from all CDM projects are deposited into the Adaptation Fund, which currently has over 8 million CERs.[548] It is mandated to fund climate adaptation projects in developing countries which are Parties to the Kyoto Protocol.

The Vienna Convention for the Protection of the Ozone Layer also contributes to reducing GHG emissions through the **Montreal Protocol,** of which the primary goal is to reduce ozone depleting substances such as halons, CFCs, HCFCs and other chlorine and fluorine based chemicals. Every UN-recognized nation has ratified the Montreal Protocol, making it one of the most successful and effective international agreements to date. Its goal of returning stratospheric ozone levels to pre-1980 levels is expected to be met between 2060 and 2075.[549] ODSs also have extremely high global warming potential (GWP), up to 10,000 times that of CO_2, so their reduction also contributes to climate change mitigation efforts.[550] However, industry substitutes for ODSs, which are not covered under the Montreal Protocol, also have high GWP. These substitutes, called HFCs, are covered by the Kyoto

[545] The six greenhouse gases are Carbon dioxide (CO_2), Methane (CH_4), Nitrous oxide (N_2O), Hydrofluorocarbons (HFCs), Perfluorocarbons (PFCs) and Sulphur hexafluoride (SF6). UNFCCC, Kyoto Protocol, online.
[546] Poland has committed to reducing by 6% from 1988 levels, Hungary has committed to reducing by 6%. UNFCCC, List of Annex I Parties, online.
[547] EEA, 2010c, p. 5.
[548] UNFCCC, Kyoto Protocol Adaptation Fund, online; UNFCCC, Share of proceeds, online.
[549] Sher and Sauer, 2009, p. 2
[550] Sher and Sauer, 2009, p. 4.

Protocol, which has not seen nearly the ratification success rate of the Montreal Protocol. Furthermore, there is still concern that 'banks' of ODSs, that is those which have not yet been destroyed or recycled and could still be released into the atmosphere, present a significant threat to GHG reduction efforts. These ODS banks are mostly contained in old refrigerators and air conditioners. The average leakage rate of ODSs from supermarket systems in the US and Europe is approximately 18%.[551]

The UNECE Convention on Long Range Transboundary Air Pollution covers air pollutants which are indirect sources of climate forcing, including CO, NO_X, NMVOC and SO_2. The EU's efforts related to this Convention are discussed in Transport (section 2.8).

Energy

EU policies

Renewable Energy Requirements, Energy Efficiency and Greening Transport

The EU Renewable Energy Directive (2009/28/EC), which comes into effect in December 2010, amends previous RE Directives (2001/77/EC and 2003/30/EC) sets a goal of renewable energy comprising 20% of total energy consumption by 2020. The EU is currently slightly below its 2010 goal of utilizing 12% renewable energy, which was set in 1997. The 2009 RE Directive sets mandatory national targets for each Member State, based on its projected RE potential, and existing energy mix. Each Member State must submit a National RE Action Plan, which were due on June 30, 2010. Only three action plans have been submitted so far.

The RE Directive also lists the sustainability criteria for biofuels, which are one of the main mechanisms for utilizing RE in transportation. In order for biofuels to contribute towards Member States' RE goals, they must meet certain GHG reduction requirements (including land-use change, but not indirect land-use change, emissions), cannot be grown on biodiverse land or on land with high carbon stock (e.g. wetlands, continuously forested areas, peatland), among other stipulations.

The Fuel Quality Directive (2009/30/EC) seeks to reduce lifecycle emissions from transport fuels by 10% by 2020 through the use of biofuels, other alternative fuels, reduced venting and flaring at production sites, carbon capture and storage (CCS) and CDM credits. The Fuel Quality Directive also discusses sustainability criteria for biofuels, but not for any fossil fuels. Petroleum products must meet quality requirements concerning sulfur and lead content, as well as potential for contributing certain vehicle emissions. Proposals for assigning different lifecycle greenhouse gas emissions to various fossil fuel sources, such as tar sands, are currently under review.[552]

The EU also seeks to increase total energy savings by 20% in 2020 under the **Energy Efficiency Action Plan**, though this target is non-binding.[553] Existing Directives, including those requiring labeling of all energy-using devices, encouraging electricity production from combined heating and power (CHP) installations, and increasing energy efficiency of

[551] Sher and Sauer, 2009, p. 3.
[552] ENDS, 2010c.
[553] European Commission, 2008a.

buildings and vehicles, would only achieve 13% energy savings if completely implemented.[554]

External and energy security policy

The EU's most important Arctic energy partners are Russia and Norway, both of whom the EU conducts regular energy dialogues. The EU-Russia Permanent Partnership Council on Energy was formed in 2003 to acknowledge and strengthen the economic interdependence of both regions and to improve EU energy security. The EU and Russia seek to integrate their energy markets and are also interested in encouraging the penetration of energy saving technology as well as reducing environmental impact of energy production and consumption. [555] One of the developments of this partnership was the creation of an Early Warning Mechanism for addressing energy shortage crises.[556]

The Baltic Sea Region Energy Cooperation (BASREC) also focuses on EU dependence on Russia for energy, as well as energy-related environmental concerns.

The EU and Norway have a similar energy dialogue, due to their energy interdependence, which was initiated in 2005. Yearly meetings are now held which focus on cooperation, strengthening security of supply, increasing usage of renewable energy and liberalising energy markets. More recently, the agenda has included initiatives to address climate change, such as CCS projects and offshore wind power. Energy exploitation in the Arctic, particularly in the Barents Sea, is also discussed.[557]

Because EU energy import dependence will continue to rise, these external energy dialogues will become increasingly important in order for the EU to influence the environmental footprint of its energy consumption, particularly in the event of increased Arctic hydrocarbon activity.

Directive 2004/67/EC includes measures to safeguard security of natural gas supply by establishing a three step approach to energy shortages: if industry and national level measures are insufficient to address the problem and the crisis is such that 20% of all imports are missing, Community level mechanisms are activated. The January 2009 gas crisis showed that a more coordinated Community approach is needed, as well as the need for increased gas storage capacity and reverse flow capability.

This directive called for the creation of a Gas Coordination Group (GCG), which was established in 2006 to guarantee security of natural gas supply and is comprised of Member States representatives, national regulators, EU organizations representing the gas industry, consumers, etc.[558] The GCG assesses gas infrastructure development in the EU, develops emergency preparedness strategies in the event of supply disruption and analyzes supply disruption scenarios.

Reducing environmental footprint of the energy industry

Broadly-scoped environmental regulations of the energy industry are presented here. More on regulation of greenhouse gas emissions from energy production can be found in Climate Change (section 2.3).

[554] COM(2008) 778; European Parliament, 2004; European Parliament 2002; European Comission, 2008a, p. 14.
[555] European Energy Forum, 2006.
[556] Euoprean Energy Forum, 2000.
[557] IHS, 2009.
[558] Europa, 2009.

Directive 2001/80/EC places limits on air pollutants from large combustion facilities and applies to the energy industry by regulating combustion plants that produce energy, including petroleum refineries. Under this directive SOx, NOx and dust emissions are limited for plants with thermal input greater than 50 MW where solid, liquid or gaseous fuels are combusted. This applies only to EU combustion plants and therefore would not limit these emissions from imported sources of refined petroleum products.

Directive 2008/1/EC calls for an integrated approach to pollution control and prevention from industrial and agricultural activities with high pollution potential, including energy industries. To receive a permit in accordance with this Directive, installations must, inter alia, use all appropriate pollution control measures, prevent all large scale pollution, use energy efficiently and return sites to original state when the activity is over. It is unclear whether this Directive applies to energy recovery activities, which are not included in the Annex I list of targeted installations, but could be considered "technically connected" to the activities carried out in, for example, petroleum refineries or other fuel combustion plants.

Recommendation 2001/331/EC of the European Parliament and Council is a non-binding set of minimum criteria for carrying out environmental inspections. It applies to all industrial installations which require environmental permits or licenses, such as for Directives 2001/80 and 2008/1. It recommends that environmental inspections are routine, on-site, and monitor the environmental impact of the installation. The results should be recorded and available to the public. [559]

Directives 85/337/EEC, 97/11/EC and 2003/35/EC establish and EU framework for requiring and executing environmental impact assessments (the EIA Directive). As will be discussed further below, an environmental impact assessment is the key first step for minimizing the impact of new energy recovery projects. An EIA is meant to ensure that all potential impacts of an individual project are identified before it is undertaken. After over 20 years of implementation, all Member States now have EIA frameworks in place.[560] Energy installations and related infrastructure subject to the EIA Directive include but are not limited to oil refineries, coal gasification and liquefaction plants, road construction, extraction of petroleum and natural gas, and petroleum storage facilities.[561]

Strategic Environmental Assessments (SEAs) are performed for larger plans or programmes which include multiple related projects. The SEA Directive (2001/42/EC) was an important development in utilizing EIAs and inspired the SEA protocol for the Espoo Convention, which applies explicitly to offshore hydrocarbon recovery.[562] The SEA Directive applies only to those plans or programmes which are undertaken by government entities at the local, national or regional level.[563]

More information on targeted regulation of energy installations, including energy recovery projects, will be included in the final report, particularly regarding any development in EU's regulation of offshore drilling, which may be updated in response to BP's Deepwater Horizon oil spill.[564] Norway has already stated that no deep-water drilling will be conducted until the

[559] Europa, 2007.
[560] European Commission, 2009c, p. 2.
[561] Council of the European Union, 1997, pp. 11-13 (Annex I).
[562] Koivurova et al., 2008, p. 30.
[563] European Commission, 2009b.
[564] O'Halloran, 2010.

circumstances surrounding the BP spill and its implications for Norwegian legislation are well understood.[565]

Multilateral agreements

International Convention on Oil Pollution Preparedness Response and Cooperation

The OPRC Convention, entered into force in 1995, seeks to reduce marine pollution from ships and offshore drilling operations through preparedness and early response. Offshore unit operators must have oil pollution emergency plans in place and coordinate these with relevant national authorities. In the actual or probable event of a pollution incident, the relevant national authorities must be notified immediately. The convention also requires party States to devise national response systems to oil pollution and must be able to cooperate internationally to respond effectively to marine pollution incidents.

Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal

The Basel Convention entered into force in 1992 and seeks to protect human health and the environment from hazardous wastes by regulating their transboundary movements and ensuring that waste is disposed of in an environmentally sound manner. Global trafficking of wastes without “prior informed consent” is illegal under this convention. Used and waste oils and emulsions are covered by the Basel Convention, which limits the ability of hydrocarbon recovery and transport companies to dump this waste. The Convention furthermore incentivises proper disposal of any waste and chemicals generated or utilized by an energy company.

OSPAR Guidelines for Monitoring the Environmental Impact of Offshore Oil and Gas Activities

OSPAR introduced these guidelines in 2004 to reduce maritime pollution from offshore oil and gas activities through targeted monitoring and improved reporting and assessment.[566] The guidelines include applying established OSPAR guidelines for eutrophication, sediment contamination, general biological effects and others when monitoring the environmental effects of oil and gas activities as well as new, detailed guidelines for monitoring the water column and sediments specific to potential oil and gas impacts. These guidelines are non-binding but are meant to harmonise monitoring efforts by providing guidance on the design of monitoring programmes.

Espoo Convention on Environmental Impact Assessment in a Transboundary Context

The Espoo Convention, entered into force in 1997, was formulated to address growing awareness and concerns over the transboundary nature of many environmental pollution problems. It requires that parties perform environmental impact assessments for any projects or programmes that could potentially result in transboundary impacts, and that these assessments take into account the entire spatial scale of impacts. This would be relevant to any bilateral or multilateral energy agreements that may arise in the future as the EU

[565] BarentsObserver.com, 2010b.
[566] OSPAR, 2004.

increases reliance on energy imports. The resulting economic and infrastructural developments will likely result in transboundary environmental impacts, for example from pipeline or road construction or increased potential for oil and gas related accidents, which must be assessed and accounted for in mitigation strategies. The Protocol on Strategic Environmental Assessment, adopted in 2003, is particularly important for sustainable development of energy production and transportation in the EU and surrounding energy exporters. The SEA Protocol is applicable to offshore hydrocarbon production.[567]

UN Law of the Sea Convention

UNCLOS also contains language relevant to energy production, under which coastal states are responsible for preventing, reducing and controlling marine pollution from offshore oil and gas activities.[568] Under UNCLOS exploitation of natural resources is subject to exclusive control of the coastal state for the length of the continental shelf.[569] Parties may make extended shelf claims subject to approval by the Convention, which Russia, Denmark, Norway and Canada have done in the Arctic Ocean. Though their extended shelf claims has not been approved (and Russia's has been contested by the US), if these claims are legally recognized then a vast majority of the Arctic Ocean would be accounted for under UNCLOS.[570] *This is also assuming that the contested maritime boundary between Norway and Russia will be resolved (a delineation has been devised, but neither party has signed or ratified it).*[571]

Fisheries

EU policies

EU Common Fisheries Policy

The EU developed its fisheries regulation through the EU Common Fisheries Policy (CFP), which applies to Member State-flagged fishing vessels and Member State nationals regardless of their location, as well as any non-EU vessels and nationals engaged in fishing or related activity within the Community waters or within Member States.[572]

The main goal of the CFP is to divide the common resource of fish stocks using national quotas and other mechanisms to preserve political stability with respect to fishing rights and to preserve vulnerable fish populations.[573] The original policy came into force in 1983, but was significantly reformed in 2002 to address the growing EU fishing fleet, dwindling fish populations, and the effects of short-term planning on a long-term sustainability problem.[574]

The 2002 reform created seven Regional Advisory Councils (RACs), which allowed for greater involvement of stakeholders in fisheries policy development and provided a source of permanent consultation for stakeholders. It also redirected subsidies from building fishing

[567] UNECE, 2003.
[568] Koivurova et al., 2008, p. 24.
[569] Koivurova et al., 2008, p. 23.
[570] Koivurova et al., 2008, p. 21.
[571] BarentsObserver.com, 2010a.
[572] Council of the European Union, 2002, p. 3.
[573] European Commission, 2009, p. 6.
[574] European Commission, 2009, p. 6.

fleet capacity to supporting coastal communities. Perhaps most importantly, annual decisions such as total allowable catches (TACs) and national quotas were made subordinate to longer term strategies of conservation and sustaining the fishing industry. In particular, multi-annual plans are developed to define how scientists' stock estimates are to be translated into fishing possibilities for the coming year.[575]

The new CFP requires Member States to actively reduce fleet capacity and makes funding available for capacity reduction through the European Fisheries Fund (EFF).[576] No public money can be used to build new capacity or to 'modernize' existing boats (making them more effective at catching fish), nor can it be used to export overcapacity to third countries. Fleets' active vessel-days are also capped, quantitatively limiting fishing effort.[577]

Related bodies to the CFP are the Scientific, Technical and Economic Committee for Fisheries, which produces an annual report on the state of fisheries, and the Community Fisheries Control Agency (CFCA), which seeks to improve CFP enforcement by pooling resources among Member States and encouraging cooperation between Member State national inspectorates. Of potential relevance to transboundary Arctic fish stocks, in 2007 the CFC launched a plan for cod recovery in the North Sea. Atlantic cod are found throughout the North Sea, the Norwegian Sea and the Barents.[578]

EU Integrated Maritime Policy

In order to further reduce the overall pressure of fishing activity on the sustainability of fisheries and ecosystems they exploit, the EU has developed an Integrated Marine Policy, consisting of, in part, the Marine Strategy Framework Directive (MSFD, 2007). The MSFD calls on Member States sharing maritime regions to devise standards for 'good environmental status' and roadmaps for how they plan to achieve this. Assessments of marine impacts from each Member State are due in 2012, and mitigation programmes must be in place by 2015, the goal being to have "healthy marine waters" by 2020.[579]

Multilateral agreements

OSPAR Convention

The OSPAR Convention is an international legal instrument which replaced the Oslo and Paris Conventions on marine pollution from dumping and land-based sources in the Northeast Atlantic. The EU and 15 EU Member States are currently parties to the OSPAR Convention. Some decisions made under the Convention are legally binding.[580] The OSPAR Commission's activities include taking steps to establish a network of managed marine protected areas (MPAs) by 2010, performing assessments of, for example, damage from dumping waste or marine litter, and monitoring of radioactive substances in the water column. Other initiatives analyze strategies for reducing hazardous discharges into the ocean and eutrophication reduction. OSPAR's Quality Status Reports (QSRs) monitor progress towards improving the environmental state of marine areas in the Northeast Atlantic.

[575] European Commission, 2009, p. 15.
[576] European Commission, 2009, p. 20.
[577] European Commission, 2009, p. 16.
[578] FishBase, 2009.
[579] European Commission, 2010b, p. 2.
[580] OSPAR List of Decisions, Recommendations, Agreements.

One of OSPAR's concerns regarding the Arctic, which falls under Region 1 of the Convention, is that growing exploitation of hydrocarbon resources in this region will impact the ocean environment, including fish stocks.[581] OSPAR plans to seek a closer relationship with the Arctic Council in 2010, recognizing both growing Arctic environmental threats and the European Commission's Arctic Communication.[582]

EU fish import standards and barriers

As the largest seafood market in the world and by far the largest importer of fish products, the EU standards out as a key trading partner for many fisheries-based economies. However, the EU also has some of the strictest importing standards and barriers to trade, especially with regard to seafood:[583]

- EU fish imports have an average tariff of 12%, compared to a 5.6% average for all EU MFN imports.[584]
- In order to access the EU market, exporting countries must have a competent authority that guarantees inspection and official controls throughout food production.
- The national authorities must guarantee hygiene and public health requirements are met.

In 2008 Fiji was removed from list of countries authorized to export seafood to EU for non-compliance with hygiene requirements and ability of authorities to carry out reliable checks.[585]

In 2010, exporters must further provide a "catch certificate" with any imports of fish into the EU, which seeks to prevent illegal, unreported and unregulated (IUU) fish products from entering the EU.[586] This is a positive sign that EU will strengthen its regulatory power and encourage exporting countries to observe international fisheries law.

EU Northern Dimension

This partnership of the EU, Iceland, Norway and Russia seeks to encourage sustainable development and economic cooperation in northwest Russia, the Baltic and Barents Seas, and the adjacent Arctic areas. In 2000 the EU Council identified challenges in the Northern Dimension, including building pressures on fisheries, and proposed an EU-Russia Fisheries Cooperation Agreement for conserving fish stocks and marine resources in the Baltic, which was adopted in 2009.[587] It does not appear that any cooperation has focused on Arctic fisheries.

[581] OSPAR Annual Report, 2009, p. 11.
[582] OSPAR Annual Report, 2009, p. 11; EC COM(2008) 763 final.
[583] European Commision, EU import conditions, p. 2.
[584] Rudloff, 2010, p. 13.
[585] Hosch, 2009, p. 43; EC Regulation EC No 439/2008.
[586] Council of the European Union, 2008.
[587] European Commission, 2010a, p. 3.

UN Agreement for the Implementation of the Provisions of the United Nations Convention on the Law of the Sea of 10 December 1982 relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks (UN Fish Stock Agreement)[588]

The UN Fish Stock Agreement is a treaty on management of straddling and migratory fish stocks, highlighting the need for multilateral cooperation and planning. The agreement states that any conservation and management efforts must be precautionary and based on the best available scientific information. It clearly states which fish stocks require management, areas of required application, and mechanisms by which to gather data and review the status of managed stocks (Article 9).

Each State Party ensures compliance with the agreement by monitoring its flagged vessels, but Parties can also request help from other States. The primary mechanism through which Parties are to negotiate and carry out management activities are regional fisheries management organizations (RFMOs) or Arrangements. Approximately eight RFMOs apply to the Arctic region, but none completely and not all parts of the Arctic are regulated by an RFMO. This represents a policy gap that many have recognized but that has not yet been addressed.

The North East Atlantic Fisheries Commission's (NEAFC) regulatory area covers the eastern portion of FAO area 27 and applies to a portion of the Atlantic side of the Arctic. Its parties are Denmark (on behalf of the Faroe Islands and Greenland), the EU, Iceland, Norway and the Russian Federation.[589] The NEAFC concentrates on managing pelagic and deep sea species, such as redfish, mackerel, haddock, herring, blue whiting and halibut. It recognizes the UN Fish Stock Agreement and takes into account FAO Code of Conduct for Responsible Fisheries in its Declaration on the Interpretation and Implementation of the Convention on the Future Multilateral Cooperation in North-East Atlantic Fisheries.[590] FAO Statistical Area 21 is covered by the Northwest Atlantic Fisheries Organization (NAFO).[591] The NEAFC applies to a very productive portion of Arctic fisheries, an area that may see northern expansion and greater fisheries development than other Arctic areas.

