EU Arctic Footprint and Policy Assessment

Report Summary

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About the EU Arctic Footprint and Policy Assessment

The *EU Arctic Footprint and Policy Assessment* study aims to improve the effectiveness of EU environmental policies with respect to the Arctic region. The study assesses the EU's current footprint on the Arctic environment and evaluates how it could change over time. The effectiveness of the EU's current environment-related policies is analysed, including how these policies relate to current and future footprint scenarios. Options for improving EU policy are presented. The *EU 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.

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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.

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, the 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 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] In December 2009, the European 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] The European Parliament's Draft Report on a Sustainable EU policy for the High North", which focuses on enhancing coordination for stronger EU coordination of Arctic research and information is expected in 2011.

Against this background, the Arctic Footprint and Policy Assessment (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). At the same time the importance of the sustainable development of the region's natural resources for the benefit of local and indigenous people must be recognised. 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. Detailed policy options associated with each issue area are provided to inform a new Arctic Policy for the EU. This report summary provides a brief overview of each section of the full 120-page AFPA report as follows:

- Section 2: *EU Arctic footprint and policy assessment*. This section evaluates each of the nine distinct issue areas according to 1) status, trends and pressures, 2) EU's footprint, 3) EU policies and MEAs, 4) effectiveness of policy instruments, and 5) policy options. The full report accompanying this document includes annexes with detailed description of policies discussed in each issue area and a policy summary matrix.
- 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 environmental policies of the EU are based on international and European legal instruments that rarely refer directly to the Arctic. An EU strategy for the Arctic region would ideally consider the Arctic comprehensively, recognising the entire ecosystem and including its stewards and users. 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 governance, 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

The Arctic is host to a range of ecosystems and unique species, but also many globally significant animal populations, including half of the world's shore bird species.[5] Changes in Arctic ecosystem services already affect the well-being of people living in the region and can 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.[6]

The Arctic Biodiversity Trends 2010 assessment included the following key findings about the current status of Arctic biodiversity: [7]

- Unique Arctic habitats, 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.

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.[8] 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.

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.[9]

Increased exploitation of natural resources in the Arctic has led to changes in the landscape and thus the habitats of flora and fauna. Over-fishing and other pressures directly related to human exploitation of natural resources, such as certain harvest methods (e.g. by-catch of seabird and marine mammals) and reindeer overgrazing, stress wildlife populations. Pollution can pose a challenge to individual plants, animals and local ecosystems.[10] Populations and ecosystems often experience several stressors simultaneously, which can increase their vulnerability.[11]

Much hope has been generated by successes of the negotiations under the Convention on Biodiversity 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.

EU's Footprint

No formal footprint has been calculated for biodiversity because its loss is the result of a range of pressures. The EU countries and citizens can influence biodiversity through activities within the Arctic region, 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.

EU and Multilateral Policy Options

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 EU could focus on further protecting the European Arctic through Natura 2000. These efforts could be combined with the Arctic Council's strategies for Arctic biodiversity protection through its CAFF working group.

Create a conservation think tank: 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 the rethinking of conservation strategies by bringing together scientists and conservation

practitioners to focus on research, policy and tackling the challenge of building resilience and capacity for adaptation in wildlife populations.

Help reduce spread of invasive species: 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.[12] 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. The UN Fish Stock Agreement and regional fisheries management organisations (RFMOs) can contribute to marine biodiversity protection.

Promote cooperation for conservation: New bridging mechanisms between conservation bodies at different levels of governance are likely to become important, as will networks for knowledge sharing and learning, as biodiversity conservation continues to require greater international cooperation. The EU could 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.[13] The EU can also support the cooperation between OSPAR and the Arctic Council on issues of Arctic marine biodiversity, particularly related to the impacts of fisheries. 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.[14]

2.2 Chemicals and Transboundary Pollution

Status

Persistent organic pollutants (POPs) and heavy metals include a range of anthropogenic and natural substances that are potentially toxic to people and wildlife. The main source of POPs in the Arctic is long-range transport from outside the region, including via prevailing wind patterns and ocean currents. These contaminants accumulate and biomagnify in the food web, with human and wildlife exposure resulting from dietary consumption.

