The Arctic Express

An emerging transport route and its feedbacks to global environmental change



Øystein Kristiansen
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Institute of Sociology and Human Geography
University of Oslo
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Øystein Kristiansen

TABLE OF CONTENTS

LIST OF ABBREVIATIONS

- ACIA The Arctic Climate Impact Assessment
- AHDR The Arctic Human Development Report
- AIDS Acquired Immune Deficiency Syndrome
- AMAP Arctic Monitoring and Assessment Programme
- BP British Petroleum
- CCS CO2 Capture and Storage
- CEO Chief Executive Officer
- CH4 Methane
- CICERO Center for International Climate and Environmental Research – Oslo
- CO2 Carbon Dioxide
- EC The European Commission
- EU The European Union
- FNI Fridtjof Nansen Institute
- GDP Gross Domestic Product
- GECHS Global Environmental Change and Human Security
- GECP Global Environmental Change Program
- GHG Greenhouse Gas
- HIV Human Immunodeficiency Virus
- IEA The International Energy Agency
- IFA The Inuvialuit Final Agreement
- INSROP The International Northern Sea Route Programme
- IPCC Intergovernmental Panel on Global Change
- IPY The International Polar Year

- IUCN The International Union for Conservation of Nature
- LDKN Landsdelskommando Nord-Norge
- LNG Liquefied Natural Gas
- NATO North Atlantic Treaty Organisation
- NGOs Non Governmental Organisations
- NSR The Northern Sea Route
- OPEC The Organization of the Petroleum Exporting Countries
- PAME Protection of the Arctic Marine Environment
- PCBs Polychlorinated Biphenyls
- POPs Persistent Organic Pollutants
- SES Socio-Ecological Systems
- TAR Third Assessment Report
- UN United Nations
- UNEP The United Nations Environment Programme
- UNFCCC UN Framework Convention on Climate Change
- WGI Working Group I
- WGII Working Group II
- WGIII Working Group III
- WTO World Trade Organisation
- WWF World Wide Fund for Nature

1. Thesis Introduction

Climate change has received a tremendous increase in coverage and attention over the past years. Although public warnings about the dangers of climate change were already made in the late 1980s[1] (Hansen 1988), the issue has yet to become a political priority in all countries. However, an elevated international awareness of the challenges that climate change poses is likely to change the political environment in the coming years. The growing awareness of climate change is partly related to a series of important publications or events over the past four years. In 2004 the political community became concerned when Sir David King made international headlines, arguing that "climate change is the most severe problem that we are facing today – more serious even than the threat of terrorism" (King 2004: 176). The business community became more interested in climate change in 2006, when the Stern Review (Stern 2006) was published and demonstrated that climate change is going to be more expensive than mitigation. Prime Minister Tony Blair responded early to the Stern Review, saying that climate change is "the greatest long-term threat to our planet" and serves as both a "wake up call" and "the final word on why the world must act now to limit the damage we are doing to our planet" (The Sun 30 October 2006). The public made an emotional connection to climate change later in 2006, when Al Gore's documentary film "An Inconvenient Truth" was shown at cinemas (Gore 2006).[2] Finally, the Intergovernmental Panel on Global Change (IPCC) released its Fourth Assessment Report in 2007 and removed any doubt about the need to take climate change seriously (IPCC 2007). Climate change issues received attention again when the IPCC and Al Gore were awarded with the 2007 Nobel Peace Prize for their contribution to raising climate change issues to the forefront of public debates. The IPCC was recognized because of their contribution to the science of climate change, and Gore was recognized for his communicative abilities and his potential for influencing political leadership around the world.

Although the science of climate change is still contested by skeptics, it has become harder to ignore or trivialize climate change as unusual weather events and natural hazards unfold, accompanied by dire warnings about future changes from experts. The IPCC Fourth

[1] The public debate over what to do about possible warming is relatively new, and many believe it started in 1988, when James E. Hansen, the director of NASA's Goddard Institute for Space Studies (GISS), announced in his testimony before US Senate that he was '99%' certain that global warming was here. This event triggered massive coverage across the globe and marked the start of the global warming policy debate that continues to this day (O'Donnel 2000).

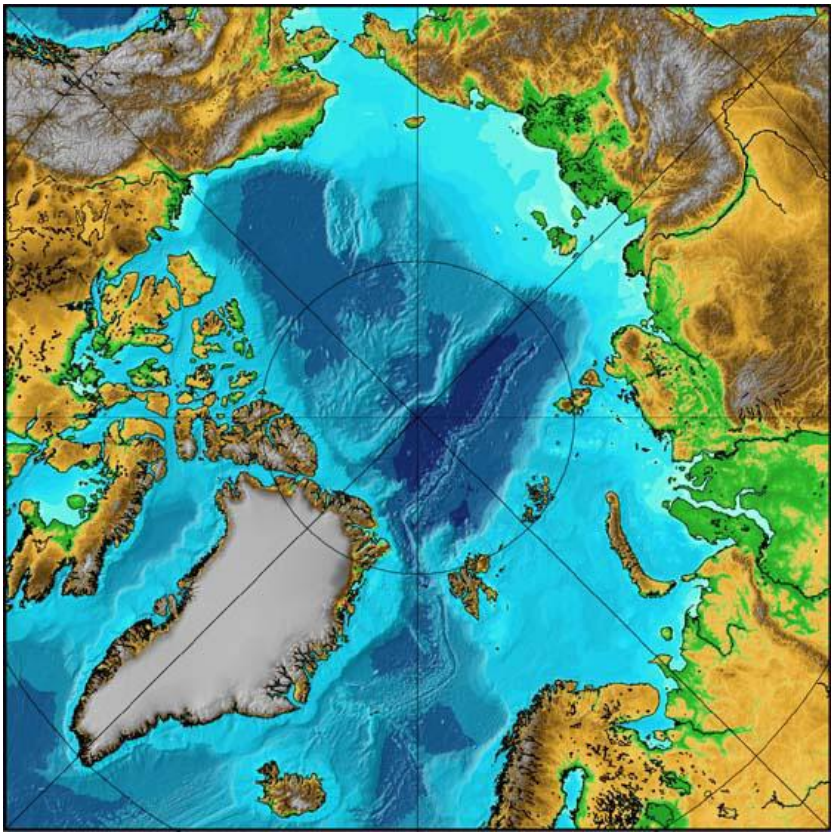
[2] The Oscar winners film *An Inconvenient Truth* also had a great impact and contributed to raising the public awareness of climate change.

Assessment Report states that "[w]arming of the climate system is unequivocal, as is now evident from observation of increases in global average air and ocean temperatures, widespread melting of snow and ice, and rising global average sea level" (IPCC 2007d: 5). The IPCC report also confirmed that "[o]bservational evidence from all continents and most oceans shows that many natural systems are being affected by regional climate changes, particularly temperature increases" (IPCC 2007e: 2). While observational evidence has had a profound impact on how society perceives and is responding to climate change, it is the situation in the Arctic that has arguably mobilized the greatest awareness and concern. Reports of faster-than-anticipated melting of sea ice and the Greenland ice sheet have drawn increased attention to the urgency of climate change. The melting of the Arctic is considered by many to be an early warning indicator and harbinger of future climate impacts, much like the proverbial canary in the coalmine.

The Arctic Region

The Arctic region is a single, highly integrated system comprised of a deep, ice covered, and nearly isolated ocean surrounded by the land masses of Eurasia and North America, except for breaches at the Bering Strait and in the North Atlantic. Approximately two-thirds of the Arctic is comprised of ocean, including the Arctic Ocean and its shelf seas plus the Nordic, Labrador, and Bering Seas. It consists mostly of nation states whose political centers of gravity largely lie far to the south. It is neither an industrialized nor a developing region, but has a middle position since it is surrounded by wealthy nations or consists of wealthy nations (Young & Einarsson 2004). The region is characterized by snow and ice most of the year due to its geographic location. The higher latitudes of the planet are expected to have the greatest increases in temperature, which makes the Arctic one of the world's most sensitive areas to climate change (ACIA 2004, Laidler 2006).

Map 1.1: The Arctic region



Source: Arctic Ocean Diversity.

Threats to the Arctic oceans, other than petroleum and shipping activities, which will be discussed in greater length in this thesis, include depletion of biodiversity, radioactivity and long-range pollution. Fisheries pose a considerable challenge to the Barents Sea. The aquaculture industry is also expanding, and introduced species may prove to be important challenges in the near future (WWF 2003). Chemicals, heavy metals, persistent organic pollutants (POPs), which drift with wind and ocean currents from other locations, are found in higher concentrations in the Arctic. Studies show that Arctic species, especially those at the upper end of the food chain carry high levels of POPs, which reduces their reproductive abilities. Native residents are exposed through their diets which increases health risks (AMAP 2002). In this respect, climate change should not just be treated as an additional stressor, but as a stressor that interacts with other stressors in the region (O'Brien et al 2003). Apart from the Arctic Ocean, parts of Canada, Greenland (a territory of Denmark), Russia, the United States (Alaska), Iceland, Norway, Sweden and Finland comprises the Arctic. It is home to 2-4 million people depending on where the boundary is drawn (ACIA 2004, AHDR 2004). Arctic societies refer to groups ranging from ethnic groups or nations to co-residents of a settlement. It can be distinguished by two broad types of cultural and social traditions; indigenous

peoples who established themselves there millennia ago and the more recent presence of peoples from a European background (AHDR 2004). The resource-rich Arctic has received, and is most likely to continue to receive considerable attention for its nonrenewable and renewable resources, including major sources of hydrocarbons, nickel, lead, zinc, and diamonds and for its fisheries and biological wildlife (AHDR 2004, ACIA 2004).

The International Polar Year (IPY) is a large scientific program focused on the Arctic and Antarctic regions. The program, which runs from March 2007 to March 2009, has drawn international attention to the Arctic. The importance of the Arctic cannot be understated because of the feedbacks it poses to the earth system and to social systems (ACIA 2004, IPCC 2007). The transformations in the Arctic will be radical and have global consequences, affecting every sector of human society, natural cycles and ecosystems. The most striking physical transformation is associated with the reduction of sea ice. The sea ice has decreased substantially in the region, especially the last few years, and has startled scientists, who did not believe this could happen so rapidly (Holland 2006).[3] When sea ice retreats it exposes the darker waters of the Arctic, resulting in more solar radiation absorbed by the Earth's surface rather than reflected back into space, and consequently warming the Earth. This ice-albedo mechanism, one of several positive feedbacks, is contributing to transforming the physical conditions of the Arctic in an increasingly rapid pace. For many, this creates a situation of both uncertainty and difficulty. Arctic residents have traditionally organized their lives around snow and ice, which is now becoming increasingly more difficult to do. At the same time, because of these significant changes, new opportunities are unfolding quickly. Retreating sea ice will open up the Arctic seas and create new conditions for the oil and gas industry, shipping companies, exploitation of natural minerals and fisheries. Consequently, strong economic interests are drawn to the north to exploit the emerging opportunities, which may be of great benefit to them.

The shipping industry in particular is becoming increasingly aware that climate change is a big issue, and that shipping through the Arctic holds prospects for great economic benefits which can potentially revolutionize global trade patterns. This was *not* the case ten years ago, when a major assessment on the potentials for a commercial sailing route through the Arctic, the Northern Sea Route (NSR), was completed, and climate change was hardly mentioned as an issue (Østreng 1999). Back in the late 1990s, they were either not willing or able to

[3] Loss of Arctic ice leaves experts stunned. Guardian, September 4th 2007. http://www.guardian.co.uk/environment/2007/sep/04/climatechange

consider the warnings from climate scientists, which in retrospect can be considered the assessment's major flaw (Ragner 2007). Whether this is the reflection of a slow international awareness of climate change in general, or rather the failure of the scientists working on the assessment to make the connection between the viability of the NSR and the implications of climate change, can only be speculated. Nevertheless, one aspect of shipping in the region that was emphasized in the assessment was the potential of the NSR as a trans-Arctic shipping route.