RFMOs such as the International Commission for the Conservation of Atlantic Tuna (ICCAT) and the Western and Central Pacific Fisheries Commission (WCPFC) may cover area 18, because the northern boundaries of these commissions are not defined.[592] Other RFMOs focus on single species, such as salmon, whose regions could extend into area 18. The North Pacific Fishery Management Council (NPFMC) has adopted fishery management strategies (FMS) in the Bering Strait and closed the Northern Bering Sea to bottom trawling in 2007. It also adopted a comprehensive Arctic FMS to the Arctic Council, which was approved by the US Secretary of Commerce in 2009 and entered into force that December.[593] The plan has closed the US waters north of the Bering Strait to commercial fishing until research determines the extent of its effects on the surrounding ecosystem and local populations.

[588] UN, Oceans and Law of the Sea, online.
[589] Information taken from www.neafc.org.
[590] North East Atlantic Fisheries Commission, 2007, p. 4.
[591] Molenaar, et al., 2009, p. 20.
[592] Molenaar, et al., 2009, p. 18.
[593] Molenaar, et al., 2009, p. 23; Oceans North, 2010.

The UN Fish Stocks Agreement applies only to straddling and highly migratory fish stocks, not 'shared' fish stocks, which migrate across EEZs but not into the high seas. This is significant due to the fact that most development of new Arctic fishing areas will still be within EEZs, at least in the short and medium term.

FAO Code of Conduct for Responsible Fisheries

The Code was unanimously adopted by FAO Member States in 1995. Implementing its recommendations is voluntary and FAO actively promotes its implementation.[594] Through this document FAO seeks to establish national and international policies and agreements to achieve conservation, management, development of all fisheries, and to promote the contribution of fisheries to food security in local communities.[595] This is an implication for the Arctic insomuch as fish and other marine animals are a major food sources for indigenous Arctic peoples.

The Code is to be applied in light of the 1982 UN Law of the Ocean and UN Fish Stocks Agreement and contains detailed and practical recommendations on fisheries management (including objectives, procedures, data gathering, and implementation). It also covers a broad range of best practices for fishing operations (duties of flag states, port states, appropriate fishing activities, fishing gear selectivity, post-harvest practices, trade, energy efficiency, etc.).

One of the results of the Code has been the development of several international plans of action (IPOAs) on different topics: IPOA-SEABIRDS, IPOA-SHARKS, IPOA-CAPACITY and IPOA-IUU (referring to Illegal, Unreported and Unregulated fishing). These are implemented on the national level through NPOAs, of which the EU has two devoted to IUU fishing and one to sharks.

FAO Agreement to Promote Compliance with International Conservation and Management Measures by Fishing Vessels on the High Seas

Entered into force in 2003, this is a key compliance agreement which, as an important precursor to the FAO Code of Conduct, seeks to reduce IUU fishing and hold States accountable for their flagged vessels.[596] As a legally binding UN agreement, it requires that each Party State take measures to ensure its flagged fishing vessels are not undermining the effectiveness of international law. This makes reflagging of ships to "flags of convenience" to avoid international agreement without impunity more difficult, which should reduce IUU fishing.

FAO Agreement on Port State Measures to Prevent, Deter and Eliminate Illegal, Unreported and Unregulated Fishing (FAO PSM Agreement)

The EU is one of 14 Parties to have signed the FAO PSM Agreement, approved by the FAO Conference in 2009 in Rome.[597] The agreement, not yet entered into force, would be the first international treaty to explicitly address IUU fishing, and empowers port States to monitor incoming foreign fishing vessels. It also calls for an information-sharing network to coordinate efforts to reduce IUU fishing among States.

[594] FAO, 1995,, 1.1; FAO,, 2010.
[595] FAO, 1995, Article 1.
[596] FAO Legal Office, 2010.
[597] FAO Legal Office, 2010.

Forestry

EU policies

In order to streamline Member States' national forestry policy, the following policies have been established specifically aiming at: forest management, forestry industry and/or nature protection:

- EU Forest Action Plan (FAP)[598] under the Forest strategy - aiming at an integrated approach to achieve sustainable forest management;
- Communication on innovative and sustainable forest-based industries in the EU[599], is complementary to the FAP, with actions meant to improve the long-term competitiveness of the forest-based sector;
- Biomass Action Plan (BAP) [600], relevant with regard to the rising demand for bio-energy;
- Policy on nature protection (Natura 2000) [601] – the Boreal region is the EU's biogeographical region with most Natura2000 sites (more than 5000)[602]; and
- Common Agricultural Policy (CAP) and Rural Development Plans (RDPs), offering concrete possibilities to implement measures of forest protection.

The Forest Action Plan (FAP) introduced the principle of Sustainable Forest Management (SFM) on an EU wide scale. However, because the Scandinavian countries helped design SFM, it is unlikely that the FAP will result in major changes to Sweden and Finland's forestry policy. One important change is that the two countries will now participate in a common European effort to ensure healthy forests across the EU.

In addition to SFP, Sweden and Finland have strong nature protection policies and have protected more than 5000 Natura2000 cites in the boreal forest. The Common Agricultural Policy (CAP) also contains concrete opportunities for implementing forest management measures through its Rural Development Plans (RDPs). The Biomass Action Plan (BAP) is part of the Climate and Energy Package, but has a non-binding character. Recommendations in the BAP support increased development of the forestry industry.

Norway participates in European policy processes through the EEA agreement[603] and must comply with some EU policies. The above mentioned policies do not have a binding character for Norway though, while at the same time they are relevant for Norway as it aligns its national approach to forestry management with neighboring countries and other EU Member States.

Multilateral agreements and international fora

There are a number of international fora and multilateral agreements that may influence decision-making and management on forestry in the north. Among others, these include the

[598] European Commission, 2006, p. 3.
[599] European Commission, 2008.
[600] European Commission, 2005a.
[601] Council of the European Community, 1992.
[602] European Commission, 2005b.
[603] Europa, European Union external action: Norway, online.

UN Forum on Forests[604], UN Framework Convention on Climate Change (UNFCCC) and Kyoto Protocol[605] and the Convention on Biological Diversity (CBD)[606]. In addition, there have been multiple attempts to develop international agreements specifically related to forests. The most promising is through the Ministerial Conference on the Protection of Forests in Europe (MCPFE), which is leading the effort to develop a legally-binding instrument to ensure sustainable forestry practices at the pan-European level, including Russia. The MCPFE has also adopted a number of resolutions covering environmental, economic and social aspects of forestry. The adoption of Pan-European Criteria and Indicators for Sustainable Forest Management[607] and of the Pan-European Operational Level Guidelines for Sustainable Forest Management[608] are among the most prominent outcomes of this process.

Another forum which facilitates EU – Russia discussion on northern forests is the Barents Euro-Arctic Council. The Barents Forest Sector Task Force (BFSTS), part of the Economic Cooperation working group of the BEAC, focuses on the economic, environmental and sustainability concerns of Barents region forestry. It also cooperates with the BEAC task force on bioenergy. It has developed three networks devoted to assessing trade of timber and wood products, utilisation of forest resources and biomass, and cooperation of forest authorities. Since the Barents region is a major supplier of paper, pulp and timber to the EU and Russia, the BEAC is an important Arctic-relevant body for forestry management, though there are questions about whether forestry related work should continue under the BFSTS or should simply be covered by the Economic Cooperation working group.

Tourism

EU policies

EU Tourism Policy

The European Commission issued several communications beginning in 2006 (hereafter, EU Tourism Policy) which seek to direct tourism policy in Member States.[609] The EU Tourism Policy's three stated goals are:

1) "mainstreaming measures affecting tourism," which includes vertically coordinating tourism policies and effectively using EU financial instruments;
2) "promoting tourism sustainability," which includes sustainable management of destinations, addressing tourism providers' sustainability concerns and increasing awareness of tourists; and
3) "enhancing the understanding and the visibility of tourism."[610]

[604] United Nations, United Nations Forum on Forests, online.
[605] UNFCCC, 1997.
[606] http://www.cbd.int/
[607] MCPFE, 1998a.
[608] MCPFE, 1998b.
[609] EC Communication (2006) 134, EC Communication (2007) 621.
[610] Europa, EU Tourism Policy, online.

With regard to promoting sustainability, the understanding is that Member States and tourism providers will voluntarily support this policy goal.

EU Structural Funds

In addition to the EU Tourism Policy are several EU Structural Funds that could potentially incentivise development of sustainable tourism in the EU, though none are dedicated to this issue.[611] These funds are:

- European Social Fund (1957) targets educational programs and training for the tourism sector, which could be utilized in sustainability initiatives;
- European Regional Development Fund (1975) "foresee[s] the possibility of funding sustainable tourism related projects";[612] A portion of the ERDF is dedicated to the Northern Periphery Programme, which was implemented in 2001.[613] The NPP will fund €45 million of projects from 2007-2013 in qualified regions of EU Member States Finland, Ireland, Northern Ireland, United Kingdom and Sweden and Non-EU Member States Faroe Islands, Greenland, Iceland and Norway.[614]
- The European Agricultural Fund for Rural Development (2005) provides support for *inter alia* diversifying rural markets by promoting tourism;
- European Fisheries Fund (2007) supports eco-tourism development as an alternative for employees of failing fisheries.