Many POPs have been deliberately produced for technical applications or are created when the technical products break down. Some POPs are created as by-products in the production of technical products or in various combustion processes (e.g. dioxins and furans). Levels in the environment often reflect proximity to source regions and time trends often reflect changes in production and use volumes. 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.

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, a major source of GHG emissions.

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.[15] Black carbon (BC), for example, likely reduces the albedo of Arctic snow and ice and accelerates warming.

Climate change is likely to affect both sources and pathways of POPs and mercury. However, it is difficult to predict whether climate change will lead to generally increased or decreased loads, as there are processes working in both directions.

EU's Footprint

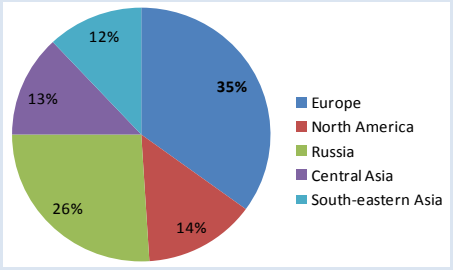
The EU share of global transboundary pollution in the Arctic depends on the specific substance. Figures 1 shows examples of the EU's contribution to pollution in the Arctic.

Figure 1 a) Source regions of HCB depositions over the Arctic, 2005[16]

b) Source regions of mercury depositions over the Arctic, 2005[17]

c) Source regions of SO2 emissions over the Arctic, 2001[18]

a)



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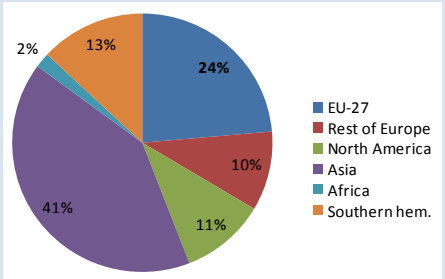

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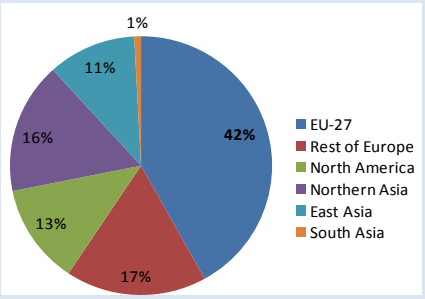


EU and Multilateral Policy Options

Support reduction of mercury emissions: 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.[19] 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.

Develop integrated pollution control systems: 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 CCS goal.[20]

Coordinate activities between existing mechanisms: The Registration, Evaluation, Authorisation and Restriction of Chemical substances (REACH) programme, as one of the regulatory frameworks to control chemicals in the European Union, could initiate cooperation with existing working groups in the Arctic Council. 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 Arctic Monitoring and Assessment Programme (AMAP) and REACH, such as the one between the Convention on Biological Diversity and Conservation and CAFF.[21] The EU could also provide a leadership role in the continued work of Convention on Long-range Transboundary Air Pollution (LRTAP) and the Stockholm Convention, including effective sharing of data between European monitoring and modelling efforts and these conventions.

2.3 Climate Change

Status

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.[22] The Arctic could warm further as much as 2-9°C by 2100.[23] Arctic sea ice is receding at a decadal rate of 2.7%, with 7.4% decadal decreases in the extent of summer ice.[24]

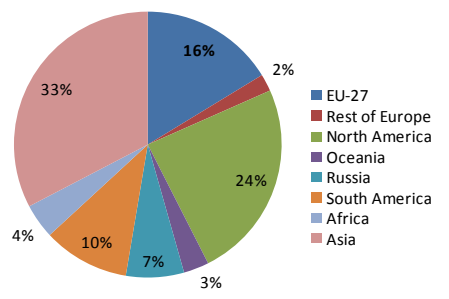
As a major GHG emitter and neighbour of the Arctic, the EU has a stake in the impacts of climate change on Arctic industries, communities, and ecosystems. The EU has indicated its concern over the drastic changes predicted for high northern latitudes as the global average temperature continues to increase, likely creating the need for significant adaptation efforts.[25] 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.[26]