Large nation states, such as Russia, Japan, China, and Northern European countries are involved in supporting Arctic shipping. Looking at the potential economic opportunities for capturing part of the transportation that is currently shipped through the Suez Canal, there is seemingly a large political will of the involved parties to making this a reality – if the physical conditions allow for it. Further, Arctic shipping will also be important in facilitating the transportation of oil and gas products, both internally and to markets around the world. The transportation of petroleum products is considered by many to be the most risky operation in the Arctic, and an accident will most likely lead to a catastrophe. Closely related to economic activities from oil and gas expansion and the dramatic increase in ship traffic is the growing of international cruise and tourist presence and expansion of commercial fishing activities (ACIA 2004, AHDR 2004, AMAP 2007). These activities are all placing increasing pressure to Arctic ecosystems and communities.

Direct relationships between climate change, petroleum hydrocarbons and transportation will become increasingly visible as sea ice decreases due to climate change related issues and oil and gas activities which is facilitated by international shipping. As fossil fuels are finite resources, arguments are made that we already have passed the maximum rate of global petroleum production, as predicted in Hubbert peak oil theory (Kharecha & Hansen 2007). This holds implications for the Arctic, as surveys estimate that there are large quantities of petroleum resources in the region. There are thus very likely that the region will experience increasing oil exploitation.

Table 1.1: Direct linkages of economic related issues

Impacts of petroleum and transportation	**Feedback**	**Opportunities**	**Outcome**
Oil and gas	-Climate change. -Increasing temperature	-More jobs	-Increasing GHG emissions -Energy for the world
Transportation	-Climate change -Transformations	-Trade -Tourism	-Cheaper goods

Climate scientists, on the other hand, have acknowledged that climate change will lead to new possibilities and benefit shipping and petroleum exploitation in the Arctic. The implications of these activities for the global economy and for climate change, however, have seldom been considered. For example, both the ACIA and IPCC's polar chapters recognize that sea ice will decrease, making shipping and petroleum activities more plausible.

Table 1.2: Direct linkages of climate change related issues

Impact of climate change	**Feedback**	**Opportunities**	**Outcome**
Sea ice	Warming ocean	-New shipping lanes -Access to more petroleum fields	-Increasing oil and shipping industries -Difficult for indigenous peoples -Coastal areas more exposed
Permafrost	Methane		-Increasing GHG emissions -Increasing temperature -Changes to infrastructure -Displaces communities
Melting of glaciers	-Slowing down or reorganization of Thermohaline circulation -Cooling North Atlantic and Arctic Ocean		-Migration of species
Sea level rise	Greater storm surges		Displaced communities

There have been a number of studies assessing the impacts and consequences of climate change and different economic activities and external pressures in the Arctic region, but they have viewed these processes separately, and not taken into account how cumulative effects intersect and interact with each other, which the front cover pictures is an illustration of. The picture of a polar bear on ice floe, an Eskimo in solitude and an oil platform have all become clichés, but as will be discussed in this thesis, this is the way these issues are being treated – as narrow and isolated incidents. This thesis presents a more holistic approach to these issues

and shows that multiple processes of change must be included to meet the challenges posed by global change issues.

1.1 Theoretical Framework

Increasingly, the traditional environmental sciences, especially those based in the natural sciences, are subject to criticism because they do not consider the impacts and feedbacks to social systems (Forsyth 2003). Voices within certain schools, such as political ecology, are now calling for a social view of nature, and for the need to bring politics into environmental research (Castree 2001; Forsyth 2003). Working with and addressing global change issues also need to incorporate a much wider social perspective. Climate change, for example, has often been regarded as a pollution problem, without considering the broader contextual reality in which it is occurring. This thesis presents a critique of the dominant yet narrow systems perspectives, and it calls for looking at the wider social dynamics – like economic structures, development paths, technological improvements and limitations, political interests, psychological aspects, and power structures. Further, this thesis argues that the frameworks available are too often tied to one particular discourse, and hence do not provide a wide analysis that takes into account other perspectives. This thesis builds on critical realism and political ecology to develop a more integral understanding of climate change related processes. In the next paragraphs, selections of the key terms that have guided my research are presented.

'Climate change' is understood in different ways. A textbook definition explains it as: "A statistically significant variation in either the mean state of the climate or in its variability, persisting for an extended period (typically decades or longer). Climate change may be due to natural processes or external *radiative forcing*, or to persistent *anthropogenic* changes in the composition of the atmosphere or in land use" (Dow and Downing 2006: 15). Slightly different, under the UNFCCC term climate change is defined as: "a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability over comparable time periods" (Pielke Jr. 2003: 2)[4]. Finally, IPCC has in contrast to UNFCCC a broader definition and states that climate change is "any change in climate over time whether due to natural variability or as a result of human activity" (Pielke Jr. 2003: 2). Roger Pielke Jr. argues that the UNFCCC definition should be disregarded because under this version, natural climate

[4] UNFCCC 1992. Text available at http://www.unfccc.int

variability, like an increase of the sun's intensity resulting in climate changes, would not qualify. Furthermore, in addition to human caused effects on the climate system other than those that affect the chemistry of the atmosphere, like land use effects on the climate, are similarly not considered (Pielke Jr. 2003). This holds implications for global response to the challenge of climate change, and hence the UNFCCC definition is partly the reason for the gridlock and ineffectiveness that is now visible (Pielke Jr. 2005). Hence Pielke Jr. finds the IPCC definition more appropriate as it holds a more comprehensive perspective.

'Globalization' is often understood as movement toward greater economic, political, and cultural integration across nations (Leichenko & O'Brien 2008). It is defined by Held and McGrew as "a widening, deepening and speeding up of worldwide interconnectedness in all aspects of contemporary social life, from the cultural to the criminal, the financial to the spiritual" (Held and McGrew 2000: 2). The geography of interconnections in the Arctic is increasingly apparent. Although economically motivated resource extraction has taken place in the remote region for centuries (Heininen 2004) the scope of it is now escalating and occurring on a larger scale. This is possible because of sea ice reductions and the important improvements in transport and communication technologies and the interconnected dimensions of global international trade and investments.

'Human security' in the global environmental change literature is considered as "the condition when and where individuals and communities have the options necessary to end, mitigate, or adapt to risks to their human, environmental, and social rights; have the capacity and freedom to exercise these options; and actively participate in attaining these options" (O'Brien 2006: 1). The concept of human security focus' on making individuals and societies capable of responding to change, either by reducing vulnerability or by challenging the causes to global environmental change (O'Brien 2006). The concept also points to winners and losers. In a broader sense, by changing climate change to a question of human security the focus are drawn to vulnerability, justice, conflict, cooperation and sustainable development.

'Vulnerability' is according to IPCC's Third Assessment Report considered to be a function of exposure, sensitivity, and adaptability (McCarthy et al 2001), and is commonly used to describe the likelihood of being damaged or hurt by some event or process. Nonetheless, the word 'vulnerability' is interpreted differently and means different things to different researchers. This is in part due to the fact that there exists many discourses on climate change which defines vulnerability differently according to their own beliefs and worldviews (O'Brien et al 2007).

1.2 Thesis Statement and Research Questions

Global GHG emissions partly come from Arctic oil and gas, and the emissions are expected to increase due to plans for increasing petroleum activities in the region. Some time into the future, it may contribute significantly to the world's GHG emissions, depending partly on the status of Arctic sea ice, as well as the political and economic interests in continuing the exploration. This may have dramatic consequences for the world's future, especially if the Greenland ice sheet melts, if there are changes to the thermohaline ocean circulations, or if other thresholds and tipping points are crossed resulting in dangerous climate change.

The thesis will explore how climate change and economic globalization interact and contribute to significant consequences for social and environmental systems in the Arctic. The over-arching argument is that we do not have a good enough understanding of how these processes are related, because the two processes have been studied separately. Until this date, little attention has been given to the relationships between these different issues, resulting in a poor understanding of how they may be connected. In other words, multiple processes of change that are transforming the Arctic have not satisfactorily been taken into consideration. Thus, the research and analysis needs to have a wider perspective if society is to successfully address global change and promote sustainability. Further, these global processes of change will be considered within a broader analysis of how they are framed and discussed by different actors and interests. Through a discursive approach it will be revealed how our understanding of these processes are too narrow and why ultimately this can lead to catastrophic results. Economic activities, including transportation and oil and gas extraction, may become increasingly important in the Arctic, accelerating climate change further. The most serious threat in the view of this thesis is the contribution it makes to global atmospheric concentrations of greenhouse gas emissions.

Without claiming to provide a complete answer of all the connections between these processes, this thesis will provide an analysis of how climate change, transportation and the natural resource extraction are closely related. The research on Arctic climate change issues has paid little attention to this three-way connection. This thesis argues that *climate change and changes in transportation are creating a carbon transport corridor through the Arctic that will enable the exploitation and distribution of petroleum resources, and thus contribute to further global greenhouse gas emissions (GHG).* The increase in economic activities opens up the region to many new issues, which today have been remotely touched upon or are still hidden, including environmental, geopolitical economic, institutional and social concerns.

Arctic shipping is especially important for transportation of oil and gas and for being a potential driver of economic globalization. Firstly, it will facilitate the transportation of petroleum resources. Most of the oil and gas in the Arctic is scheduled to be transported to world markets, either by pipeline or by tankers. Secondly, it might also become an important transportation and trade route, connecting the Pacific and Atlantic Ocean. Both of these processes are much easier to undertake as the sea ice melts, and likewise, both processes will contribute to a globalization of the Arctic and to GHG emissions. Drawing attention towards the 'carbon corridor' by linking this three way connection is important, and research done on this particularly area is insufficient (Leichenko & O'Brien forthcoming 2008). The connections between them are often missed, thus the first point in this thesis will be to argue through a discourse analysis that they are closely related and also show in what ways they are related. In exploring the relationship between climate change, shipping and petroleum, I argue that shipping – as an important contributor to climate change and distributor of petroleum resources, and the relationship between shipping and the exploitation and distribution of hydrocarbons – has received little attention. The consequence of not seeing them as related may contribute to positive feedbacks. Further, there will be conducted an analysis of how the three way connection really interact and how they will profoundly contribute to transform the Arctic. Given the context described above, the thesis seeks to answer these three questions:

1. What are the links between climate change, petroleum and transportation in the Arctic and how is this relation framed and discussed by different interests and actors?
2. What are the implications of these discussions and how do discourses inadvertently contribute to positive global change feedbacks in the Arctic and the Barents Sea?
3. How do discourses on climate change, petroleum and transportation in the Barents Sea reveal the contradictions between the Norwegian Governments' position on environmental concerns, on the one hand, and economic interests on the other hand?

As will be discussed in chapter 4, this thesis is within the tradition of qualitative analysis. My data is based on several conferences and seminars, and newspaper articles. The way climate change issues have been framed has been central when attending these arrangements and the objective has been to distinguish the different prevailing discourses.

1.3 Structure of Thesis

The next chapter will present empirical information about the three main areas of interest to this thesis; climate change, petroleum resources and shipping in an Arctic context. Chapter 3 outlines the theoretical underpinnings. Chapter 4 accounts for how I conducted the study and try to give grounds for some of the choices I have made. Chapter 5 identifies and presents five distinct Arctic discourses, which in different degree influence public perception and environmental policy towards the region. Further, I discuss whether the discourses manage to reflect the interconnections between climate change, petroleum activities and transportation. Chapter 6 sets out to explore how economical, political, social and ecological issues in the Arctic are fundamentally related. Finally, the conclusions of this thesis are elaborated in chapter 7.

2. Arctic Changes

This chapter will start with describing three important changes to the region, one being climate change, the other two being the development of petroleum resources transportation. The climate change section will introduce data on temperature, sea ice and other variables succeeded by important feedbacks to the region and potential tipping points. The following section will survey the petroleum hydrocarbons in the Russian and Norwegian areas, before continuing with an assessment of the Arctic shipping and transportation situation. It will be assessed both as a trans-Arctic transport route which potentially can connect the significant and growing markets in Asia with markets in Northern Europe, and in terms of oil and gas shipment from a regional perspective. After viewing these three processes separately below, chapter 6 will explore the linkages between them and show how they will profoundly affect each other, also considering its feedbacks and potential new outcomes to the region.