Multilateral agreements and organisations

Sustainable Model for Arctic Regional Tourism (SMART) (2000)

A policy initiative specifically relevant to the Arctic is the Sustainable Model for Arctic Regional Tourism (SMART), which was developed by the Northern Forum and the Arctic Council, with funding from the EU through the Northern Periphery Programme and Nordic countries.[615] Started in 2000, the goals of SMART were to:

1) Collect, document and analyze best sustainable tourism practices specific to the Arctic;
2) Communicate these findings to SMEs, trade associations, and communities with a stake in Arctic tourism;

[611] Europa, European policies for tourism, online.
[612] Europa, European policies for tourism, online. "Structural Funds: The Commission has foreseen the possibility of funding sustainable tourism-related projects through the European Regional Development Fund (ERDF) in support of social and economic development. Under its three objectives, "Convergence", "Regional Competitiveness and Employment" and "European Territorial Cooperation", the ERDF shall support more sustainable patterns of tourism to enhance cultural and natural heritage, develop accessibility and mobility related infrastructure as well as to promote ICT, innovative SMEs, business networks and clusters, higher value added services, joint cross-border tourism strategies and inter-regional exchange of experience. Environment and transport infrastructures, both of utmost importance for tourism, are also financed by the Cohesion Fund."
[613] NPP, 2004, Strategic Documents.
[614] NPP, 2010, Programme Info: Funding.
[615] SMART, 2006, p. 3.

3) Assist the Arctic tourism sector in adopting sustainability recommendations via a training manual and educational sessions (to be offered at the national level); and
4) Award businesses which effectively implement sustainability strategies.[616]

A result of this initiative was the creation of the Sustainable Arctic Tourism Association (SATA) in 2005.[617] SATA is mainly comprised of local level tourism stakeholders and is meant to continue the mission of SMART and carry out the objectives listed above, including promoting the adoption of an international "Sustainable Arctic Tourism" label. It is unclear how active or successful SATA initiatives have been in recent years.

UNESCO World Heritage Convention

The UNESCO World Heritage Convention – also known as the Convention Concerning the Protection of the World Cultural and Natural Heritage – is ratified or accepted by all but three EU-27 countries. It is a multilateral UN agreement which states that State Parties will identify and protect domestic sites of cultural heritage (e.g. monuments, groups of buildings) and natural heritage (e.g. physical or biological formations, natural sites of outstanding scientific value or beauty).[618] This is based on the concept that these sites are actually of such value that they are the world's heritage and require international cooperation for their preservation. State Parties must submit periodic reports on the "State of Conservation" in their regions. Europe's most recent report highlights that polar and tundra regions, and cold winter deserts are missing or underrepresented in their list of heritage sites. In 2004, two Arctic natural sites were inscribed.[619] There are currently no inscribed Arctic cultural heritage sites, though there are some cultural sites in Russia, Sweden, Finland and Norway directly below the Arctic Circle.

The World Heritage Convention is partnering with other UN programmes (Intergovernmental Oceanographic Commission, Man and Biosphere Programme, UN Environment Programme, Regional Seas Programme) to establish a network of marine and coastal protected areas by 2012.[620] While this partnership could potentially have implications for Arctic marine and coastal areas, particularly regarding the development of cruise tourism, it specifically targets small island developing nations and their ownership rights of surrounding waters. No Arctic focal points are currently included in the programme.[621]

Transport

EU policies

The EU policies which govern marine environmental and vessel safety are the three Erika packages, largely galvanized by the sinking of oil tanker Erika in 1999, which spilled 14,000 tonnes of oil off the coast of Brittany, France.[622] Over the following decade, the EU

[616] SMART, 2006, pp. 14-15.
[617] SMART, 2006, p. 3.
[618] UNESCO World Heritage Convention, 1972, Article 1-2, 5.
[619] World Heritage Reports, Periodic Report and Action Plan: Europe, 2007, p. 30.
[620] UNESCO, UNESCO Partnership on Coastal and Marine Protected Areas, online.
[621] UNESCO, UNESCO Focal Points for Coastal and Marine Resources' in SIDS Regions, online.
[622] IMO, 2002b.

implemented new and revised shipping regulations meant to address the lack of oversight and precaution that led to the Erika disaster.

Erika I

Erika I, introduced in 2000, is comprised of three initiatives to address short term and immediately rectifiable marine safety issues, particularly in oil trade. The Erika incident highlighted the need for more port State regulation and enforcement, since flag State and ownership of vessels can be difficult to ascertain. Erika I accomplished:[623]

- Giving more control to port States, allowing more rigorous inspection of ships that use Community ports, as well as a ban from all EU ports ships older than 15 years that have been detained more than twice in the two preceding years.
- Stricter monitoring and more stringent quality criteria for classification societies, to which Member States delegate power to inspect quality of ships and issue certificates of class. The EU Commission is now able to suspend or withdraw a society's recognition.
- A general ban on single hull oil tankers with a faster phase out schedule to be completed by 2015.

Erika II

The second Erika package was introduced at the end of the year in 2000 and was meant to provide longer lasting reduction of marine accident risk and pollution from vessels, supplementing the more short-term initiatives. Erika II contains new regulations that:[624]

- Enhance the ability of port States to monitor a broader range of vessel traffic by, *inter alia*, clarifying procedures which require vessels to communicate about dangerous cargo, requiring vessels to carry on-board automatic identification systems, and increasing the commonality of database systems. This is meant to provide a better picture of vessel traffic in EU waters to all port States.
- Extend the limits to compensation of victims of oil pollution from oil tanker accidents to €1,000 million, which would be enabled through the creation of the Fund for Compensation for Oil Pollution in European waters (COPE). This fund requires contributions from European oil receivers, but only in the event that an oil spill in EU waters threatens to exceed existing international compensation scheme limits.
- Establish the European Maritime Safety Agency (EMSA), which is meant to provide Member States with technical and scientific support, expertise in implementing Community legislation on maritime safety, and assist in updating and developing new Community legislation on this topic.

Erika III

Proposed in 2005 and adopted in 2009, the third maritime safety package introduced seven new objectives which build on the previous two packages:[625]

- Ensure all EU flag vessels are in good standing by incorporating the IMO flag-state audit scheme into EU law and introducing a new system to certify national maritime authorities;
- Empower the Commission to carry out audits and in general more rigorous inspection of classification societies as well as issue penalties;

[623] European Commission, 2000a, pp. 5, 12, 26.
[624] European Commission, 2000b, pp. 10-11, 12, 14, 52, 55, 63.
[625] EC Mobility and Transport, 2009.

- Require greater control at EU ports by Member States (instead of inspecting 25% of ships, there is a collective target for Europe to inspect all ships, with more frequent inspections of high-risk ships);
- Improve knowledge of maritime traffic by more efficiently and effectively sharing information among Member States and requiring onboard identification and positioning equipment;
- Make uniform the rules for compensating passenger victims of accidents aboard cruise ships and ferries, supplementing the IMO Athens Convention on the carriage of passengers and their luggage by sea;
- Require safety investigation, not seeking to assign liability, following certain maritime accidents (when an EU country can 'learn a lesson' from the accident, when the accident occurs in its waters, or when their significant interests are affected);
- Require all ship-owners to be insured against third-party damage caused by their ship.

Proper implementation and enforcement of the regulations contained in the Erika packages can help prevent accidents that might affect Arctic waters either by directly contaminating the ocean, and Arctic coastlines or impacting migratory fish stocks or marine birds and mammals. EU countries are empowered as port States to inspect and hold all vessels accountable which port in Member States, including those that may also be travelling through Arctic waters.

Directive on ship-source pollution (2005/35/EC)

This directive builds on MARPOL (discussed below), increasing the penalties for ship-source pollution. Any ship-source polluting discharges, from a vessel of any flag, anywhere in internal or territorial Member State waters, or EEZs, or the high seas is considered a criminal offence. Member States are able to determine the penalties. The Commission is to submit a Community report on the effectiveness directive every three years. Directive 2008/0055 134 amends this directive to incorporate provisions for penalizing individuals responsible for ship-source pollution. The amendment process may explain why a Community effectiveness report is not yet available.[626]

Integrated Maritime Policy for the European Union (IMP)

COM(2007) 575 outlines an EU strategy for integrating the goals of economic development, sustainability, and governance in maritime sectors and coordinating all sea-related policies.[627] This would be facilitated, among other initiatives, through improved maritime surveillance, marine spatial planning and coastal management, and improved data collection and accessibility. Marine transport is an area of focus within the IMP, highlighted in COM(2009) 8, which lists initiatives for improving the environmental performance of ships and ultimately achieving zero emissions and zero waste from shipping.[628] This includes reducing GHG emissions from international shipping, ensuring adequate port reception facilities for ship-generated waste (accounting for a growth in traffic), reducing NO_x and SO_2 emissions from ships under MAPROL, Annex VI, and promoting the use of alternative fuels.[629] This communication also discusses a European Environmental Management System for Maritime Transport, which would seek to continuously reduce environmental

[626] European Parliament, 2009.
[627] European Commission, 2007, p. 2.
[628] European Commission, 2009a, p. 6.
[629] European Commission, 2009a, p. 6.

impacts from shipping. The timeline over which these initiatives will be implemented is unclear.

Multilateral agreements

International law on maritime safety and environmental impact is comprised of many agreements, and continues to evolve with new amendments as new needs become apparent. Some are devoted to marine safety, such as SOLAS and COLREGS, others to protecting the marine environment, such as the London Convention, but most touch on both topics because there are significant synergies between safe, regulated shipping and keeping pollution out of waters. This is relevant to increased Arctic shipping activity because many of these Conventions will have to be expanded or clarified in order to be applied to the Arctic.

International Convention for the Prevention of Pollution from Ships (MARPOL)

This convention entered into force in 1983, and is one of the most important global legal frameworks for preventing pollution from ships. Of the convention's six annexes, only the first two are obligatory for state Parties. EU countries have in general ratified all six annexes (Malta has not ratified Annex IV; Czech Republic, Slovakia, and Hungary have not ratified Annex VI).[630]

Annex I seeks to reduce operational pollution from oil tankers, due to the fact that most marine oil pollution comes from the operation of tankers (cleaning tanks, disposing of cargo residues), not accidents.[631] It requires, inter alia, segregated ballast tanks and Crude Oil Washing, which eliminated the need to wash cargo tanks with sea water.[632] A 1992 amendment requires double hulls for all new tankers.[633]

Annex II controls four categories of noxious liquid substances carried in bulk via ship. Category X substances are prohibited from being discharged into the sea, Category Y have strict limits on amount of discharge allowed, Category Z have slightly less stringent discharge limitations and Other Substances are not subject to any MARPOL requirements.[634]

Annexes III-VI outline standards for packing, marking, labelling and notifications on harmful substances; control of sewage discharge from ships; management of garbage discharge and tracking requirements; and limits to sulfur oxide and nitrogen oxide emissions from ships.