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. According to the UNFCCC, in 2008 the EU-27 was the third largest emitter of global GHG emissions (16.3%) after North America (24.2%) and Asia (32.6%).[27,28]

Black carbon (BC) also likely has a net positive climate forcing in the Arctic by accumulating on ice and snow, increasing the rate of melting.[29] The European continent contributes approximately 59% of all black carbon deposited in the Arctic.[30]

Figure 2 Global shares of greenhouse gas emissions, 2007[31]



EU and Multilateral Policy Options

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.[32]

Reduce black carbon (BC) emissions: One policy option for reducing BC emissions from the EU, which has already outlawed most agricultural burning and already limits these emissions (albeit indirectly, through air quality standards) 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. 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.

Support reducing emissions from international shipping: The EU could also increase the emissions reductions from maritime transport by committing all revenues resulting from the implementation of a CO_2 charge or an operator emissions trading scheme as Climate Finance 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. The EU has said it will move forward alone if there is no international agreement by the end of 2011.[33]

Provide support for adaptation: 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. 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.

2.4 Energy

Status

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.[34] 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.[35] A recent US Geological Survey (USGS) study estimates that there are approximately 400 billion barrels of oil equivalent reserves in the Arctic, 84% of which are located offshore.[36] 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).[37]

The October 2010 Commission Communication, "Facing the challenge of the safety of offshore oil and gas activities" 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.'[38]

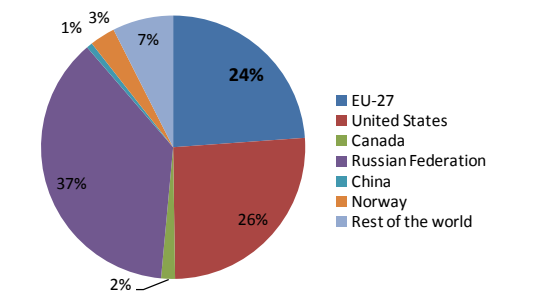
Some Arctic regions are also rich sources of rare earth minerals, which similarly require infrastructure development and extraction. The Arctic's most infrastructure-intensive industries are oil, gas, diamond and metal extraction.

EU's Footprint

The EU-27 receives 24% of the total output of the Arctic's oil and gas industry, including pipeline transportation.[39] Market influence and cooperation with Arctic energy partners will be important tools for encouraging sustainable energy exploitation in the Arctic.

Furthermore, the share exports to the EU from all Arctic infrastructure-intensive industries (oil, gas, diamond and metal extraction) is 60% out of the global total.[40]

Figure 3 Final demand for Arctic oil and gas production, including pipeline transportation, by region.[41]



EU and Multilateral Policy Options

Support a multilateral agreement on offshore oil and gas activities: Following the recent Communication on offshore oil and gas activities, the EU could work with Arctic states to coordinate 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 BC pollution from oil and gas flaring and other operational activities.

Enhance cooperation with Russia: Russia receives 60% of its foreign currency revenue from oil and gas exports,[42] most of which comes from the EU.[43] 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. Furthermore, 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 was started in 2008 and resulted in nine full negotiating rounds by May 2010.[44] The new Agreement expects to include substantive and legally binding commitments, inter alia, in the area of investment and energy.[45] The EU could thus urge Russia 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

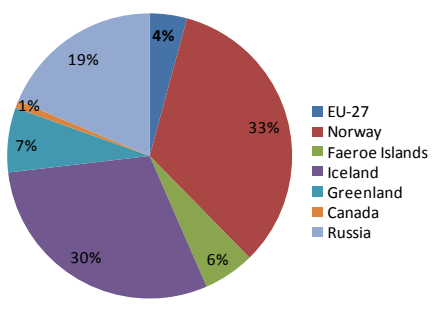
Declining sea ice cover and warmer Arctic waters may increase the potential for a larger area of more abundant fishing grounds in the Arctic, which currently only provides 4% of global fish catches.[46] Though there are opposing drivers to such development, including ocean acidification and competition 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.