2.1 Climate Change:

Global environmental change research focuses on how human activities are transforming the Earth system, which is expected to have impacts on human societies and ecosystems. The transformations associated with global environmental change have led to suggestions that we have entered into a new geological era – the Anthropocene Era – where humans have become a major driver of change (Steffen et al 2004). GHG emissions, heavy metals, persistent organic pollutants (POPs) which originate in other parts of the world are causing environmental and social transformations in the Arctic (AMAP 2005), and the changes in the Arctic have tremendous implications for global sea level rise, which point to the global interconnectedness. A major part of this research field includes climate change, which is considered a priority because of its truly global nature and it's consequences for social-ecological systems (Adger et al 2001). In this section, climate change will be assessed in an Arctic context, a region of the world that is experiencing dramatic changes, but it will also keep a global outlook, as the two are closely related.

Climate change is always occurring as a natural process, but until the present, these changes have predominantly had natural causes, for example change in the strength of the sun, changes in the Earth's orbit around the sun and volcanic eruptions. What we now are experiencing, together with natural variability, is human induced climate change, that is, the processes resulting from human use of fossil fuels and emissions of greenhouse gases. This

so-called anthropogenic climate change is considered the result of industrial revolution, accelerated by globalization processes in the last decades. The IPCC states clearly that: "Most of the observed increase in global average temperatures since the mid-20th century is *very likely* due to the observed increase in anthropogenic greenhouse gas concentrations" (IPCC 2007d, emphasis in original). The recognition that it is largely human activities that are affecting the global climate system means that humans have the ability to address these emissions. It is argued that if we continue to deal with climate change in a 'business as usual' scenario it could cost the world economy up to 20% of global GDP per year, whereas it could be limited to 1% if a global effort is undertaken to mitigate greenhouse gas emissions. At the same time, based on the global emission scenarios for the next decades and plans for exploring and opening up new oil and gas fields around the world – including Snow White, Goliat and Shtokman in the Barents Sea – the prospects for emissions reductions are not very promising. In fact, the global GHG emissions have continued to grow rapidly, increasing by 70% between 1970 and 2004 (IPCC 2007f). Increased atmospheric concentrations of GHG are very likely to have a larger effect in the Arctic than anywhere else on the globe (ACIA 2004).

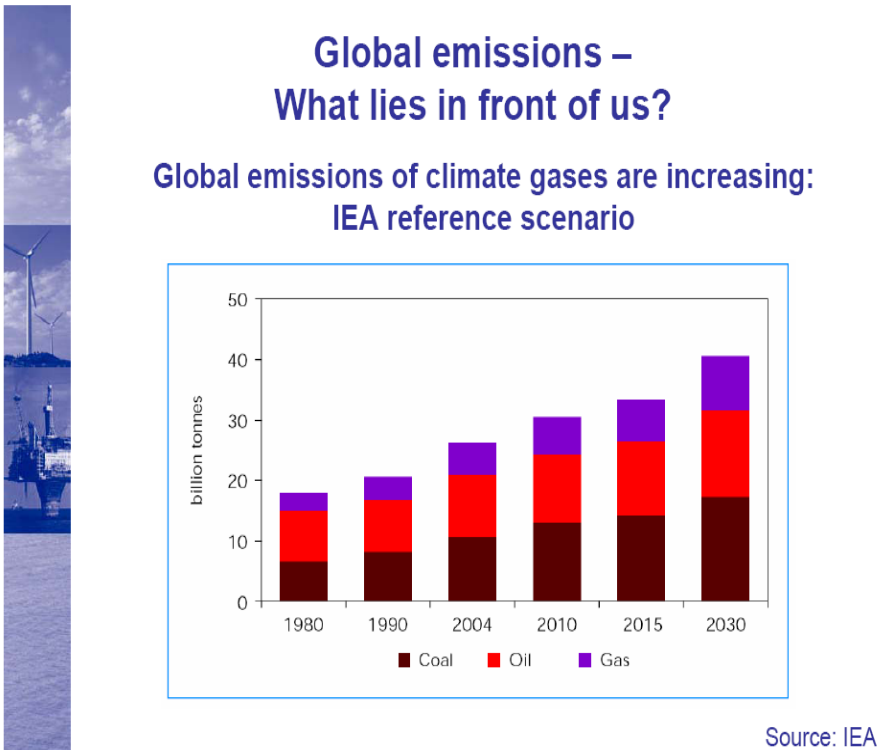


Figure 2.1: Global emissions of coal, oil and gas between 1980-2030. Source: IEA.

Examining the development of global emissions more closely for some of the most central GHG in the last decades, carbon dioxide (CO2) is believed to be the most important source of anthropogenic greenhouse gases, and has grown by 80% between 1970 and 2004. It constituted 77% of the total GHG emissions in 2004 (IPCC 2007f). The global increase in CO2 emissions are due primarily to the burning of fossil fuels and also a small part from land use changes (IPCC 2007d). Figure 2.1 shows recent and expected path of emissions based on 3 hydrocarbon emission sources. Emissions will continue to grow significantly, and oil, gas and coal will constitute the major sources of energy. The debate regarding renewable energy vs energy from petroleum hydrocarbons is beyond the scope of this thesis. However, it is clear that renewable energy from many sources needs to be developed in order to replace the dependency of fossil fuels.

Methane (CH4) and nitrogen dioxide nitrous oxide represent other central greenhouse gases. In pre-industrial times the global atmospheric concentration of CH4 had value of about 715 ppb, whereas in early 1990 it was 1732 ppb and in 2005 1774 ppb. Agriculture is the main reason for the global increase in CH4 (IPCC 2007d), which there is little of in the Arctic. There is, however, methane stored in the frozen ground. Looking at the outlook for snow cover and permafrost thawing, released methane may contribute to greater GHG emissions. The main point here is that if emissions are not reduced, global GHG emissions will continue to grow this century (IPCC 2007f), and the transformations associated with climate change will exacerbate.

To find evidence of recent climate change, scientists have developed climate models, often termed global coupled atmosphere-land-ocean climate models. They are used to project possible future climate change (ACIA 2004; IPCC 2007), incorporating both natural and anthropogenic drivers of climate change. They operate with different emission scenarios based on population projections, expected economic growth, new technologies and energy sources, and the models can help estimating how much changing concentrations of greenhouse gases in the atmosphere will influence the global climate (Steffen 2004). Given a change in atmospheric concentrations it is possible to model changes in temperature, precipitation, wind and other variables (ACIA 2004; IPCC 2007). IPCC has developed a set of scenarios, and the ACIA uses their middle range scenarios, A2 and B2, in their own assessment:

Table 2.1: Global and Arctic temperatures in 2050 and 2100 according to two scenarios.

Increase in temperature				
Location	2050		2100	
	A2 scenario	B2 scenario	A2 scenario	B2 scenario
Globally	1,4 ºC	1,4 ºC	3,5 ºC	2,5 ºC
Arctic (north of 60 ºN)	2,5 ºC	2,5 ºC	7,0 ºC	5,0 ºC

Source: ACIA 2004.

Both of the scenarios show that the global mean temperature in 2050 is estimated to increase by 1,4 °C compared to the present temperature. Towards the end of the century the global mean temperature increase is projected to be 3,5 ºC (A2 scenario) or 2,5 ºC (B2 scenario). According to ACIA, the Arctic will experience a larger increase in mean temperature. For the region north of 60º N both scenarios show, by mid century, a 2,5 ºC increase compared to the present climate, and at the end of the century the Arctic temperature will increase with 7 ºC and 5 ºC for the A2 and B2 scenarios, respectively. For example, the temperature in Scandinavia is expected to increase by 3 ºC within 2100. The increase in Arctic temperatures will be largest during autumn and winter and less in the summer (ACIA 2004).

There have been incremental advancements from IPCC's Third Assessment Report (TAR) to the models in the Fourth Assessment, and new projections for the future are presented with higher confidence. Nevertheless, the present models are still very crude and do not really allow for very specific projections, so they are more accurate at a global scale, and less at a local and regional scale, although the ACIA has made efforts to show future projections on a regional scale in the Arctic. The IPCC's Fourth Assessment provides the latest projections, which shows that in the last decade of this century the best estimate for the global mean temperature in the B2 scenario is 2.4 ºC (likely range is 1.4 – 3.8 ºC) and for the A2 scenario 3.4 ºC (likely range is 2.0 – 5.4 ºC). The expected temperature changes for the Arctic spans from 2ºC to about 9ºC (IPCC 2007d), which is less specific compared to the ACIA. The central point, however, is that large temperature changes as expected in this century. Moreover there is alarming news presented almost every week about the conservative estimates that the IPCC has presented, arguing that the changes will be much bigger.[5]

A key feature regarding Arctic temperature is that it is almost twice the global rate, and climate model simulations project further increases in average temperatures as well as

[5] The Warming of Greenland. John Collins Rudolf. The New York Times January 16, 2007.

projecting a trend to warmer high and low temperature extremes (UNEP 2007). The last years, there have been abrupt and sudden changes in temperatures and ice conditions.

Continuing with the physical changes in the Arctic, thickness of sea ice has declined in parts of the region since the 1950s, and both the extent and the thickness of the regions sea ice are projected to continue to decline (IPCC 2007; UNEP 2007). The sea ice extent for the last three decades has been declining with 8.9 per cent per decade in September and 2.5 per cent per decade in March, and the retreat is particularly noticeable along the Eurasian coast, but also along the Alaskan and Canadian coasts which experienced that the West Passage was ice free in September 2007. Another related issue is the melting of glaciers. Most of the world's glaciers are receding, but it is the ice caps on Greenland and Antarctica which may have the most severe effects if they should melt, without neglecting the consequences for what melting of the Himalayan glaciers and Andes glaciers will have for future water supplies (Steffen et al. 2004).

2.1.1 Positive Feedbacks

Climate change triggers effects called feedback processes. In the natural sciences, feedbacks are defined as mechanisms where a change triggers effects which can either amplify or reduce the original change in the climate system, known as positive and negative feedbacks, respectively (Bernes 2003). For example, an important positive feedback is linked to water vapor. It occurs when the temperature increases and more water evaporate from land and water surfaces, leading the water vapor in the atmosphere to increase. The resulting heat absorption is due to the powerful greenhouse effect which water vapor inhabits, leading to a further rise in temperature (Dow and Downing 2006; Bernes 2003).

There are three important feedback mechanisms related to the cryosphere which act through the surface albedo, thermohaline circulation, and release of greenhouse gases from thawing permafrost (Steffen et al. 2004). Warming of the Arctic leads to positive feedbacks that accelerate the greenhouse effect, and the melting of the Arctic ice is self-reinforcing through the albedo effect – the reflectivity of the earth's surface. The Arctic snow and ice albedo feedback amplify warming. The sun's rays strike the polar region during summer at a sharper angle and together with decreasing snow and ice cover, it is allowing more solar radiation to reach the darker ground which increases temperature and enhance melting (Dow and Downing 2006). Thermal expansion – of which due to a warming of the ocean – constitutes to about 50% of the sea level rise today, the remaining (UNEP 2007). The last

years have shown that the amount of time during a year which sea ice insulates the Arctic Ocean has decreased; making radiation heat up the ocean, which further reduces ice cover (Steffen et al. 2004). This is one of the processes which may lead to a "tipping point".