Each Annex specifies 'special areas' or Particularly Sensitive Sea Areas (PSSAs) where stricter standards apply. For Annex I, these areas are the Mediterranean Sea, the Baltic Sea, the Black Sea, the Red Sea, the Gulfs region, the Aden Sea, the Antarctic area, northwest European waters, the Oman area, and southern South African waters. The Antarctic area is the only special area listed for Annex II. The Maritime Environment Protection Committee (MEPC) adopts amendments to MARPOL and plays a coordinating role for determining PSSAs. If a safety measure is proposed within the proposed Associated Protective Measures

[630] IMO, 2010.
[631] European Commission, 2000a, p. 12.
[632] European Commission, 2000a, p. 14.
[633] IMO, MARPOL, 2009.
[634] IMO, 2009a.

(APMs) for a PSSA, the proposal is considered by the IMO Sub-Committee on the Safety of Navigation.[635]

Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter (London Convention)

The London Convention, which entered into force in 1973, and its 1996 Protocol limit the deliberate disposal of wastes or other potentially harmful matter from ships, aircraft, platforms or other man-made structures.[636] It specifies which wastes cannot be dumped under any circumstances and which require a dumping permit. Parties must designate an authority to handle permits, determine appropriate dumping areas and monitor sea conditions.

The 1996 Protocol is much more restrictive than the original convention, namely due to its incorporation of the precautionary approach. Dumping of any wastes is prohibited, other than dredged material, sewage, fish waste, and several other categories of innocuous wastes. Incineration and exporting of wastes is also prohibited.

Most EU countries have ratified the 1972 Convention and 1996 Protocol.[637]

1974 Convention for the Safety of Life at Sea (SOLAS)

Among provisions for protecting the safety of passengers on maritime vessels, SOLAS also contains measures that can help prevent pollution due to vessel accidents. It includes requirements for ship construction, such as watertight integrity and stability requirements, as well as safety of navigation, specifying that all ships be sufficiently manned and safely routed, which are of particular importance for Arctic navigation.

The Maritime Safety Committee (MSC) adopts amendments to SOLAS and has the authority to adopt ships routing systems (SRSs) and vessel traffic services. There is no comprehensive mandatory or voluntary IMO SRSs for any part of the Arctic marine area.[638]

International Convention on Oil Pollution Preparedness Response and Cooperation

The OPRC Convention entered into force in 1995, requiring Parties to establish protocol for addressing pollution incidents from ships. Ships are required to carry oil pollution emergency plans and report pollution incidents to coastal authorities. The Convention also calls for building stockpiles of oil pollution control equipment. It also covers offshore energy recovery units, which is discussed further in the Energy section (section 2.4).

United Nations Convention on the Law of the Sea (UNCLOS)

UNCLOS contains provisions on protection of the marine environment in Part XII, which outlines the need to control vessel-source pollution. It does not include regulation of ballast water or anchoring effects. The Convention states that coastal states can adopt and enforce regulations for controlling marine pollution from vessels in ice-covered areas within the state's EEZ, if the ice coverage exists for "most of the year" and if the pollution could cause

[635] VanderZwaag, 2008, p. 31-32.
[636] IMO, 2009b.
[637] IMO, 2010.
[638] Molenaar et al., 2009, p. 5 (Shipping).

major harm and/or irreversible damage.[639] With reduced ice coverage in the Arctic, states may not be able to rely on this provision for prescribing more stringent standards. Furthermore, UNCLOS grants the right of "innocent passage" in the Territorial Sea which according to Art. 19 indirectly refers to pollution from ships, as "Passage of a foreign ship shall be considered to be prejudicial to the peace, good order or security of the coastal State if in the territorial sea it engages in any of the following activities: (g) the loading or unloading of any commodity […] contrary to the […] sanitary laws and regulations of the coastal State." Art. 211.4 sets out that in their territorial seas, coastal States can adopt laws and regulations for the prevention, reduction and control of pollution from foreign vessels.

International Convention for the Control and Management of Ships' Ballast Water and Sediments (BWM Convention)

The BWM Convention seeks to prevent, minimize and ultimately eliminate the transfer of harmful aquatic organisms and pathogens through the control and management of ships' ballast water.[640] It specifies standards for ballast capacity and the design and maintenance of ballast areas and states that discharge of ballast water shall only be conducted through Ballast Water Management. Introduced in 2004, this Convention is not yet adopted and, within the EU, has only been ratified by France, the Netherlands, Spain and Sweden.[641]

IMO Guidelines for ships operating in Arctic ice-covered waters

These voluntary guidelines are intended to promote safety of navigation and prevent pollution from ship operations in Arctic ice-covered waters. They develop a system of Polar Classes to designate different levels of vessels' abilities to travel at certain times of year within the Arctic. The International Association of Classification Societies (IACS) has subsequently specified construction requirements for Polar Class ships, but this is non-mandatory. As of yet there are still no enforceable international standards for vessels sailing or voyaging through Arctic ice, in terms of safety or environmental protection.[642]

Other National Policies: Canada and Russia

Canada and Russia are able to regulate shipping in certain areas of the Arctic under UNCLOS Article 234. They have used this authority to, *inter alia*, pass stricter standards on vessel pollution, shipping safety control zones and fee systems.

The Arctic Waters Pollution Prevention Act (AWPPA) extends to Canada's EEZ limit and specifies that only untreated sewage and emergency discharges are allowed in Arctic waters. It establishes shipping safety control zones, and specifies when and where ships of certain ice strength can operate. The Canada Shipping Act of 2001 authorizes regulations on VTS zones, which require vessel reporting and clearance in specified Arctic areas. Thus far one voluntary zone has been adopted, NORDREG, which covers all Canadian Arctic waters.[643] It is now enforced for many commercial vessels, including all ships over 300 tons, cargo ships, cruise ships, and ships carrying hazardous materials.[644]

[639] Molenaar, et al., 2009, p. 19 (Shipping); Article 234 UNCLOS Convention.
[640] IMO, 2004.
[641] IMO, 2010.
[642] AMSA, 2009, p. 4.
[643] AMSA, 2009, pp. 66-67.
[644] Bennett, 2010.

Russia opened the Northern Sea Route to foreign shipping by regulations introduced in 1991 and 1995, while simultaneously introducing pollution standards which are stricter than MARPOL and conditions for using the Northern Sea Route. These conditions include ship inspection by Russian maritime authorities, sufficient crew size, and a requirement that the ship's master have 15 days of experience with ice conditions within the Northern Sea Route.[645]

The EU cooperation with Russia on Arctic transport issues can be found in the **Steering Committee for the Barents Euro-Arctic Pan-European Transport Area (BEATA)**, through which the BEAC seeks to make transport in the Barents region more efficient and integrated. Under this framework decision makers from Russia, Norway, Finland and Sweden discuss transport investment plans, goals for development and environmental concerns.

Arctic indigenous and local livelihoods

EU policies

As the EU develops its Arctic policy, its attention to indigenous issues has acquired a new, northern dimension. The 2008 Arctic Communication makes a direct reference to an already developed body of policy on indigenous peoples (within EU development aid), thus suggesting that the same rights and guidelines pertain in the North, including providing "opportunities for self-driven development and the protection of […] lifestyle", as well as support for sustainable development. Arctic peoples are to be engaged in regular rights-based dialogue, in particular those traditionally acquiring their livelihood from the hunting of sea mammals, as well as within the Northern Dimension's Arctic Window.[646]

Protocol 3

The European Union acknowledged a special position of Sámi people as an indigenous group by the adoption of a special protocol to the accession treaty concerning the Sámi during the accession of Finland and Sweden in 1995. The EU recognizes the commitment of Finland and Sweden to the preservation and development of indigenous livelihood, language, culture and way of life as well as their dependence on primary economic activities, especially reindeer husbandry. Therefore, Sámi people may be granted exclusive rights to reindeer husbandry in traditionally inhabited areas and other provisions taking into account any exclusive Sámi rights that may be adopted in the future.[647]

EU cross-border and external co-operation

Currently, in the European North, the main framework for EU-driven cross-border cooperation remains Interreg Programme IV A North, which was designed to address common needs and challenges in the cross-border regions.[648] The objective of one of the Programme's priority axes, *Sápmi,* is to "develop Sámi cultural life and industry by making use of their resources in an ecological and sustainable way". This is to be done through the

[645] AMSA, 2009, p. 67.
[646] European Commission, 2008b, pp. 4-5; Council of the European Union 2009, paras. 3, 6, 20.
[647] Official Journal of the European Union, 1995.
[648] It is a third cross-border cooperation programme in North Fennoscandia.

strengthening of Sámi culture and industry and better business cooperation. Presently, it is the only EU programme (including also Russian partners) dedicated directly to Sámi issues.[649]

The main objective of the Northern Periphery Programme 2007-2013 (also known as Interreg IV) is to "help communities to develop the potential […] to achieve a sustainable and high quality future". The programme addresses problems of Sámi and Inuit (Greenland takes part in the Programme), as well as crucial issues for indigenous and local communities involving environment, cultural diversity, health and social well-being. For example, indigenous languages and cultures are to be promoted among young people. Specific projects are based, for instance, on local and indigenous knowledge, fishing practices or indigenous handicraft. Other priorities include enhancing, in a sustainable manner, new economic opportunities and competitiveness in the northern regions, especially for young people. The relationship between urban centres and rural areas is to be strengthened.[650]

Indigenous peoples of North-West Russia benefit indirectly from EU cross-border policies within the framework of the Northern Dimension (ND) and the EU-Russia cooperation framework. The EU instruments applicable to Russia in particular include Technical Aid to the Commonwealth of Independent States (TACIS), the European Neighbourhood and Partnership Instrument (ENPI), and the Democracy and Human Rights Instrument (EIDHR). Human rights programmes, such as EIDHR or the Institution Building Partnership Programme (IBPP), conduct projects in capacity-building, support to NGOs, and minority rights, with potential, although not explicit, reference to indigenous peoples' situation.[651]

The Kolarctic programme, a part of ENPI supporting cross-border cooperation in the European Arctic, acknowledges the importance of Sámi and Nenets for the region. The programme identifies the threat to traditional livelihoods posed by exploitation of natural resources. Consequently, it aims at "integration of traditional ways of living into modern social development" and creation of businesses enhancing indigenous cultures. Cultural *people-to-people* cooperation is to be supported as well.[652]