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.[47]

EU's Footprint

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. However, the EU-27's fish imports from selected Arctic countries (Canada, Iceland, Norway, Russia, and USA) constitute 39% of the total fish exports of these countries.[48]

Figure 4 Fish capture production by region in Arctic waters, 2006[49]



EU and Multilateral Policy Options

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.[50]

Enforce IUU fishing regulation: The EU focus against IUU fishing could include stricter control measures for any new and expanded fisheries in the Arctic. 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.[51] 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.[52] 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), while encouraging other Parties to do so as well.

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).

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.[53] 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, particularly for straddling fish stocks which are not covered under the existing UN framework. 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. They are also needed in FAO statistical areas 18 and 27, where until now status of fish stocks has been largely ignored. Basic fisheries research is also necessary for ensuring sustainable management of any fishery, and scientists can start in the Arctic by beginning to understand levels of fish stocks and species interactions before fishing activity increases substantially. Furthermore, the EU could 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.

2.6 Forestry

Status

The boreal forest biome makes up about 27% of the world's forest cover, with the largest areas located in Russia and Canada.[54] A wide variety of tree species can be found in the boreal forest, including primarily evergreens such as firs, pines, and spruces, but also deciduous tree species, such as larch. Boreal forests form a 1000 km wide belt across North America, Europe and Asia. Though forestry has declined during the last century, boreal forests are still of economic importance in the Arctic and forestry and wood-processing form the major economic activities in some areas.[55] In particular, local and indigenous peoples living in the boreal forest zone depend on these resources.

Pressures on the boreal forest include both climate change and direct impacts from human activities. These activities include forestry, land conversion to farmland or flooding to make 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[56] and the use of wood for energy.

The rising demand for bioenergy offers new opportunities for forest enterprises to sell timber of poorer qualities.[57] The boreal forest is also affected by and contributes to climate change through its role in the atmospheric carbon cycle. Global CO_2 levels are influenced by the uptake of carbon in forest growth, the storing of carbon in live and dead plant matter and its release through decomposition, animal respiration and combustion during fire. An increase in temperature as a result of climate change is expected to increase forest growth and expand its distribution northward.[58]

EU's Footprint

Due to a lack of specific boreal forest data – especially trade data – it was not possible to quantify the impact of the EU on the Arctic boreal forest.

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 on climate change) rather than forest exploitation.

EU and Multilateral Policy Options

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. 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]).

Reduce pressure on boreal forests: Reduction in the consumption of pulp and paper within the Member States could lead to a reduced pressure on forest ecosystems, which would benefit boreal forests in countries like 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.[59] 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.

2.7 Tourism

Status

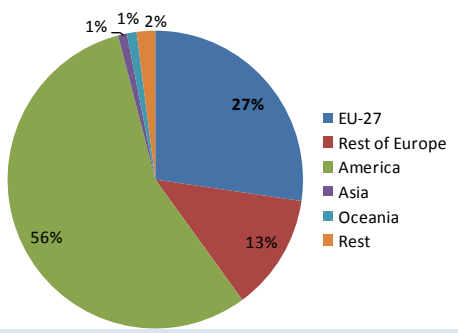
The popularity of Arctic tourism has increased greatly over the past two decades due to increases both in demand and supply. Tourists are becoming increasingly interested in 'ecotourism' and wilderness destinations, both of which are readily available in the Arctic.[60] The cruise ship industry is the fastest growing sector of the travel market and one of the top tourist attractions in the Arctic.[61] 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.[62]

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.[63] 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.[64] 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.

EU's Footprint

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. 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.[65]

Figure 5 Distribution of visitors to Arctic countries and regions by origin, around 2007.[66]



EU and Multilateral Policy Options

Form 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 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, but not yet implemented, by the Sustainable Arctic Tourism Association (SATA) in 2005.

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).[67] 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.