Although the marine Arctic covers a small fraction of the globe, positive feedback between the Arctic Ocean and the climate system has the potential to cause global effects. The Thermohaline Circulation in the North Atlantic Ocean is part of the Oceanic Conveyer Belt, the global-scale overturning in the ocean that transports significant heat via a pole ward flow of warm surface water and an equator ward return of cold, less saline water at depth (Steffen et al. 2004). The Thermohaline Circulation has been slowed down or reorganized before, which has been a major factor in the abrupt climate change seen in palaeo-records. Should this happen again, it would have dramatic consequences for Northern Europe, including Scandinavia and the Arctic. Another positive feedback, which may have significant impacts in the future, is associated with permafrost–methane hydrate feedbacks. The decomposition of organic material is currently held frozen in permafrost, stored as methane, which is a stronger greenhouse gas than CO2. The permafrost works as a global sink, but when the temperature increases it thaws the permafrost, which might result in further release of greenhouse gases, including methane (Dow and Downing 2006; Steffen et al. 2004). This is also considered as one of the processes that may lead to a tipping point.

Feedbacks are key processes and important warning signals. These processes are highlighted in the literatures on climate change. The fact that the temperature increases more in the Arctic compared to the earth as a whole, is called polar amplification, and happens as a result of the collective effect of multiple feedbacks and other processes (Steffen et al. 2004). The feedback processes in the Arctic are particularly important in terms of the global climate system, as the Arctic is connected to the global climate, being influenced by it and vice versa (ACIA 2004).

2.1.2 Tipping points

An area of great concern associated with positive feedbacks is called tipping points. A *tipping point* refers to a critical threshold at which at a particular moment in time a small change can have large, long-term consequences for a system. The related term *tipping element* describes large-scale components of the Earth system that may pass a tipping point. It implies that human activities have the potential "to push components of the Earth system past critical states into qualitatively different modes of operation, implying large-scale impacts on human

and ecological systems" (Lenton et al. 2007: 1). The Arctic climate is an integral part of the global climate system, and cannot be understood in isolation, and there are three important processes associated with tipping elements in the Arctic. The melting of Arctic sea ice and the Greenland ice sheet, and an alteration of the Atlantic thermohaline circulation will have significant global consequences. Usually, climate models show linear global temperature change in climate forcings over a broad range, but abrubt or nonlinear change may be more prevalent at regional scales. Winton argues that abrubt changes to the Arctic sea must be considered. When the temperature rises above -5 ºC there is a sharp increase in the surface albedo feedback of one of IPCC's models, which are driving an abrupt elimination of Arctic ice. Other models show less drastic results (Winton 2006). The main point is that there is a lack of understanding of abrupt and nonlinear changes. They may, however, have large-scale and dramatic complications for the whole world, and as such must be considered.

2.2 Petroleum resources in the Arctic

Commercial oil activities in the Arctic started in Canada in the 1920s, and have slowly expanded to other areas. Today there are four Arctic oil and gas producing nations – Russia, USA, Canada and Norway – of which Russia has the majority of both (Arctic Oil and Gas 2007). Other Arctic nations, like Denmark (Faroe Islands and Greenland) and Iceland, may well become producers in the future as exploration currently is unfolding and new discoveries are found (Arctic Oil and Gas 2007). The global demand for energy is expected to increase significantly, particularly under 'business as usual' scenarios, and combustion of fossil fuels throughout the world is continuing to rise.

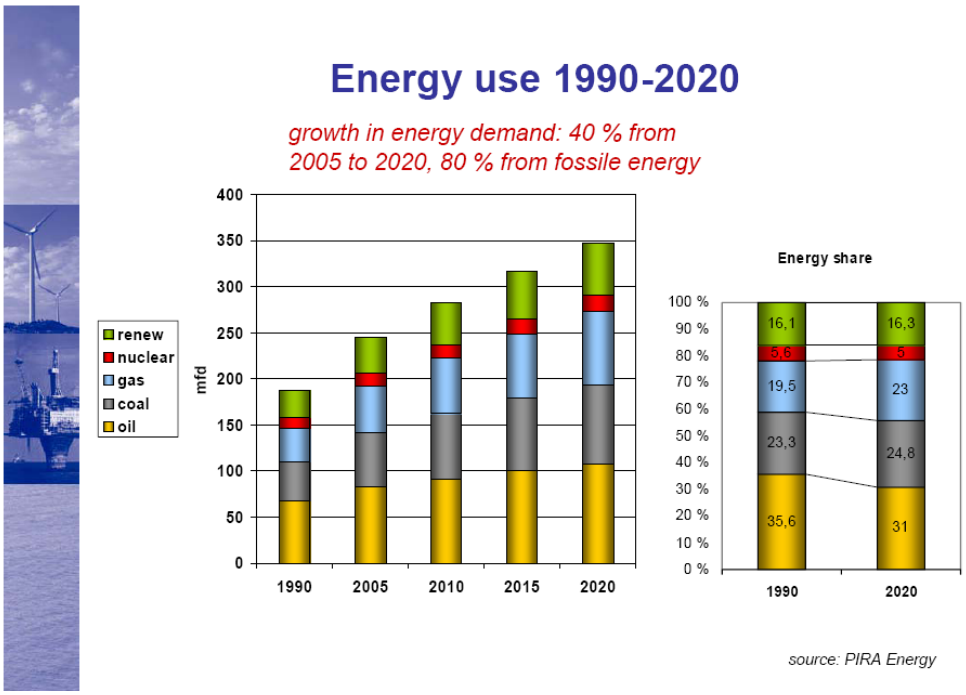


Figure 2.2: Energy use between 1990-2020. Source: Pira Energy.

Providing accurate data of the petroleum resources in the Arctic is a challenge. Due to its physical manifestations, great areas have naturally been isolated from human activities. There have, however, been a number of surveys assessing the potentials and reserves in the region. The Russians have done extensive examinations, although the official data on the Russian fossil fuel reserves are classified. Nevertheless, some public data exists and can be compared with different sources in order to see the variations between them. According to British Petroleum (BP) Russia is believed to possess greater reserves of oil than any other country, outside the OPEC group of nations, which according to the oil company amount to 6.1% (9.9 billion tons) of the proven global oil reserves in 2004 (Bambulyak & Frantzen 2007).[6] Russia's reserves of natural gas are the most extensive in the world (PAME 2006), and BP numbers estimates it to be 26.7% of the worlds confirmed reserves (48 trillion cubic metres) in 2004. Based on these figures, Russia is in a global context first in gas reserves and seventh in oil reserves (Bambulyak & Frantzen 2007).

The Russian Ministry of Industry has stated that the explored Russian reserves in 2005 were 16.3 billion tons, the initially estimated reserves were 7.8 billion tons, and the contingent and prospective resources were considered to be 70 billion tons (Bambulyak & Frantzen 2007). The Ministry of Industry and Energy estimated that in 2006 the federation possessed

[6] The proven reserves of natural gas in Russia, is according to BP, the resources that according to the available geological, technical and economical data can be extracted from the productive layer (Bambulyak & Frantzen 2007).

12 % of the world's oil resources (40.5 billion tons of oil) and 45% of the world's gas resources (79.3 trillion cubic metres of gas). Federal Subsoil Resource Management Agency of Russia (Rosnedra) claims that the potential natural gas resources are estimated to be 150 trillion cubic metres (Bambulyak & Frantzen 2007).

The Russian Ministry of Natural Resources estimates that the territory claimed by Moscow may contain 586 billion barrels of oil, although these deposits are unproven. Comparing with all of Saudi Arabia's current proven oil reserves, it constitutes 260 billion barrels, although these numbers exclude unexplored and speculative resources (Borgerson 2008).

Russia delivers approximately 60% of its recovered oil resources *and* gas resources to its home market. Still, Russia holds the first place in the world as a gas exporter, and a second place as an oil exporter, although the country holds 25% of the world's explored reserves which makes it number three in the world (Bambulyak & Frantzen 2007). Looking more closely at the Arctic, the oil and gas report from Arctic Monitoring and Assessment Programme (AMAP) believes that approximately 10% of the world's oil and 25% of the world's gas are coming from the Arctic, and that Russian Arctic contributes with as much as about 80% of the oil and 99% of the gas (Arctic Oil and Gas 2007). Further, as many as 500 exploitable oil-fields on Russia's mainland and territorial waters are expected to be exploitable, although production has yet to begin (PAME 2006).

Production is currently highest in Western Siberia which holds the largest Russian oil and gas reserves. This area is expected to provide most of the oil and gas production volumes in the next few decades (Bambulyak & Frantzen 2007). However, new resources are being surveyed both there and in the Barents Sea (PAME 2006).

It is believed that oil and gas exploration will continue in the Timan-Pechora and West Siberia provinces and in the Kara and Barents seas. Large infrastructure will be required and it is likely to build major oil pipelines from the West Siberian Basin and Timan-Pechora to a western Arctic port, a Far East pipeline for arctic oil transport to the Pacific Rim, and several new marine terminals and subsequent arctic traffic to markets (Arctic Oil and Gas 2007).

The distances in Russia are vast. To operate the Shtokman field, for instance, it is not possible to go by helicopter – it is too long, too far away from land. The only way to reach the field is by ship (Almklov 2007).

Gazprom, the Russian state-controlled oil company, has gas already under development in the fields it owns in the Barents Sea (Borgerson 2008). It is also expected to find vast resources of oil and gas in East Siberia and the surrounding continental shelf (PAME

2006). In the Norwegian areas of the Barents Sea, the Snow White gas field is in production and Goliat oil field under development.

The substantial numbers of oil and gas discussed in this section underlines the large volumes of petroleum hydrocarbons located in the Arctic, particularly on the Russian shelf. It thus supports the importance of connecting oil and gas exploration in this region of the world to climate change issues. Transportation, as the link between climate change and petroleum hydrocarbons, is another important issue, which is also expected to increase substantially in the next decades, and the next section will provide an assessment of its scope and extent.

2.3 Shipping and transportation

In the past history, the Arctic has been considered as cold and forbidding, and it was not given much attention until Europeans in the 15th century thought there might be a shorter route to Asia across the North Calotte. Several attempts were made in the following centuries, all unsuccessfully, and with the tragic demise of the Franklin expedition in 1848, the interest of the Arctic region dwindled. However, three decades later Nordenskjöld's expedition managed to accomplish the whole length of the Northeast Passage (PAME 2006). As it was for Nordenskjöld, it still proves difficult to navigate through the ice infested high north. The conditions are changing rapidly, though, and the most striking changes are loss of sea ice. This trend is expected to continue (ACIA 2004, UNEP 2007, IPCC 2007). Increasing extent of open water throughout the Arctic Polar Region will provide easier access to economic activities, such as exploration and exploitation of natural resources, and accompanying transportation and shipping, which both contribute to transform the Arctic. Indeed, there are several sailing lanes across the Arctic Ocean. The shortest route between the Pacific Ocean and the Atlantic Ocean is the Polar Route, which bisects the Arctic Ocean in a line directly from the Bering Strait, over the North Pole and then south to Iceland. This route has been impassable except for the most powerful ice-breakers, capable of forcing their way through the thick multiyear ice across the centre of the Arctic Ocean (PAME 2006). A second alternative is the Northwest Passage which runs from the Bering Strait in the west through the channels along the Alaskan and Canadian coasts, reaching the Atlantic between Greenland and Labrador. The drifting sea-ice from the Arctic Ocean into the Canadian channels has traditionally made this route very difficult to sail, since pack ice accumulates over large areas. Until 2007, just a few specially strengthened ships have completed this passage with the aid of powerful ice-breakers. However, to the surprise of many scientists the passage was actually

ice free in autumn 2007, making it possible for several vessels, even small sail boats, to complete the voyage. A third shipping route, and as many have regarded the most likely alternative as a trans-Arctic shipping route, is the Northeast Passage or what is today better known by its Russian name, the Northern Sea Route (NSR) (PAME 2006). The remainder of this chapter will concentrate on two prospects of the NSR – trans-Arctic shipping which is believed to become a reality sometimes in the future, and regional shipping which is very likely to continue and expand further.

Map 2.1: Sea ice coverage in the Arctic 2007.