These programmes are integrated under the umbrella of the Northern Dimension (ND). The ND policy encompasses areas of the Baltic and Barents seas and the Arctic. Among ND stakeholders are the Barents Euro-Arctic Council (BEAC), the Arctic Council, the Nordic Council of Ministers, as well as the US and Canada that are among parties holding observer status. The main purpose of the ND is to coordinate numerous programmes implemented in the region to raise their effectiveness and avoid overlaps, as well as enhance EU cooperation with Russia, Iceland and Norway. In order to facilitate such developments, a number of partnerships exist, including the ND Partnership for Public Health and Social Wellbeing and the ND Partnership on Culture, which may be of particular importance for indigenous peoples inhabiting the region.[653] In 2002, the ND focused its efforts on the so-called "Arctic Window", which, *inter alia*, through the inclusion of Greenland into cooperation,

[649] Interreg IV A North 2007-2013, 2008.
[650] Northern Periphery Programme 2007-2013, pp. 10, 25-26, 32, 41, 46; Northern Periphery Programme 2007-2013, 2009, pp. 21, 23.
[651] Delegation of the European Commission to Russia, 2008; Delegation of the European Commission to Russia, 2009.
[652] *Kolarctic Programme*, pp. 11, 22, 25, 27, 30.
[653] European Commission, The Northern Dimension Policy, online; Luxembourg Presidency of the Council of the European Union, 2005; MoU setting out the modalities of establishing the Northern Dimension Partnership on Culture, 2010.

added a focus on the Arctic to the scope of the policy. However, presently the Arctic Window constitutes more of a dialogue space in which the EU and Arctic stakeholders can consult on matters of common interest in the region and possible policy development rather than a concrete policy instrument.

Indigenous peoples in the EU development aid policy and human rights frameworks

EU development aid policy includes a specific approach to indigenous peoples in the programmes conducted by the EU. However, it applicability to the Arctic is limited. The 2008 Arctic Communication acknowledges the body of principles and guidelines from development aid to be applicable also in the North,[654] but few EU policy measures follow this statement as yet.

EU policy on indigenous peoples – elaborated, for instance, in the Council Resolution of 30 November 1998 on Indigenous peoples within the framework of the development cooperation of the Community and the Member States – is considered a cross-cutting issue and is to be mainstreamed in all areas of EU activity, including, e.g., elaborating ethical trade standards. The policy is to be based on the following guiding principles: development should be based on indigenous peoples' own objectives and development paths, avoidance of adverse impact, donor co-ordination, screening procedures and integrating indigenous peoples into social impact assessment, protection of indigenous knowledge, full and free participation, and capacity building. Development of long-term economic strategies based on sustainable land-use and management of natural resources is among the priority areas of all new policy. The key role of indigenous peoples in the conservation and sustainable use of natural resources has also been acknowledged.[655]

Indigenous peoples' rights are one of the thematic issues of the EU human rights framework, for example in the European Initiative for Democracy and Human Rights (EIDHR).[656] EU institutions have been working on the rights of indigenous peoples since the early 1990s, building partly on the experience of EU Member States.[657] In 1998, the Commission issued a working document that summarised their experiences and outlined goals for a more comprehensive policy.[658] This was followed by the appropriate Council Resolution.[659] Starting from the 2002 Council Conclusions,[660] annual EU human rights reports include separate sections on indigenous rights. These reports constitute one of the instruments for monitoring EU policy towards indigenous peoples.

Natura 2000

The European conservation network Natura 2000 and overall EU biodiversity policy have a potentially crucial impact on conservation schemes in Lapland. In Finland and Sweden,

[654] European Commission, 2008b, p. 4.
[655] European Commission, 1998, pp. 7-10; Council of the European Union, 1998, para. 5; Council of the European Union, 2002, doc. 13466/02, paras 5, 8.
[656] European Commission, 2008b, p. 4.
[657] For instance, the European Parliament's 1994 Resolution A3-0059/93 referred to indigenous peoples' rights, involvement in projects concerning them and training to European officials dealing with indigenous issues. See European Commission, 1998, p. 9.
[658] European Commission, 1998.
[659] Council of the European Union, 1998.
[660] Council of the European Union, 2002, pp. IX-XI.

Natura 2000 covers the majority of areas inhabited and utilized, primarily for reindeer herding activities, by the Sámi people.[661]

Seal regulation

The EU ban on seal products import has recently been one of the major issues in EU-Arctic affairs. The ban met with strong opposition both from the Canadian government and Inuit organizations from Greenland and Canada. Even though products of indigenous subsistence hunting are exempted, Inuit still face the impact of the ban on the prices of seal products. Also, the formulation of the subsistence hunting definition is difficult in light of the indigenous mixed economy.[662] Presently, a regulatory framework for implementation of the ban is being discussed, with indigenous stakeholders' participation.[663] **The EU and Greenland**

The EU also officially recognises "geostrategic interest in treating Greenland […] as a privileged neighbour".[664] The specific relationship between Greenland and the EU is governed by the Partnership Agreement and Fisheries Partnership Agreement. Areas of cooperation include sustainable management of fish stocks and the marine environment, mineral resources, energy, and culture. The EU also recognizes the impact of climate change and contaminants, such as POPs, on the Greenlandic environment. Emphasis on the need for greater protection of marine mammals and birds is visible as well. Various social problems experienced by Greenlandic, mostly indigenous, society are also acknowledged.[665]

International instruments relevant to indigenous peoples

Human rights (individual and collective) in the case of indigenous peoples are closely connected with environmental rights, owing to their particular dependence on the natural environment. This is especially visible in the case of art. 27 of the International Covenant on Civil and Political Rights (ICCPR), protecting the right to culture of minority groups, and its interpretation by the Human Rights Committee. States are obliged to refrain from actions harmful to indigenous livelihoods as well as to carry out effective participation and meaningful consultation in relevant situations.[666]

The EU declares support for UN work and mechanisms on indigenous peoples, including the UN Permanent Forum on Indigenous Issues as well as their participation in international and national environmental negotiations and strategies.[667] According to the 2002 Council Conclusions, indigenous matters are to be a part of EU political and policy dialogue with third countries, also on the local and NGO level.[668]

[661] Hossain, 2008, pp. 91-105, p. 103; Metsahallitus, 2010.
[662] Indigenous seal hunting is not only a source of food and clothing, but constitutes also an important source of financial resources coming from selling of various by-products.
[663] European Commission, 2010; European Commission, 2008a, pp. 43-44.
[664] European Community, Greenland, Denmark, (2006c).
[665] Council of the European Union, 2006, text with EEA relevance and Annex ; Programming Document for the Sustainable Development of Greenland.
[666] Heinämäki, 2009, pp. 192-201.
[667] For example, in the development of national biodiversity strategies. European Commission, 1998, p. 14.
[668] Council of the European Union, 2002.

ILO Convention no. 169

The only modern binding international treaty dealing comprehensively with indigenous peoples' issues is the 1989 ILO Convention no. 169 on indigenous and tribal peoples. The convention confirms the general human rights of indigenous peoples, calls for the protection of social, cultural and spiritual values, practices and customary law, as well as safeguards the right to appropriate and free participation at all levels of decision making. Importantly, governments are obliged to protect and preserve the environment of indigenous territories (meaning both occupied and used areas) in cooperation with indigenous communities. The Convention also requires that environmental impact assessments be conducted for planned development activities. The most significant, problematic and controversial provisions can be found in art. 14, 15 and 16 of the Convention, which recognize the right of indigenous peoples to traditionally occupy and use lands and resources, protect them from resettlement, as well as guarantee participation and benefits in resource extraction activities carried out on their lands. Issues such as health, social security, education, and employment are dealt with in the ILO instrument. Denmark, the Netherlands, Norway and Spain are parties to the Convention[669] and Finland and Sweden are considering ratification.[670]

Declaration on the Rights of Indigenous Peoples

Another important instrument is the non-binding 2007 UN Declaration on the Rights of Indigenous Peoples. Many provisions are similar to ILO Convention no. 169 or repeat the general human rights provisions. Nevertheless, the Declaration does not refrain from the use of the term self-determination (arts. 3 and 4) and goes further in securing the right to ownership and control over traditionally inhabited and utilized territories. No relocation may be carried out without indigenous peoples' free, prior and informed consent (in the ILO Convention, such relocation was possible in exceptional situations under appropriate procedures) and states are obliged to recognize and actively protect indigenous lands and resources. Article 29 declares the "right to conservation and protection of the environment and the productive capacity of [indigenous] lands or territories and resources." Additionally, storage of hazardous materials may take place in indigenous territories only after free and informed consent, and no military activities may be carried out in such locations.[671] The EU is encouraged (in a non-binding way) to adhere to and implement the provisions of the *Declaration* as a soft law instrument, as is every other actor in international relations. The EU in particular has supported work on the *Declaration* and its final adoption, as well as on the establishment of the UN Permanent Forum on Indigenous Issues.[672]

Arctic fora

Arctic fora remain one of the most important vehicles for Arctic indigenous peoples' participation in decision-making. In the Arctic Council, six indigenous organizations obtained the status of Permanent Participants, and the Sustainable Development Working Group (SDWG) deals specifically with indigenous economy, health and culture.[673] Within the

[669] In addition, Belgium is and Portugal used to be party to 1957 ILO Convention no. 107, predecessor of Convention 169, and representing – nowadays rejected – integrative approach. However, Convention 107 can be still used to protect indigenous peoples in specific situations. See ILO Convention no. 107.
[670] ILO Convention 169, 2010.
[671] United Nations, 2007.
[672] European Commission, EU Policy on Indigenous Peoples, online.
[673] Arctic Council, 2008; Arctic Council, 2001.

Barents Euro-Arctic Region (BEAR), the Working Group on Indigenous Peoples (WGIP), consisting of representatives of indigenous organizations and the Sámi Parliamentary Council, has advisory status to the Barents Euro-Arctic Council and the Barents Regional Council. The WGIP also nominates one member of the Regional Council.[674] Presently indigenous peoples are aiming at expanding their presence in the BEAC towards a participatory status equal to the one they hold within the Arctic Council. The participation of indigenous peoples in both Councils is particularly relevant because both of these intergovernmental bodies focus on the environment and thereby present an opportunity for increasing the understanding of environmental impacts on indigenous livelihoods in the Arctic. The European Commission is a member of the Barents Euro-Arctic Council and the EU is an ad-hoc observer to the Arctic Council.