Link 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.[68] In Svalbard, the linkage between tourism and conservation is furthermore promoted by the United Nations,[69] as well as in the WWF's Ten Principles for Arctic Tourism.[70] The EU could facilitate further cooperation of this nature.

2.8 Transport

Status

The direct and indirect environmental impacts of EU-owned ship traffic, air travel and road transport to, from and within the Arctic, are expected to increase in the coming decades. This section focuses on EU involvement in Arctic shipping: up to 6,000 vessels operate in the Arctic each year, 1,600 of these being fishing vessels.[71] Reduced sea ice and a potential rise in demand for Arctic oil and gas could mean an increase in Arctic shipping traffic.[72] 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.[73]

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.). 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.

EU's Footprint

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.

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.[74] 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 flags of convenience (FOCs).[75] Including Norway, the European-owned fleet comprises over 50% of the global fleet.

EU and Multilateral Policy Options

Support development of the IMO Polar Code: At present, polar vessel construction standards are unevenly applied.[76] A step towards rectifying this and promoting safe Arctic shipping is to make the IMO Guidelines for Ships operating in Arctic Ice covered Waters mandatory, a process already started under the IMO. The EU could actively advocate this process and promote the implementation of 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.

Support designation of Particularly Sensitive Sea Areas (PSSAs) in the Arctic: 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.[77] 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.[78] Examples of the routing and reporting measures 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.[79]

Support development of Arctic shipping infrastructure: 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.[80]

Given these challenges, there are several ways in which the EU can take an active role in the development of Arctic shipping infrastructure:

- Promote the multi-national Arctic Search and Rescue Instrument,[81] proposed mainly by the US and Russia, which is planned for signature at the May 2011 Arctic Council Ministerial Meeting.
- 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.[82]
- Consider closer cooperation – and even include maritime infrastructure development to a greater extent – in programmes such as Interreg, 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. 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.[83]
- Examine the possibility of expanding the "Motorways of the Sea"[84] network northward, towards the Arctic ports of Norway (presently Narvik is designated as the MoS port) and even Russia. Such discussion could take place through, for example, the Barents Euro-Arctic Council (BEAC).

2.9 Arctic Indigenous and Local Livelihoods

Status

There are approximately 4 million people living in the Arctic, ranging from very thinly populated rural areas to increasingly densely populated urban centres. Indigenous people make up about 10% of the total Arctic population and represent 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.[85]

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.

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.[86] The major components of the formal economy in the Arctic region include tourism, fisheries, large-scale mineral and energy development and reindeer husbandry.[87] 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 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.[88]

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.[89]

It is important to note, though, that nowhere in the Arctic are these subsistence activities the only source of livelihood. 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.[90]

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. Many stakeholders feel that Arctic communities deserve to have room for economic development and improved qualities of life. Environmental policies should account for this need, noting important information sources such as the Arctic Human Development Report (2004).

EU's Footprint

Measuring the 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. Generally, resource exploitation, climate change and pollution impact Arctic livelihoods. The EU contribution to these is identified in the sections on energy, climate change, and chemicals and transboundary pollution, respectively.

EU and Multilateral Policy Options

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 improve the dialogue with the indigenous community.

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.[91] 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.[92] 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.

Establish participatory mechanisms within EU biodiversity policy: EU environment and biodiversity conservation policy and indigenous participatory mechanisms could be strengthened. 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 and in the EEA, if the programme is in fact expanded (see also, Section 2.1 on biodiversity).

Support indigenous peoples in international fora: Often times 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)

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. 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 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.

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 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 BC and GHG emissions.

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.

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

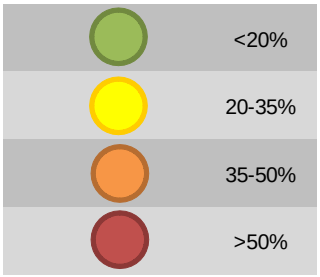
- Utilising ecosystem-based management
- Assisting in Arctic climate change adaptation efforts
- Continuing climate change mitigation efforts within the EU and internationally
- Continuing to increase resource efficiency
- Reducing pollution from a wide variety of sources
- Strengthening the policy process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

4 Conclusion

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.