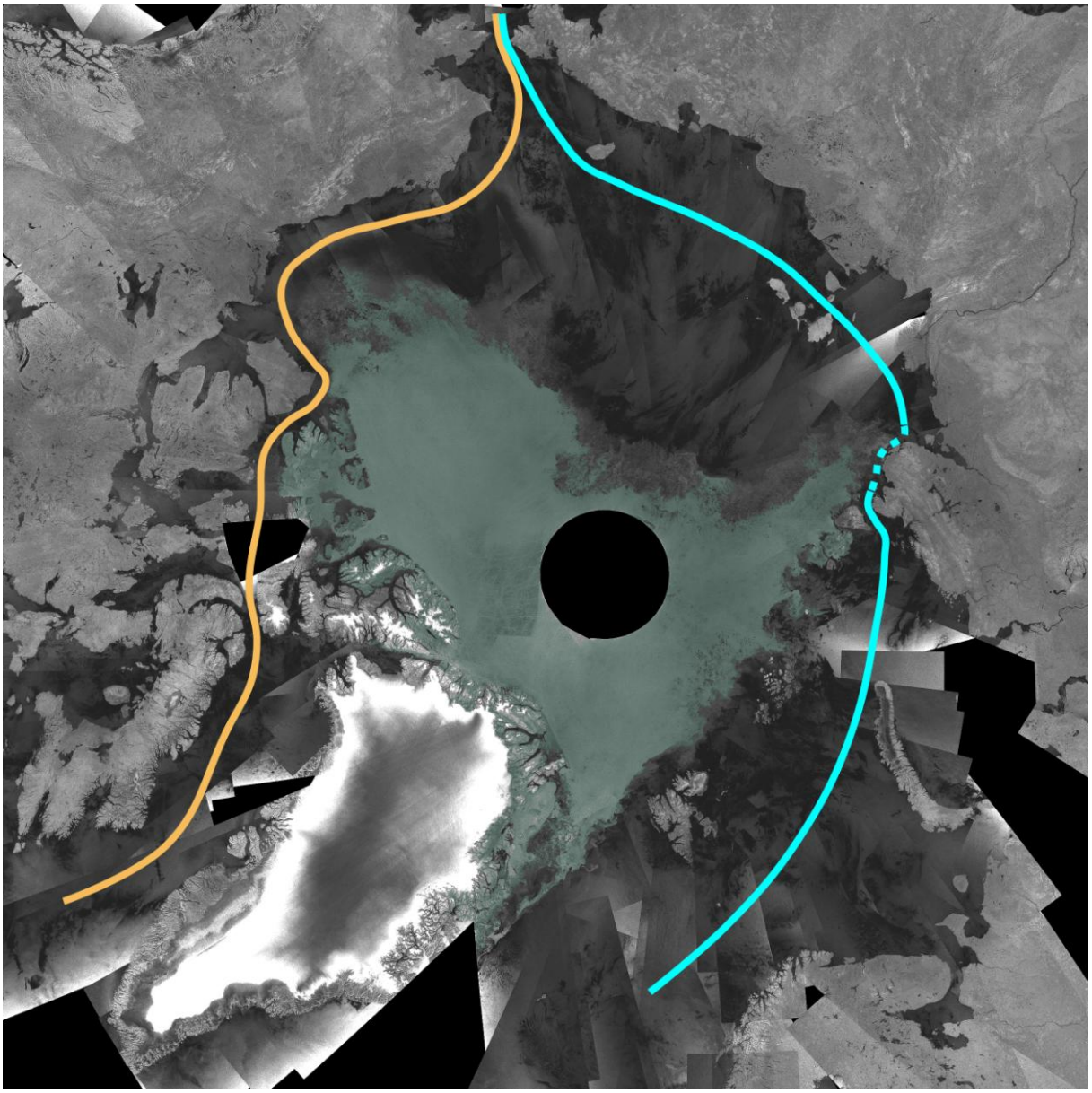


Photo: ESA/Envisat.

The Arctic Ocean 30 September 2007 displayed the lowest Arctic ice coverage in history, clearly showing the most direct route of the Northwest Passage open (orange line) and the Northeast passage only partially blocked (blue line). The dark grey color represents the ice-free areas, while green represents areas with sea ice.

2.3.1 The Northern Sea Route as a Trans-Arctic Transportation Route

According to the official Russian definition, which operates with fixed geographical endpoints, the NSR stretches across the north of Russia, from the Bering Strait in the East to

the Kara Gate Strate of Novaya Zemlya in the west (Østreng 1999). The unofficial functional definition goes beyond the official definition, and includes numerous start and end points. It essentially sees the NSR as a trade link between towns, and cities with harbors, with loading service and reception facilities, transport networks, and sizeable populations. Three examples may be: Vladivostok in the Pacific Ocean and Murmansk in the Barents Sea; another may be Vladivostok and all the way to Nordland County in northern Norway; and third example, the whole stretch from London to Japan has also been suggested as start and ending points to the NSR. This is because Japan and other countries south of the Bering Strait like North Korea, South Korea and China will contribute increasingly more on world trade flows. In this respect cities in these countries might well be regarded as functional end points (Østreng 1999).

Map 2.2: Displaying two shipping routes. The Northern Sea Route (red) compared to the Suez Canal route (yellow).

Source: PAME 2006.

The reason why the NSR is so attractive is due to the fact that it gives a comparative advantage in terms of distance connecting ports in the Pacific and Atlantic Oceans compared to the established routes through the Suez- and Panama Canals. Trade between Northern Europe and parts of Asia using the NSR will reduce the distance by up to 40% (Østreng 1999; PAME 2006).

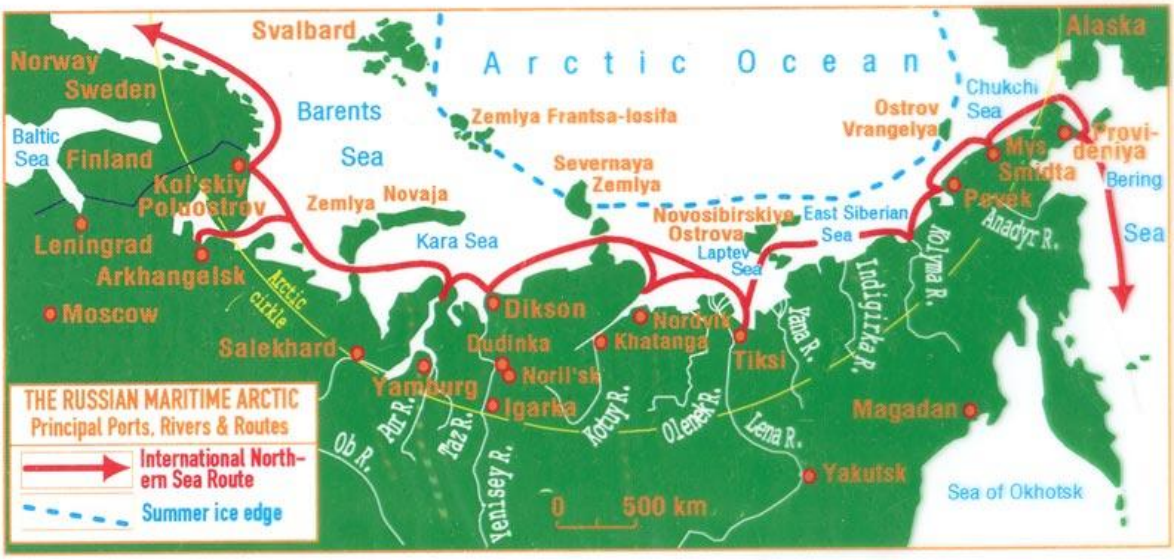
Table 2.2: Alternative Shipping Routes to Ports in the Pacific and Atlantic, in nautical miles.

Shipping routes via:	**From Hamburg to:**			
	Vancouver	**Yokohama**	**Hong Kong**	**Singapore**
NSR	6635	6920	8370	9730
Suez Canal	15377	11073	9360	8377
Cape of Good Hope	18846	14542	13109	11846
Panama Canal	8741	12420	12920	15208

Source: Østreng 1999.

Connecting Hong Kong and London, it does not matter in terms of distance if vessles go through the Suez Canal or the NSR, which makes it the equidistance (Almklov 2007). The distance between Yokohama and Hamburg through the NSR is 42% shorter than a route through the Suez Canal. Voyages between Continental Europe and Yokohama usually take 30-33 days through the Suez Canal, compared to the NSR which in summertime may save 10-15 days (Østreng 1999). The NSR could also be used to connect the northwest United States and Europe. Travelling from London by ship, the equidistance point would be San Francisco comparing the Panama Canal and the NSR, meaning the distance is the same through both routes. Cargoes originating for a point north of San Francisco for Europe would be shorter through the NSR (Almklov 2007). For example, the distance between Tromsø in northern Norway and Vancouver on the Canadian west coast is reduced by 37 % using the NSR compared with the Panama Canal (Østreng 1999).

Map 2.3: The Northern Sea Route and major terminals.



Source: Bambulyak & Frantzen 2007.

The NSR is not one single sea route, but comprises different shipping lanes which are determined by the current ice conditions. Based on the official Russian definition it consists of several adjacent seas – the Kara Sea, the Laptev Sea, the East Siberian Sea and the Chukchi Sea – which are linked together by 58 straits running through the three archipelagoes Novaya Zemlya, Severnaya Zemlya and the New Siberian Islands (Østreng 1999). The NSR is also regarded as comprising two routes, the Inner Northern Sea Route and the Outer Northern Sea Route. The Inner Route is a coastal route much used by regional shipping and for exports from Northwest Russia, and it runs between Murmansk in the west, the only port in the region that is ice-free throughout the year, and Vladivostok in the east (PAME 2006). The starting point for the Outer Northern Sea Route in the west is between Novaya Zemlya and Franz Josef Land, then it passes north of the islands of Severnaya Zemlja, and the New Siberian Islands and Vrangelya, before passing through the Bering Strait in the east. This route is much deeper, thus larger ships can pass through. But the route is more covered with sea ice, although during the summer time, it has less ice and long stretches of the route are ice free (PAME 2006). Further, if sea ice development and future projections due to climate change are taken into consideration (ACIA 2004, UNEP 2007, IPCC 2007), this route may become more and more favorable in the years to come.

There are many aspects of the NSR which restrict the commercial development of a trans-Arctic route. Most notably it is the physical aspects of the route that constitute the

obstacles to utilization. Shallow straits and multi year ice determines where it is possible to travel, not only within the NSR, but for the whole Arctic Ocean (Østreng 1999, PAME 2006).

2.3.2 The Northern Sea Route as a Regional transportation Route – Oil transportation in the Barents Sea Region

Transport vessels that form part of the shipping traffic in the Arctic include cargo ships, fishing boats, cruise ships, and research ships, as well as ice breakers, tugs, and the transport vessels for scrapping (PAME 2006). The rich natural resources of northern Russia, northeastern Russia and Siberia that are suitable for commercial export include oil and gas, forestry and also minerals. As a regional sea route it will be important in terms of domestic transportation of goods to Arctic Russia, as well as for import (Almklov 2007). Together with sea and river transportation, there are, in a regional perspective, only two other modes of transporting petroleum hydrocarbons and other products, and that is by pipeline and train. Pipelines have been central in the Russian oil and gas transportation system, and they represent an important alternative to ship. The same is true for the widespread railroad system, which transports both hydrocarbons and other types of commodities. Included in the transportation system are the many rivers in the Russian north. The Russian oil and gas industry and Russian authorities have a very strong tradition for transportation by pipeline. However, if Russia chooses to develop the coastal resources of northwest Russia and Siberia, then shipping will definitively be a very interesting mode of transportation (Almklov 2007).

Oil transportation routes and terminals in the Russian part of the Barents Region

There are 14 terminals in the Russian part of the Barents Sea region, as can be read in table 2.3 and displaced in map 2.4. The oil is shipped from these coastal or offshore terminals either directly to the destination point, or via offshore transshipment terminals in the Kola or constructed terminals in northern Norway.

Table 2.3: The oil shipment volumes in the period 2002-2006, the terminals capacity in 2006 and expected/planned capacity in 2010. The numbers are in thousand tons.