Convention on Biological Diversity

Protected areas cover more than 10% of the global terrestrial surface and often overlap with indigenous land. In the Arctic, biodiversity protection is closely connected with indigenous affairs. In the past, the process of designating protected areas often meant limiting access or relocating indigenous communities. Therefore, the Convention on Biological Diversity (CBD) is of particular importance to the situation of indigenous peoples both because their economy, identity and culture are dependent on preservation of biodiversity, and they are stewards of the natural environment. The instrument calls for respect and preservation of the knowledge, innovations and practices of indigenous and local people. Indigenous knowledge is considered relevant for the conservation and sustainable use of natural resources, which should be used with the consent of and to the shared benefit of local communities.[675]

The CBD COP has developed a substantial body of regulations on indigenous issues. The parties are encouraged to, *inter alia*, establish appropriate *good faith* participatory mechanisms, respect existing settlements, carry out cultural, environmental and social impact assessments, document traditional knowledge, as well as to focus on gender aspects, social cohesion, health, capacity building and non-discrimination. [676] Within CBD, there are also specific and extensive voluntary guidelines that have been adopted for environmental and social impact assessments on lands and waters occupied or used by indigenous or local communities.[677] The EU has pledged to apply the CBD Guidelines for projects affecting terrestrial land of indigenous and local communities.[678]

International Whaling Commission

The International Whaling Commission deals with regulation of whaling, including indigenous subsistence whaling. The EU pledged to "support proposals for the management of indigenous subsistence whaling", as long as conservation is not compromised.[679] Recently,

[674]BEAR WGIP, 2010.
[675]UNEP, 1992, art. 8j; CBD Secretariat, 2000. For more detailed information on indigenous peoples and biodiversity congruence, see, e.g., Sobrevila, 2008, p. xi-12; Toledo, 2001. Also conclusions of Rio Earth Summit together with Agenda 21 and 2002 Johannesburg summit on sustainable development contributed to indigenous peoples place in biodiversity discourse.
[676]United Nation Environment Programme, 2009. See also CBD COP decisions: COP 3 Decision III/14; COP 4 Decision IV/9; COP 5 Decision V/16; COP 6 Decision VI/10; COP 7 Decision VII/16; COP 8 Decision VIII/5, COP 9 Decision IX/13. Also, code of ethical conduct for indigenous peoples in biodiversity is being developed.
[677]United Nation Environment Programme, 2004.
[678]European Commission, 2006, p.11.
[679]European Commission, 2008b, p. 5; see Europa, Summaries of EU legislation: Whaling, online.

the EU has been developing a policy on whaling and the Commission has advocated the adoption of a common position within the IWC.

Other international venues and instruments

The EU is engaged in various international processes that may impact Arctic indigenous peoples or their environment, for instance, the UNDP and the World Bank.[680] Also, the UN Framework Convention on Climate Change is indirectly applicable to indigenous peoples when it refers to forests as natural sinks and reservoirs of greenhouse gases.[681]

[680] World Bank, 2005a; World Bank, 2005b.
[681] European Parliament, 2009b.

Annex D Policy Summary Matrix

EU Arctic Footprint and Policy Assessment						
Policy Summary Matrix						
POLICY TITLE AND REFERENCE NUMBER	DATE ENACTED AND DATE ENTERED INTO FORCE	POLICY AREA AND ISSUE AREA	INDICATORS ADDRESSED	GOAL	MONITORING/EVALUATION	ARCTIC IMPLICATION
Agenda for a sustainable and competitive European tourism COM(2007) 621	19 October 2007; non-binding	Economy, Environment; Tourism	Tourists per country, number of employees in tourism	(1) "mainstreaming measures affecting tourism," (2) "promoting tourism sustainability," includes sustainable management of destinations, addressing tourism providers sustainability concerns and increasing awareness of tourists; and (3) "enhancing the understanding and the visibility of tourism"	No dedicating monitoring system	Higher tourism activity increases GHG emissions, efforts to mainstream sustainable tourism could result in lower per capita tourism emissions. Could result in lower environmental and social impact on Arctic tourist destinations if regulation is implemented on the local level.
A renewed EU Tourism Policy - Towards a stronger partnership for European Tourism COM(2006) 134	17 March 2006; non-binding	Economy, Environment; Tourism	Tourists per country, number of employees in tourism	(1) "mainstreaming measures affecting tourism," (2) "promoting tourism sustainability," includes sustainable management of destinations, addressing tourism providers sustainability concerns and increasing awareness of tourists; and (3) "enhancing the	No dedicating monitoring system	Higher tourism activity increases GHG emissions, efforts to mainstream sustainable tourism could result in lower per capita tourism emissions. Could result in lower environmental and social impact on Arctic tourist destinations if regulation is implemented on the local level.

EU Arctic Footprint and Policy Assessment						
Policy Summary Matrix						
POLICY TITLE AND REFERENCE NUMBER	DATE ENACTED AND DATE ENTERED INTO FORCE	POLICY AREA AND ISSUE AREA	INDICATORS ADDRESSED	GOAL	MONITORING/EVALUATION	ARCTIC IMPLICATION
				understanding and the visibility of tourism"		
Northern Periphery Programme (EC Territorial Cooperation Objective) EC 1260/1999	14 December 2001	Economy, Environment; Tourism	Broad range, dependent on projects funded (potential for number of employees per sector, number of cruise ships, sustainability indicators, etc.)	to develop economic, social and environmental potential of Northern Peripheral regions: EU Member States of Finland, Ireland, Northern Ireland, United Kingdom and Sweden and Non EU Member States Faroe Islands, Greenland, Iceland and Norway	The NPP has a Programme Monitoring Committee, a Managing Authority, a Programme Management Group and an Audit Authority, in addition to Regional Advisory Groups	Specifically targets inter alia Arctic regions, could potentially support sustainable tourism development

EU Arctic Footprint and Policy Assessment						
Policy Summary Matrix						
POLICY TITLE AND REFERENCE NUMBER	DATE ENACTED AND DATE ENTERED INTO FORCE	POLICY AREA AND ISSUE AREA	INDICATORS ADDRESSED	GOAL	MONITORING/EVALUATION	ARCTIC IMPLICATION
EU Common Fisheries Policy (EC) No 2371/2002	20 December 2002	Fisheries; Fisheries	Number of ships, fish caught using trawls, Number of ship-days at sea, UDE of fish	Main legal basis for all subsequent EU fisheries policy, seeks to promote (1) sustainable fisheries and aquaculture, (2) healthy marine environment, (3) economically viable industry providing employment and opportunities for coastal communities.	Commission can fine MS and try them in ECJ; Scientific Technical and Economic Committee for Fisheries (STEFC) produces annual report on state of fisheries; Community Fisheries Control Agency (CFCA) pools MS enforcement resources	Template for Arctic fisheries regulation. Could impact straddling/migratory stocks found both in EU and Arctic waters.
Marine Strategy Framework Directive Directive 2008/56/EC	17 June 2008; 15 July 2008	Environment, Oceans; Fisheries, Biodiversity	Environmental status of maritime regions, number of marine strategies developed by MS	Achieve 'good environmental status' for all EU marine environments by 2020 (ecologically diverse, clean, healthy, productive, sustainable use strategies have been implemented)	MS must prepare assessments by 2012, programme of measures by 2015. MS must appoint national authorities that carry out the objectives of this Directive.	Seeks to reduce environmental pollution and impacts that could spread to Arctic marine areas or affect migrating and/or straddling species. Potential template for developing holistic maritime management in Arctic regions.

EU Arctic Footprint and Policy Assessment						
Policy Summary Matrix						
POLICY TITLE AND REFERENCE NUMBER	DATE ENACTED AND DATE ENTERED INTO FORCE	POLICY AREA AND ISSUE AREA	INDICATORS ADDRESSED	GOAL	MONITORING/EVALUATION	ARCTIC IMPLICATION
ERIKA I Package COM(2000) 142	21 March 2000; 22 July 2003	Transport; Transport	Number of shipping incidents, amount of water pollutants from ships	Reduce risk of accident and maritime pollution from commercial vessels in EU waters: (1) More monitoring control for port States, (2) stricter monitoring of classification societies, (3) ban on single hull oil tankers	MS must implement these regulations as national laws. Commission publishes list of ships denied access to EU waters	Applies to EU vessels in Arctic waters and would limit impacts that could spread into Arctic
ERIKA II Package COM(2000) 802	6 December 2000	Transport; Transport	Number of shipping incidents, amount of water pollutants from ships	Bring lasting reduction of accident and maritime pollution risks from commercial vessels in EU waters: (1) better maritime traffic control, (2) complete compensation to victims of oil spills from tankers, (3) create European Maritime Safety Agency	EMSA monitors efficacy of MS implementation of maritime safety regulations, collects information on Community marine accidents and other evaluations	Applies to EU vessels and any vessels travelling through EU waters in Arctic waters and would limit impacts that could spread into Arctic; Arctic parties can be compensated under the fund as long as they are eligible to receive funds under Fund Convention

EU Arctic Footprint and Policy Assessment						
Policy Summary Matrix						
POLICY TITLE AND REFERENCE NUMBER	DATE ENACTED AND DATE ENTERED INTO FORCE	POLICY AREA AND ISSUE AREA	INDICATORS ADDRESSED	GOAL	MONITORING/EVALUATION	ARCTIC IMPLICATION
ERIKA III Package COM(2005) 585	23 November 2005; 11 March 2009	Transport; Transport	Number of shipping incidents, amount of water pollutants from ships	Reduce risk of accident and maritime pollution from commercial vessels in EU waters, complete previous two legislative packages: (1) EU MS must ensure flag vessels respect IMO standards, (2) Stricter requirements for classification societies, (3) more stringent port State control with greater inspections coverage, (4) improving vessel traffic monitoring, (5) carry out safety investigation after every accident, (6) compulsory ship insurance in EU waters, (7) compensate victims of maritime accidents under Athens convention	Similarly monitored by EMSA	Applies to EU vessels in Arctic waters and any vessels travelling through EU waters, would limit impacts that could spread into Arctic
Directive on ship-source pollution and on the introduction of penalties for infringements Directive	07 September 2005	Transport; Transport	Amount of water and air pollutants from ships	Reduce ship-source pollution through stricter punishment and cooperation of MS	Assisted, monitored by EMSA; every three years, MS submit report on implementation of the Directive, Commission writes Community report to assess adequacy of	Applies to EU vessels in Arctic waters and any vessels travelling through EU waters, would limit impacts that could spread into Arctic