Figure 6 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 component of the analysis indicates that there are policies in place to address most of these impacts, both within the EU and globally. However, Table 1 below, 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 of the infrastructure impacts from Arctic imports, black carbon emissions, and SO_2 emissions from imports.

Table 1 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[93]
Black carbon emissions deposited in Arctic (59%)	EU decreased PM10 emissions by 11% and PM2.5 emissions by 12%, 2000-2007[94] (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.[95]	None[96]	None
Import mercury emissions (36%)	Global mercury emissions have risen 20% 1990-2000[97]	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[98]	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[99]	Air concentrations are slowly decreasing while trends in bioaccumulation are less clear[100]	• 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[101]	Reductions in SO_2 air concentrations have been detected in some Arctic areas since 1990[102]	• Integrated Pollution Prevention and Control (2008/1/EC) • Limiting Air Pollution from Large Combustion Plants (2001/80/EC) • 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)	• Convention on Long-Range Transboundary Pollutants
Fish imports from Arctic countries (39%)	Increased by 14% since 2000	Arctic catches have generally remained consistent from 1975-2006,[103] but	• EU Common Fisheries Policy • EU Integrated Maritime Policy • Fish import standards	• OSPAR Convention • UNCLOS • FAO Code of Conduct

IMPACT AREA	IMPACT TRENDS		POLICIES	
(EU % OF GLOBAL IMPACT)	EU source	Arctic indicator	EU	Multilateral
		little stock data is available for new and developing Arctic fisheries		

Source: Table compiled by Ecologic Institute.

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 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. 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.

[1] COM(2007) 575
[2] High Representative and European Commission Paper on Climate Change and International Security 2008.
[3] COM (2008) 763.
[4] EU Council, 2009.
[5] CAFF, 2010.
[6] ACIA, 2005, Chapin 2005.
[7] CAFF, 2010, p. 12-13.
[8] Barry, 2009.
[9] CAFF, 2010, p. 12-13; ACIA, 2005.
[10] AMAP, 2009, p. 30-32; AMAP, 2002, p. 36.
[11] AMAP, 2009, p. 30-32.
[12] CAFF, 2010, p. 46.
[13] Intergovernmental Science Policy Platform on Biodiversity and Ecosystem Services (IPBES), online.
[14] OSPAR QSR 2010
[15] ACIA, 2005, p. 1.
[16] Gusev et al., 2007, p. 17, 59.
[17] Travnikov, 2005
[18] Shindell et al., 2008; EDGAR FT; and calculations by SERI.
[19] UNEP, 2009, p. 18.
[20] EU@UN, 2005.
[21] Resolution of Cooperation, 2009.
[22] IPCC, 2007a, 1.1; IPCC, 2007b, 15.1.1.
[23] IPCC, 2007b, 15.3.2.
[24] 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, pg. 20.)
[25] COM(2008) 763, p. 5.