#	Site	Loaded, 2002	Loaded, 2003	Loaded, 2004	Loaded, 2005	Loaded, 2006	Capacity, 2006	Capacity, 2010
	Laptev Sea							
1.	Tiksi	60′	-	-	-	-	*100′*	-
	Kara Sea							
2.	Dudinka	20′	40′	-	20′	20′	*100′*	*100′*
3.	Dikson	-	-	-	-	-	-	-
4.	Ob Bay	110′	220′	240′	360′	460′	*600′*	*3000′*
	Pechora Sea							
5.	Varandey	200′	400′	560′	600′	500′	*1500′*	*12 500′*
6.	Prirazlomnoye	-	-	-	-	-	-	*7400′*
7.	Kolguev	120′	100′	80′	80′	80′	*200′*	*100′*
8.	Indiga	-	-	-	-	-	-	*12 000′*
	White Sea							
9.	Arkhangelsk	1930′	1500′	3450′	4200′	3100′	*4500′*	*7200′*
10.	Severodvinsk	-	-	-	-	-	-	-
11.	Onega Bay	-	320′	-	-	-	-	-
12.	Vitino	2900′	5700′	3700′	1600′	3700′	*11 000′*	*12 000′*
	Barents Sea							
13.	Murmansk	-	-	3700′	2700′	1700′	*8000′*	*10 000′*
	Mokhnatkina Pakhta	-	-	-	-	730′	*2500′*	*5 000*
	Lavna	-	-	-	-	-	-	*10 000′*
14.	Pechenga	-	-	-	-	-	-	-

Source: Bambulyak & Frantzen 2007.

The most important terminals in terms of size in the Russian part of the Barents Region are Arkhangelsk and Vitino in the White Sea and Murmansk in the Barents Sea which at the present are the terminals shipping the greatest volumes. Looking at the expected capacity in 2010, the Varandey and Indiga in the Pechora and Lavna in the Barents Sea also will become important terminals (Bambulyak & Frantzen 2007).

Map 2.4: Locations of terminals of the Eurasian coast.

The Laptev Sea: (1) – the port of Tiksi. The Kara Sea: (2) the port of Dudinka, (3) the port of Dikson, and (4) the terminal in the Ob Bay. The Pechora Sea: (5) Varandey terminal, (6) Prirazlomnoye oil field, (7) the terminal on the Kolguev island, and (8) Indiga settlement in the Pechora Sea. The White Sea: (9) the terminal in Talagi near Arkhangelsk, (10) the town of Severodvinsk, (11) the terminal in the Onega Bay, and (12) Vitino port. The Barents Sea: (13) the terminals in Murmansk and in the Kola Bay, and (14) the Pechenga Bay in Russia; (15) the terminal in Bøkfjord near Kirkenes, (16) the town of Vadsø, (17) the terminal in Sarnesfjord near the North Cape, (18) Kvalsund and Sørøya island near Hammerfest in West Finnmark, and (19) Grøtsund near Tromsø in Norway. Source: Bambulyak & Frantzen 2007: 35.

Oil transportation routes and terminals in the Norwegian part of the Barents Region

In the Norwegian County of Finnmark there are numerous plans for building transshipment terminals in for example Vardø, Paddeby, and Bøkfjord outside Kirkenes. Some of these plans have been terminated already, like the anchored storage super tanker that was in operation in 2005-2006, but was banned by official Norwegian authorities because of protected salmon areas. Other plans are companies that applied for permits and are still waiting for approval. Others again, like Sarnesfjord and Kirkenes have already been granted permits. Due to the expected future increase in oil to be shipped from the Russian part of the Barents Region Ports, and on the belief that the Russians do not have enough oil reloading facilities, terminals in northern Norway are expected to increase (Bambulyak & Frantzen 2007).

Map 2.5: Locations of terminals in the coast of Western Barents Sea.

(A) Pechenga Bay, Russia. (B) Bøkfjord near Kirkenes, (C) Paddeby near Vadsø, (D) Sarnesfjord near the North Cape, (E) Kvalsund, (F) Slettnes and (G) Dønnesfjord on Sørøya island, and (H) Grøtsund near Tromsø, Norway. Source: Bambulyak & Frantzen 2007.

Summary

This chapter has presented data on the three issues of interest to this thesis. Human induced climate change constitutes a complex issue, and in light of feedbacks and tipping point's processes, it may have dramatic consequences for the Arctic and to the world at large. Anthropogenic climate change is accelerated by globalization processes. Sea ice reduction facilitates economic activities in the Arctic region, such as petroleum exploitation and shipping. Surveys show that there are vast amounts of petroleum in the Arctic, with Russia possessing the majority. Shipping is likely to expand further this century. At the beginning of the 21st century, oil transportation in large tankers along the Norwegian coast, originating from Russian ports, has increased significantly. This trend is expected to continue. The next chapter will introduce the philosophical and theoretical frameworks which underlie the remaining part of the thesis.

3. Philosophical Foundation and Theoretical Framework

Agnew et al. (1996) writes that human geography is different from other social sciences by seeking knowledge within three broad fields: the relationship between nature and society, spatial distribution of human phenomena, and the unequal social and economic distribution in the world and how it develops. Geographers have for over a century sought to describe and explain the first category, the society-nature interface. As the world has changed and the society-nature relation has increasingly become more complex, human geographers now explore the relationship between politics and ecology (Neumann 2005). Among this field of study there are researchers who speak of the necessity for approaches relating a social view to nature in order to make an analysis which reflects the complex human-nature interaction (Castree 2001; Harvey 1996). This chapter will explore these views more in detail in relation to the meta narratives of globalization and climate change. The science of global change incorporates many issues and can easily become almost unmanageable to work with, but nonetheless, it is utterly important to keep a wide perspective if we are to provide an analysis that resembles the world, and which considers issues of justice and equity, power politics, social aspects, morality and ethics. This chapter will first establish the philosophical foundations of social theory, which involves perspectives on nature and critical realism, before moving on to political ecology, the theoretical approach used in this thesis. Finally, the conceptual framework Double Exposure (Leichenko & O'Brien 2008) which explores global change processes will be discussed.

3.1 Philosophical Foundation – Social theory

Social theory is described as being broad and an encompassing concept that is known to go beyond the established disciplinary boundaries of the academy, sometimes characterized as a 'post-disciplinary' endeavor (Neumann 2005). Two aspects that are associated with social theory – different views on nature and critical realism – will be a discussed here, starting with a theoretical discussion on society-nature relations.

3.1.1 Perspectives on the society-nature relation in human geography

> "The world has changed enormously [...] In the twenty-first century, society-nature relations seem to be marked by a new breadth, depth, and consequentiality. By breadth, I simply mean that few areas and aspects of nature today remain untouched by human hands; by depth, I mean that many society-nature relations extend "all the way down", even to the level of genetic modification; and by consequentiality, I mean that what happens to nature today may be of world-changing importance, both for ourselves and other species" (Castree 2001: 1).

In recognizing that human beings have dramatic unintended consequences upon the earth system have made social scientists re-emphasize their view on how human activities are interconnected in complex and unpredictable ways with the natural world (Smith 1998). As Castree described above, our interaction with nature is pervasive. But what really is nature and how should we make sense of it? Some have sought to make distinctions between different kinds of nature. According to Smith (1998) who distinguishes between first, second and third natures, first nature is described as the given, pristine nature of biophysical processes, which is what our present society evolved from. Second nature is culture and environment, part biophysical and part social. Third nature is information flows, representational signs, symbols and discourses of nature which daily has become large parts of our lives. Through the media, television, Internet, advertisement, we are presented a more or less realistic representation of second and third nature (Huckle & Martin 2001). This has been termed the *social construction of nature* which stresses the role of representation, discourse and imagery in our defining and framing of our knowledge of nature and the natural. Although often used interchangeably, there is also a distinction between socially-constructed and socially-produced nature. The latter, developed by Smith on Marx's idea of the dialectical unity of nature and society, is a way to overcome the conceptual duality of nature and society (Neumann 2005).

The idea of a socially constructed nature or the construction of socionature (socialized nature) (2001) has made social thinkers abandon the idea of "a foundational *distinction* between the social and the natural" (Castree 2001: 3). Castree advocates a 'social' approach to nature:

> "[...] which is increasingly popular and influential among critical human geographers – who see nature as *inescapably social*. Here the argument is that nature is defined, delimited, and even physically reconstituted by different societies, often in order to serve specific, and usually dominant, social interests. In other words, the social and natural are seen to intertwine in ways that make their separation in either thought or practice – impossible" (Castree 2001: 3).

Since humans always have been transforming nature – both in the way we think about it and in the way we physically are transforming it – the previous dichotomy of nature and society should be replaced by a duality, as it is impossible to separate them. Political ecology is according to this categorization a 'social' approach, but before discussing more in depth what political ecology involves, the next section will proceed with an introduction to critical realism.

3.1.2 Philosophical Foundation of Environmental Science

In the last two decades of the 20th century the hot spot of social science research debate was the relationship between knowledge and reality (Smith 1998). Much discussion has evolved around whether or not there exists an independent nature, and how we can get to know and represent this world. The deep divide between constructivism and realism has clearly contributed to a polarization in environmental science (Forsyth 2003), but there are ways out this impasse. Empirical realism or realist approaches developed in the Enlightment period are treating the world as a single, universal and measurable external reality, consisting of directly observable atomistic objects. These then can be mirrored and objectively measured and we can come to know the world exactly as it is through empirically based enquiries (Jones 2002). A contrasting view to this positivist approach is often typified as relativism or postmodernism, which seeks to deconstruct the characteristics of realist approaches. On the contrary they emphasize the significance of language and interpretation. Much debate involves whether it is possible to claim a constructionist view when working with environmental problems (Blaikie 2001, Demeritt 2001, Jones 2002). There is no genuine link, it is argued, between language and an independent reality. Such a denial of a real nature proves difficult when working with environmental issues. There exists, however, several versions of the postmodernist view of social constructionism. On the one hand, the *extreme* social constructionist view, which this thesis opposes, argues that the world is a social construction, meaning that the way we are explaining natural phenomena is just made up of words. It is a view that lacks a distinction between epistemology and ontology, and hence consisting of both an epistemology and an ontology that are unreasonable subjective (Huckle & Martin 2001).[7] On the other hand, a *moderate* version of social constructionism is suitable

[7] Ontology is the theory of being or reality, and involves a set of assumptions of what can be taken to really exist (Smith 1998). They are the underlying structures in the biophysical or social world, and it specifies what is

(Blaikie 2001, Demeritt 2001, Jones 2002) as it holds a subjective epistemology – the way we seek to know about reality – which means that there are room for interpretations and discussions of how to make sense of the world but at the same time it believes in an ontology that acknowledge the existence of an independent world (Huckle & Martin 2001).

A way out of this stereotypical representation, and which is compatible with a moderate version of social constructionism, is through critical realism, which constitutes the philosophical framework advocated in this thesis. This middle position between positivism and extreme relativism, a 'third way' as it has been called, is a distinct version of the realist philosophy, and has been widely recognized as the hallmark of the Bhaskarian version of scientific realism in the social sciences (Danermark et al 2002). A critical realist perspective will make a greater prospect for working with environmental science, it seems, because lying between those of modernity and post modernity, it seeks to bridge the gap between epistemological skepticism and ontological realism (Huckle & Martin 2001). Further, it manages to incorporate dialectical materialism, critical theory, system thinking as well as postmodernism's attention to discourse, subjectivity, pluralism, the new post-normal science, and radical politics (Huckle & Martin 2001), which are some of the tools this thesis are making use of.