EU Arctic Footprint and Policy Assessment						
Policy Summary Matrix						
POLICY TITLE AND REFERENCE NUMBER	**DATE ENACTED AND DATE ENTERED INTO FORCE**	**POLICY AREA AND ISSUE AREA**	**INDICATORS ADDRESSED**	**GOAL**	**MONITORING/EVALUATION**	**ARCTIC IMPLICATION**
2005/35/EC					the Directive	
EU Renewable Energy Directive Directive 2009/28/EC (amends 2001/77/EC and 2003/30/EC)	23 April 2009; 13 May 2009	Energy; Energy	Amount of final energy consumed supplied by renewable energy sources, GHG emissions from energy consumption	Meet 20% of total energy demand through renewable energy sources by 2020	MS develop National RE Action Plans and submit progress reports to Commission every two years until 2021. Commission must monitor and report on biofuel sustainability progress.	Reduces dependence on imported fossil fuels, which could potentially come from the Arctic in greater volumes in the near future, especially from Norway and Russia.
Fuel Quality Directive Directive 2009/30/EC	23 April 2009; 13 May 2009	Energy; Energy	Total lifecycle emissions from transport fuels, GHG emissions from lifecycle of biofuels and other potential biofuels impacts (amount of land utilised for biomass production, by land use type)	Reduce lifecycle emissions from transport fuels by 10% by 2020, largely through using biofuels. Also, implement sustainability criteria for biofuels.	Commission shall report every 3 years starting 2012 on needs for amendments to the Directive and will monitor achievement of GHG reduction target in transport.	Reduces dependence on imported fossil fuels, which could potentially come from the Arctic in greater volumes in the near future, especially from Norway and Russia.

EU Arctic Footprint and Policy Assessment						
Policy Summary Matrix						
Policy Title and Reference number	**Date enacted and Date entered into force**	**Policy area and Issue area**	**Indicators addressed**	**Goal**	**Monitoring/Evaluation**	**Arctic implication**
Concerning measures to safeguard natural gas supply Council Directive 2004/67/EC	26 April 2004; 19 May 2004	Energy; Energy	Number of importers of natural gas to EU, number of natural gas system connections between MS, number of natural gas supply 'crises'	Safeguard an adequate amount of natural gas for energy security and improve functioning of internal natural gas market.	MS must submit reports on number of external suppliers, policies implemented to secure supply. Gas Coordination Group created to coordinate security of supply measures.	Arctic regions are sources of natural gas for EU.
On the limitation of emissions of certain pollutants into the air from large combustion plants Directive 2001/80/EC	23 October 2001; 27 November 2001	Energy, Environment; Energy	SOx, NOx and dust emissions from energy production	Significantly reduce SOx, NOx and dust emissions from large combustion plants	MS responsible for ensuring adequate monitoring on the MS level, must report progress in implementing national plans and targets to Commission.	Reduces air pollution impact of EU on Arctic.
Concerning integrated pollution prevention and control Directive 2008/1/EC	15 January 2008; 18 February 2008	Environment; Energy, Chemicals	Amount of air pollution, amount of mercury emissions	Reduce and prevent pollution from industrial and agricultural activities with high pollution potential through integrated measures	Permits granted to installations at the MS level, and MS ensures compliance of installations with Directive.	Reduces air pollution impact of EU on Arctic.

EU Arctic Footprint and Policy Assessment						
Policy Summary Matrix						
Policy Title and Reference number	**Date enacted and Date entered into force**	**Policy area and Issue area**	**Indicators addressed**	**Goal**	**Monitoring/Evaluation**	**Arctic implication**
Providing for minimum criteria for environmental inspections in the Member States Recommendation 2001/331/EC	04 April 2001; non-binding	Environment; Energy	Number of noncompliance incidents under EU environmental law	Set minimum standards for environmental inspections for all MS to strengthen compliance with Community environmental law	MS report to Commission on effect of this Recommendation on environmental inspections, Commission directed to review effectiveness of Recommendation	Could potentially reduce transboundary impact on Arctic. Template for environmental inspection criteria carried out in Arctic.
EU Framework for Environmental Impact Assessments Directives 85/337/EEC, 97/11/EC and 2003/35/EC	26 May 2003; 25 June 2003	Environment; Energy	Various measures of environmental impact from an EU project or development	Reducing environmental impact of projects and economic development by mandating EIAs implement MS frameworks and improving efficacy of EIAs by increasing public participation in decision-making	MS must enact laws to create framework and are tasked with enforcement. Commission evaluated efficacy of 85/337/EEC.	Could potentially reduce transboundary impact on Arctic. Could extend to projects undertaken with third parties, including in Arctic regions.
Strategic Environmental Assessment Directive Directive 2001/42/EC	27 June 2001; 21 July 2001	Environment; Energy	Various measures of environmental impact from an EU project or development	Reducing environmental impact of EU and MS plans and programmes undertaken by government entities through minimum environmental assessment criteria	MS shall monitor environmental effects of plans and programmes, and share information with Commission on applying the Directive through environmental reports. Commission is to devise regular evaluation reports.	Could potentially reduce transboundary impact on Arctic. Could extend to projects undertaken with third parties, including in Arctic regions.

EU Arctic Footprint and Policy Assessment						
Policy Summary Matrix						
Policy Title and Reference number	**Date enacted and Date entered into force**	**Policy area and Issue area**	**Indicators addressed**	**Goal**	**Monitoring/Evaluation**	**Arctic implication**
EU National Emissions Ceiling Directive Directive 2001/81/EC	23 October 2001; 27 November 2001	Environment; Energy, Chemicals	Amount of air pollutants	Limit emissions of pollutants contributing to acidification, eutrophication, and ground level ozone to protect environment and human health	Commission is to track progress towards meeting ceilings for 2010 and 2020	Reduces transboundary air pollutants which impact the Arctic
EU Communication on Biodiversity: Post-2010 COM(2010)4	01 January 2010; non-binding	Environment; Biodiversity	Rate of biodiversity loss	Halt biodiversity and ecosystem services loss within the EU by 2020, restore them to extent possible, and increase EU contribution to addressing global biodiversity loss	EEA will launch a Biodiversity Information System for Europe (BISE) to address inconsistent MS-level monitoring	Arctic biodiversity implicated in EU plans to contribute to addressing global biodiversity loss. EU conservation strategies can also have positive transboundary impacts on Arctic species.
EU Birds Directive Directive 79/409/EEC	02 April 1979; 07 April 1981	Environment; Biodiversity	Number and population sizes of EU bird species	Protect, manage and regulate all EU bird species, regulate their exploitation. Habitat protection for certain species is specified.	MS must report to Commission on implementation of this directive, from which Commission prepares report every 3 years	EU conservation strategies can have positive transboundary impacts on Arctic species. Applies to species in the EU-Arctic.

EU Arctic Footprint and Policy Assessment						
Policy Summary Matrix						
Policy Title and Reference number	**Date enacted and Date entered into force**	**Policy area and Issue area**	**Indicators addressed**	**Goal**	**Monitoring/Evaluation**	**Arctic implication**
EU Habitats Directive Directive 92/43/EEC	21 May 1992; 10 June 1992	Environment; Biodiversity	Number and population sizes of EU plants and animal species, number of habitat types, number of areas of threatened habitat types	Ensure maintenance of biodiversity by conserving natural habitats and restore to favourable conservation status species of Community interest	Established Natura 2000, a network of EU protected areas designated by MS. Seeks to ensure sustainable management of these areas. Collects statistical information on progress achieved under Birds and Habitats Directive.	EU conservation strategies can have positive transboundary impacts on Arctic species. Applies to species in the EU-Arctic.
Registration, Evaluation, Authorisation, and Restriction of Chemicals (REACH) (EC) No 1907/2006	18 December 2006; 01 June 2007	Chemicals, Environment; Chemicals	Amount of chemical pollution from manufacturers and imports	Manage risks from import and manufacturing of chemicals through a registration system overseen by European Chemicals Agency (ECHA)	CARACAL is an expert working group which advises the Commission on REACH and CLP	EU pollution is transported into Arctic atmosphere and waters, so any reduction in EU pollution can influence Arctic levels

EU Arctic Footprint and Policy Assessment						
Policy Summary Matrix						
Policy Title and Reference number	**Date enacted and Date entered into force**	**Policy area and Issue area**	**Indicators addressed**	**Goal**	**Monitoring/Evaluation**	**Arctic implication**
EU Mercury Strategy COM(2005)20	28 January 2005	Chemicals, Environment; Chemicals	Amount of mercury pollution	Reduce mercury emissions, reduce entry of mercury into circulation by reducing supply and demand, addressing mercury reservoirs (in products and storage), promoting international action on mercury	Clean Air for Europe, IPPC permit system, Scientific Committee on Health and Environmental Risks, European Food Safety Authority are all bodies relevant to monitoring activities due to wide range of mercury sources and pollution impacts	EU pollution is transported into Arctic atmosphere and waters, so any reduction in EU pollution can influence Arctic levels
EU Mercury export ban (EC) No 1102/2008	22 October 2008; 04 December 2008	Chemicals, Environment; Chemicals	Amount of mercury pollution	Eliminate the export of mercury-containing (and various mercury alloys) products from the EU	Competent authorities in MS oversee decommissioning of certain facilities and permitting of mercury storage facilities	Could reduce transboundary mercury pollution into Arctic
Restriction on marketing of mercury Directive 2007/51/EC	25 September 2007; 03 October 2007	Chemicals, Environment; Chemicals	Amount of mercury pollution	Eliminate mercury from certain marketed products (does not apply to those already in use or sold second hand)	MS responsible for enacting the Directive at MS level	Could reduce transboundary mercury pollution into Arctic