[26] 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 Arctic waters could disrupt oceanic thermohaline circulation, affecting global weather patterns and temperatures. IPCC, 2007b, 15.4.1.2.
[27] UNFCCC, 2009.
[28] 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.
[29] COM(2001) 245, p. 2.
[30] Shindell et al., 2008 and calculations by SERI.
[31] 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).
[32] COM(2010)265, p. 8.
[33] COM(2010)265, p. 8.
[34] COM(2008) 763, p. 6, Arctic Energy Agenda, 2005.
[35] 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.
[36] USGS, 2008, p. 4.
[37] USGS, 2008, p. 4.
[38]COM(2010) 560, p. 12.
[39] AMAP, 2008, p.26; Bogoyavlenskiy, 2004, p.27; OECD, 2009; OECD, 2006.
[40] 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.
[41] AMAP, 2008, p.26; Bogoyavlenskiy, 2004, p.27; OECD, 2009; OECD, 2006; SERI, 2010.
[42] Jeníček and Krepl, 2009, p. 10.
[43] 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.
[44] EU External Action, 2010.
[45] EU External Action, 2010.
[46] Rudloff, 2010a, p. 3.
[47] Burnett et al., 2008, p. 5.
[48] UN Comtrade database, 2010.
[49] Adapted from Rudloff, 2010b, pp.46. Original source: FAO FishStat, 15 May 2010.
[50] The Commission has discussed an eco-labelling scheme for fisheries products in COM(2005) 275.
[51] Rudloff, 2010b, p. 33.
[52] Norwegian Ministry of Fisheries and Coastal Affairs, 2010.
[53] Molenaar and Correll, 2009a, p. 6.
[54] ACIA, 2005 pp. 784-785.
[55]Arctic Centre,1998.
[56] Natural Resources Canada, 2005, p. 55.
[57] Rametsteiner et al., 2008, p. 34.
[58] White et al., 2000, as cited by ACIA, 2005, p. 851.
[59] Välkky, et al., 2008. p. 40
[60] Globally, ecotourism is growing at three times the rate of tourism overall. SMART, 2006, p.6; Guðmundsdóttir, 2009, pp. 1-2.
[61] Daily Mail, 2007.
[62] AMSA, 2009, p. 78.
[63] TSG, 2007, p. 11.
[64] COM(2010) 352, p. 4.
[65] 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. Data availability: Finland 2007, Sweden 2007, Norway 2006, Iceland 2007, Greenland 2008, Canada 2004/2009, Alaska 2006.
[66] Data availability: Finland 2007, Sweden 2007, Norway 2006, Iceland 2007, Greenland 2008, Canada 2004/2009, Alaska 2006. The category "Rest of Europe" includes travellers from EU and non-EU countries that could not be allocated with certainty to the EU-27. Lack of detailed data sources also explains the

category “Rest” in the figure above, which represents tourists with origins not further specified. See entire AFPA report for more detail.

[67] TSG, 2007, pp. 9-10.
[68] Laponia World Heritage, Ecotourism, online.
[69] UN News Centre, 2010.
[70] WWF: Ten Principles for Arctic Tourism.
[71] AMSA, 2009, p. 4.
[72] AMSA, 2009, p. 97.
[73] Norwegian Maritime Directorate, 2003, p. 2.
[74] COM(2000) 142, p. 8.
[75] COM(2000) 142, p. 8.
[76] AMSA, 2009, p. 187.
[77] IMO, 2005, *PSSA Guidelines,* Titles. 6-7; Molenaar, 2009, p. 313.
[78] Common Wadden Sea Secretariat, The Wadden Sea designated as particularly sensitive sea area (PSSA), online.
[79] VanderZwaag et al., 2008, p. 42; See also Molenaar and Correll, 2009b, pp. 14-16.
[80] Molenaar and Correll, 2009b, p. 20; AMSA, 2009, p. 7.
[81] See US Department of State, Arctic search and rescue, online.
[82] AMSA, 2009, pp. 5, 6, 55-59, 68; Molenaar and Corell, 2009b, p. 4.
[83] European Council and Commission, 1997.
[84] EC Mobility and Transport, Motorways of the Sea, online.
[85] Bogoyavlenskiy and Siggner, 2004, p. 29.
[86] Kofinas, Subsistence hunting in a global economy, online.
[87] Hall and Saarinen, 2009, p. 304.
[88] Durhaime, 2004, p.69; Nordic Council of Ministers, 2010, p.49; Glomsrød and Aslaksen, 2006, p.18.
[89] Duhaime, 2004, p. 74.
[90] ACIA, 2005, pp. 656-657.
[91] 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].
[92] 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.
[93] 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.
[94] EEA, 2009, pp. 40, 43.
[95] Zender, 2007, p. 2.
[96] 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.
[97] SEC(2005)101, p. 15.
[98] Smith et al., 2004, p. 7.
[99] European Commission, 2009, p. 119-120.
[100] Hung et al., 2005, p. 129; Addison, et al., 2005, p. 351; Letcher et al., 2009.
[101] EEA, 2010.
[102] Hole et al., 2009, p. 934.
[103] Rudloff, 2010b, p. 11.

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