The scientific philosophy of critical realism celebrates the existence of a reality independent of our knowledge, and since there exists an independent world, human knowledge is not itself reality, but a representation of it. This means that it acknowledges the ontological independence of the biophysical world – that there is an independent world 'out there' – "real" structures of society and the world which we should seek to understand. But at the same time it is recognizing that our understanding of the world is partial, situational, and contingent, and that the structures only reflect partial experience of them, which ultimately influence social and political framings within the research process (Forsyth 2003, Neumann 2005). To progress beyond the claim that there is an independent world 'out there' social theorists and political ecologists have endorsed Bhaskar's schema, which is a classification into three levels – the real, the actual and the empirical – in order to examine how scientific inquiry orders knowledge (Neumann 2005). The *real* or the 'deep' (structures, mechanisms, powers and tendencies) is the underlying ontology and structures that give rise to events and

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possible to know about it: the reality that exist and how it does so. It aims at creating a framework for understanding the kinds of things that constitute the world's structures. Epistemology is the study of knowledge construction. It specifies how the reality can be known. In so doing it seeks to establish criteria for defining when we know, and do not know, something about reality (Huckle & Martin 2001, Forsyth 2003).

experiences, the *actual* (events and states of affairs) is experiences, and the events that give rise to experiences, and the *empirical* (experience and impression) is the simple experiences (Sayer 2000; Forsyth 2003). The Bhaskarian version also distinguishes between so-called "transitive" explanations (socially constructed and changeable) and "intransitive" knowledge (referring to underlying and unchanging reality) (Forsyth 2003).

While holding on to a philosophical foundation, there should be taken considerations in the way environmental issues are addressed; that is, bear in mind the actors and stakeholders you want to influence. Blaikie (2001) argues that we have to talk about the environment to people who will listen and in a language which we share, and not so much discover 'truth', or the most philosophically appealing approach. There should be room of being pragmatic when it comes to involve key actors, so that the ways that nature and policy is represented may have a chance of being acceptable. The construction of nature for policy should be able to suggest where policy is damaging to people and environment, and how it may be improved (Blaikie 2001).

A full-fledged outline of Bhaskar's realist philosophy or complete evaluations of some of the different varieties of critical realism is beyond this thesis' scope. Nevertheless, the basic tenets provided by critical realism when working with nature-society relations is critical to this thesis, because it manages to acknowledge the existence of a real biophysical world which humans can make sense of – though only in a limited and biased way.

The Age of Enlightment of the seventeenth and eighteenth century provided the philosophy of mechanical materialism; which basically perceived the world as a dead machine, and all matter behaved according to strict mathematical principles and everything was predictable. Positivism was the philosophy which shaped and accompanied modern science and modern approaches to understanding and managing the environment. Although the ways humans have acquired knowledge about nature since the eighteenth-century has served us well, its limitations have now become apparent (Huckle & Martin 2001). In industrial society the environment was considered an area of inquiry and control and decisions were mostly made by science and industry (Dryzek and Schlosberg 2005). Increasingly we are becoming more aware that our ideas about the environment are socially framed and embedded (Berkhout et al 2003).

Recently, science has faced a new challenge. Funtowicz and Ravetz (1992), claim that 'Normal' science, stemming from Kuhn, is no longer sufficient to convince the public and decision-makers. Science must provide politicians with knowledge despite that facts are

uncertain, values are in dispute, stakes are high and political decisions are urgent. This brings the discussion of how to understand and explain long-term issues where we possess less information than the politicians and the public would like. For example, when environmental problems are hardly observable it tends to host high environmental uncertainty and a potentially higher level of social constructedness exists as natural systems are complex (Samantha Jones 2002: 249). The complex climate system makes it difficult to know enough about them. Conventional methods of inquiry, based on determining all relevant information before proceeding have their limitations. They are too slow and uncertain to deal with an issue too complex to be fully understood and too important to wait on (Funtowicz and Ravetz 1992; Forsyth 2003). Since facts are uncertain and political decisions are urgent, Funtowicz and Ravetz argue that science should become Post-Normal. Their concept, Post-Normal science, acknowledges that science always involves uncertainties, and that their mistakes can be costly or even lethal.

Social scientists claim that there has arisen a situation where the public are experiencing a lack of faith in 'the modern project', which in part is due to that the public perceive governments, corporations and scientific communities as irresponsible (Huckle & Martin 2001). This can be attributed statements by state-sponsored scientists arguing that nuclear power and GM food are safe, while Greenpeace claim the opposite. The result is a delegitimization of science, which ultimately undermines a central feature of modernity. New risks that have arisen from trying to solve past or present crises; the increasing scarcity of fossil fuels and its contributions to GHG emissions, which results in enhancing climate change, are now leading to subsidies of the nuclear industry which in turn leads to increased risks of radioactive pollution (Huckle & Martin 2001). Risks have always been part of human existence, for example natural disasters. Now, we are facing different risks, or new risks as Beck calls them, where we are moving away from the industrial society to a 'risk society' where our daily life's such as eating or even breathing, are filled with risks. What separates the 'old' risks from the 'new' risks is that the latter has a significant level of human agency behind them; they are manufactured risks – the direct result of modernism and our advances in technology. The term 'risk society' is not intended to imply an increase of risk in society, but rather a society that is organized in response to risk. Risk can be defined in the risk society as a systematic way of dealing with hazards and insecurities induced and introduced by modernization itself (Beck 1992). An important analysis of Beck's research involves how he views the distribution of risks. Risks are distributed uneven through a population and between different parts of the world. It is the same people who is responsible for creating pollution

who also will be exposed and eventually suffer from them, for example contamination of the water supply. This 'boomerang effect' will make even the richer nations and wealthy individuals more exposed to risks, not just the developing countries and the poorer individuals. In light of human induced climate change and the melting of the Arctic sea ice which is seen by many as a go-ahead in search for economic profits, an enhanced version of Beck's 'boomerang effect' may during this century come back to those who produce or profit from them, as will be discussed in chapter 6.

In trying to uncover why there exists so many opinions about climate change and what the future holds for humanity, John Adams suggests it is due to how each individual perceives risk, especially how humans view 'nature' as a risk (Maslin 2004). Adams has developed 'four myths of nature' and 'four myths of human nature' and combined them to uncover the variety of individual responses to risk and uncertainty, which then Maslin builds on further. Maslin's argument is that people base their worldviews on many different factors; personal agendas (financial or political), belief systems, or whatever is expected by them at the time. One example of Maslin's categorization, which might help explain why some do not believe in the threat of climate change, are those who see 'Nature as benign' (stable, bountiful and forgiving of any insult that human kind might inflict upon it) and who are 'Individualists' (enterprising self-made people, strive to exert control over the environment and other people). This is according to the author because they exhibits their own perception of nature and hence believe that there is a low potential risk and uncertainty. This has relevance to chapter 5 which will expand through the five discourses on how actors and interests look at Arctic issues differently in relation to the three way connection.

3.2 Theoretical Framework – Political Ecology

For over a century geographers have sought to describe and explain the society-nature interface (Castree & Braun 2001). Political ecology is the most recent expression of geographers' long-standing interest in the relationships of human society to the natural environment (Neumann 2005). Political ecology refers to a scholarly field that emerged in the 1980s among a group of primarily geographers and anthropologists based in the United States, Great Britain, and Australia. The initial focus of the progenitors of political ecology, working in third world former colonial countries, "was on probing how the politics of access to and control over land and resources were related to environmental change" (Neumann

2005: 5). Harold Brookfield and Piers Blaikie, two geographers who named this field explain that:

> "[t]he phrase 'political ecology' combines the concerns of ecology and a broadly defined political economy. Together this encompasses the constantly shifting dialectic between society and land-based resources, and also within classes and groups within society itself" (Blaikie & Brookfield 1987: 17).

Watts (2000) defines political ecology as the understanding of

> "[…] the complex relations between nature and society through a careful analysis of what one might call the forms of access and control over resources and their implications for environmental health and sustainable livelihoods" (Robbins 2004: 6-7).

Based on the definition, Robbins writes that the goal of political ecology is to "[e]xplain environmental conflict especially in terms of struggles over 'knowledge, power and practice' and 'politics, justice and governance'" (Robbins 2004: 6-7). In short, the proponents of political ecology contend that it is a field of study that explores the relationship between politics and ecology, arguing that there are political, economic, and social factors affecting all environmental issues.

Further, and very importantly, human transformations of natural ecosystems cannot be understood without consideration of the political and the economic structures and institutions within which the transformations are embedded (Neumann 2005), and thus the contextual reality of where environmental change happens are emphasized. The relationship of nature and society is then dialectical. This directs attention to the multifaceted relationship of politics to ecology, or put in another way, environmental change and ecological conditions are the product of political process (Neumann 2005). Bryant and Bailey (1997) write that political ecologists

> "accept the idea that costs and benefits associated with environmental change are for the most part distributed among actors unequally . . . [which inevitably] reinforces or reduces existing social and economic inequalities . . . [which holds] political implications in terms of the altered power of actors in relation to other actors" (Robbins 2004:11).

Political ecology is known for its diversity. According to Robbins (2004) there are, however, four big questions or themes that unite the diverse work of political ecologists, namely the degradation and marginalization thesis; the environmental conflict thesis; the conservation and control thesis; and the environmental identity and social movement thesis. Several of these themes will be discussed, at least implicitly, in relation to different Arctic discourses during the thesis.

Tools and directions

The objective of this section is to create a theoretical framework that manages to address the political and the ecological dimensions of environmental issues in a more integrated and balanced manner. I argue that political ecology holds this ability, as it can provide the tools necessary to analyze the complex social, economic, and political relations in which climate change issues are embedded. There is no single methodology for political ecology research; on the contrary, multiscalar analysis is regarded the methodological hallmark of political ecology and thus separates it from other human-nature relation approaches. Political ecology has taken many directions, but almost as a definition, its research incorporates political-economic analysis. Attention is directed at the particular roles and interactions between the state and the market, and the consequences for the environment (Neumann 2005). In the High North, the five Arctic states (Norway, Russia, the United States, Canada, and Denmark (PAME 2006) compete in a struggle over the vast Arctic Ocean, and its continental shelves, which is international waters, and international shipping companies and oil companies increasingly see the region as potentially lucrative areas. Political ecology pays increasingly attention to new models and theories of non-equilibrium ecology, that is, opposed to equilibrium ecology, the realization that stability is not the norm for many natural communities, rather disturbance is common and frequent (Neumann 2005). In terms of this thesis the concept of non-equilibrium is important in terms of feedbacks and tipping points. Though there are insecurities regarding these phenomenon's, they are still imperative regarding climate change in the Arctic, because these processes may make the region a globally significant issue.

Political ecology incorporates research on the sociology of science and knowledge (Adger et al 2001). Forsyth's notion of "a 'critical' political ecology may be seen to be the politics of ecology as a scientific legitimization of environmental policy" (2003: 4). He argues that a priori understandings of environmental explanations should not be taken and emphasizes how the importance of reflexive attention to science; meaning that attention must

be given political aspects of science, because science is used to legitimate different environmental policies (Forsyth 2003).

A frame is according to Forsyth (2003) a local perception or evaluation of environmental changes, they are usually implicit, and "refers to the principles and assumptions underlying political debate and action" (Forsyth 2003: 77). Analyzing underlying frames and assumptions in political debates is an important aspect of discourse analysis. Discourse analysis is an example of a constructionist approach, where the object is not to directly analyze the phenomenon itself, but rather the claims concerning this phenomenon (Adger et al. 2001). The discursive era was led by Foucault and eventually this new way of analysis was picked up by researchers of third world political ecology, most notably with Escobar's interest in poststructuralism (Bryant 2001). Peet and Watts (1996), in reviewing the frontiers of political ecology, argue that discursive approaches to the analysis of environment and development are central to this emerging discipline (Adger et al. 2001). In chapter 5, considerable attention will be given to discourses and why they are important.

The geographic scales of which each methodology is used are of great importance, and may vary greatly within and among studies. Few political ecological studies incorporate all of these methodologies, or do so in the same relative proportions (Neumann 2005). Robbins explains that:

> "political ecologists follow a mode of explanation that evaluates the influence of variables acting at a number of scales, each nested within another, with local decisions influenced by regional policies, which are in turn directed by global politics and economics" (2004:11).

In contrast to other approaches, it typically emphasizes the importance of local scales, for example the scale of villages and the surrounding areas. The focus on the local scale is thus a way to expose property relations, for example by looking at who has material access to land and resources, and at what level. This does not mean that it is limited to just the local. In practice, attention is also given to the regional, national, and international scales and to the linkages among them (McCarthy 2002). To better understand climate change and economic globalization in the Arctic region, political ecology calls for a multiscale analysis. There are winners and losers, hidden costs, power relations to be revealed and interests to be uncovered on the global, national, regional and local scale.

Political ecology on first world countries

As an approach, political ecology can offer theories and methods drawn from third world research to other parts of the world, although the approach receives its theoretical pluralism and thematic content from Marxism, dependency theory, world systems theory, and agrarian studies. It is though not surprising that there has been debate about how suitable political ecology is in the study of environmental and resource conflicts in First World countries. McCarthy (2002) notes that several researchers have rejected this notion, or at least maintained that political ecology of the First and Third Worlds are distinct and that inquiries into them must proceed from fundamentally different premises (Bryant & Bailey 1997, Castree & Braun 1998). Others and perhaps most of political ecologists argue that it is about time that political ecology expands its area of interest to also include First World locales (Walker 2003; McCarthy 2002; Neumann 2005). An increasing number of researchers within this field argue that the insights and tools of political ecology from third world research have much to offer in the study of First World cases (McCarthy 2002; Walker 2003; Neumann 2005). McCarthy argues that the core concerns and approaches are directly relevant to research on environmental issues in First World industrialized countries, and political ecology studies have for instance been done on the rural USA (McCarthy 2002; Walker 2003).

This thesis will continue to use the insights from political ecology on First World countries, and show that is has much to offer a remote location like the Arctic. Political ecology's attention to historical analysis and ethnography, are concerned with highlighting the differing and sometimes conflicting perspectives on the environment and environmental problems held among various actors operating at local, regional and global scales (Neumann 2005). As will be discussed more in detail during this thesis, historical relations in the region with its native communities, whose livelihoods have long depended on using the lands and natural resources, are now about to lose access to and control over their areas in favor of imposing actors and interests which turns attention to relations of power. New and strong actors and the melting sea ice will inevitably have social implications to them as a people, making winners and losers a central theme. The decreasing sea ice is inevitable leading to new opportunities, which strong economic interests from nation states and the petroleum and shipping industries sets out to exploit. In this respect, by revealing the undesired outcomes of current energy policies, this thesis is striving to expose the flaws in the dominant approaches favored by the Arctic nations, corporate industries and international authorities regarding their petroleum activities. Importantly, political ecology is prone to finding causes rather than symptoms of problems. In the case of climate change and GHG emissions, it seems more like

a question of connecting the relationship between climate change, petroleum activities and transportation in the Arctic, rather than the well-known causes of climate change which are the anthropogenic emissions of greenhouse gases. There are also very visible interests in favor of protecting and conserving Arctic sea and land areas, most notably environmental NGOs, which are seen by indigenous peoples of being interventionists, distant, professionalized and not paying attention to the natives' situation. Local communities are increasingly the subject of regional natural resource exploitation, which will have significant local and regional consequences for environmental systems, but as will be discussed later, they will also have dramatic global implications. Moreover, expected global sea level rise during this century will affect areas world wide, also the low lying areas of Bangladesh and Tuvalu. These two developing countries are contributing insignificantly to the total of the world's greenhouse gas emissions. As such, attention is directed to questions of morality and ethics. Political ecology is seeking less exploiting ways of doing things and has a normative understanding that there are better and more sustainable ways of carrying out environmental policies or policies in general for that matter.

Political ecology has been criticized of being unmanageably complex and theoretically incoherent because it includes such a broad range of approaches (Neumann 2005). Further, seeing political ecology in a historic perspective, it falls into the trap of downplaying the importance of a nature that we act upon, due to some researchers have seen further work in biophysical explanation not necessary in essential social science applications (Forsyth 2003). As such, there is too much constructivism at the expense of considering the biophysical research and explanations of environmental problems. Importantly, and more generally, Forsyth (2003) warns about the separation of science and politics in environmental policy. This poses a significant problem as many environmental policies will not address the underlying biophysical causes of environmental problems. Finally, even though political ecology emphasizes geographical scales with special attention towards local communities, it does not include subjective worldviews. Worldviews and values are not shared equally between individuals or groups within communities (O'Brien 2008).

One of political ecology's challenges is to integrate ecological and political dimensions, together with material and discursive dimensions. Critical realism is seen as the provider for tying these dimensions together, as it accepts that there is a real, independent nature that we act upon and which acts back upon us, but at the same time giving attention to the constructed ways humans perceive environmental issues, making way for discourse

approaches (Neumann 2005). Further, critical realism is appealing to political ecology because the philosophy emphasizes underlying structures that go beyond fixed models of causality and partial empirical research. As such, critical realism provides political ecology with an instrument that reflects more complex underlying causes of change (Forsyth 2003).

3.3 A Conceptual Framework – Inclusive and Holistic Approaches

A key point when considering climate change and its feedbacks is to acknowledge multiple processes of change. There are a number of processes that are happening at the same time and the interplay among these processes can reinforce or strengthen the outcomes, and thus enhance the positive feedbacks to the natural environment, and to the social worlds. Newer research has in fact shown that it is imperative to view stressors together. These processes are highlighted in the literatures, and discourses on climate change and globalization emphasize the dynamic feedback among physical, ecological, and social systems (Leichenko & O'Brien 2008). Likewise, social systems are also producing positive feedbacks, especially through economic globalization which for example results in increasing GHG emissions and land use change, which poses significant potential positive feedbacks to the natural systems. Thus, looking at the big picture and examining connections and interactions across the discipline – and turning away from systems perspectives that do not take into account political, social, and economic interests and motivations – is essential for advancing environmental research. Although there already exists a broad range of frameworks and approaches (O'Brien et al 2003; Turner et al 2003; Newell et al 2005) there are considerable flaws in much of the existing research, and they have in particular one thing in common – they treat very complex issues too narrowly. A main statement of this thesis is to call for inclusive approaches. Introducing new integrated and holistic approach will then have to be broad and inclusive, and reflect political ecology, critical realism and other approaches that are being outlined in this chapter.

The Double Exposure framework

Leichenko and O'Brien's (2008) 'double exposure' framework is a theoretical/conceptual framework that emphasizes the interactions among global change processes. In considering global environmental change and globalization together, the framework shows how new and sometimes unexpected outcomes may be exposed. The framework accounts for not only the overlapping outcomes of these two processes, but also the changing context in which the

processes occur, a context that influences both exposure and the capacity to respond to a wide array of stresses and shocks (Leichenko & O'Brien 2008). It also looks at how the processes contribute to further changes. The pathway of *feedback* double exposure is of particular interest for this thesis because it emphasizes "how global change processes can generate responses that can amplify the processes, leading to new cycles of double exposure" (Leichenko & O'Brien 2008: 42). It highlights the dynamics inherent within these interacting processes, and emphasizes temporal linkages between global change processes, outcomes, and responses. The framework shows that actions taken in response to either or both processes may contribute to the drivers of global change (Leichenko & O'Brien 2008: 80).

Individuals, communities, social groups or regions that are 'double exposed' to both processes may experience negative impacts from both globalization and global environmental change. In contrast to these "double losers," others may benefit from both processes, making them double winners. However, it is important to point out that short term winners from globalization may nonetheless experience the negative consequences of environmental change in the long run (Leichenko & O'Brien 2008). Looking at the dynamic interactions between the two processes presents a different picture of winners and losers in the Arctic region, as will be discussed in later chapters.

Summary

This chapter has introduced discussions in social theory, critical realism and political ecology. I have restricted myself to present critical realism's philosophical explanation which argues that there exists an independent world, but which can only be partially understood by humans. This is a key point since it seems a greater prospect for working with climate change issues, and since it also explains why people see the world so differently. In addition, a short presentation of the distinctions between the real, the actual and the empirical has been made. The theoretical framework which constitutes political ecology has been presented, and here emphasize has been placed on social, political and economic aspects of human transformations to natural ecosystems. Then, attention has been drawn to holistic and inclusive approaches to climate change. Finally, an introduction to the double exposure framework has been presented, which shows how processes of globalization and environmental change are linked. In the next chapter I will give an account of the research strategies that constitute this thesis.

4. Research Strategies – Capturing the Missing Parts

In this chapter, I will start by explaining where I position myself scientifically, and then discuss the challenges I have encountered and the motivation for writing this thesis. Further, I will explain how I collected the data and justified the choices I made during the research process.

As anyone who opens up a newspaper these days discovers, climate change issues do not lack attention in the popular media. On the contrary, the information available is overwhelming. Climate change is a cross-disciplinary research field, as it involves both social and biophysical aspects. Keeping my 'head above water', in terms of all the issues and literature needed to be considered, was a considerable challenge. As such, my challenge was to find a balance between holding on to the material I already had while being open to the constantly new empirical data from new studies and research.

Considering the scope of this thesis, it has been challenging to gain the knowledge needed to conduct a satisfactory argument towards a deeper and broader understanding of climate change issues. Nonetheless, I am convinced that this knowledge is necessary for addressing complex global challenges. Although my initial level of knowledge regarding climate change was limited, the research was undertaken with vitality due to the scope and seriousness of Arctic climate change. Two ways for choosing research topics in the social sciences have been highlighted; to study topics that have relevance for society and to fill knowledge gaps in existing research (Furuseth & Everett 1997). This thesis meets the first criterion easily, as all societies are confronted by the observed and potential impacts of climate change. It also fills an important knowledge gap, namely by questionings the way climate change is being framed and linking it to other social processes. Although there are numerous frameworks that can contribute to the understanding of climate change (O'Brien et al 2003; Turner et al 2003; Newell et al 2005), most are quite narrow, as was discussed in the previous chapter. Hence, my challenge was not a lack of existing material; but rather a question of how to combine various strands of research to make new advances in the study of nature-society relations and environmental research.

4.1 Methodological starting point and qualitative research

I have chosen a qualitative methodological approach to address the objectives and research questions of this thesis. This form of research is often "less structured than other kinds of

social research", as the investigator initiates a study with "a certain degree of openness to the research subject and what may be learned from it" (Ragin 1994 :85). The idea behind qualitative research is to 'purposefully' select participants or sites, as well as documents that will best help the research to understand the problem and research questions (Creswell 2003). This involves a well-considered contemplation regarding the setting (where the research will take place); actors (who will be observed); events (what the actors will be observed doing); process (the evolving of nature of events undertaken by the actors within the setting) (Creswell 2003). The method for collection of data that I found most appropriate to my research questions was observational participation, which included attending conferences and seminars as well as the analysis of documents.

Working at the intersection between nature and society, I position myself within the tradition of a political-economic analysis, more specifically political ecology, while at the same time using a deconstructive postmodernist epistemology. Post-structuralism's attention to discursive approaches that explore how meanings are temporarily stabilized or regulated into discourses has been source of inspiration for my methodology. The challenge has been to make these perspectives as equally important when analyzing empirical material, which may be achieved through the use of critical realism.

4.2 The Role of Participant Observation and Secondary Data

Exploring the links between climate change and economic globalization necessitates attention to different arenas. I have primarily used existing research literatures, newspaper articles and conferences and seminars for my inquiries. To investigate how current actors and interests perceive and discuss climate change-related issues, I attended several conferences and seminars, nine in total (See Appendix D). These periods of participatory observation gave me extremely valuable information about climate change, petroleum activities and shipping issues in the Arctic. In participatory observation, the researcher assumes a distinctive role in relation to the researched, and participates only by observing (Cloke et al 2004). As such, I was not on an equal footing with the professionals who held presentations. Although the literatures stress that participation may distort the 'natural' unfolding of events, my role during the conferences and seminars was strictly as an observer to the presentations. However, I used opportunities during breaks and at social events after the sessions to actively participate by talking to actors involved. My presence cannot, however, be considered to make any difference in terms of altering opinions or the course of events.

The process of collecting data through conferences, seminars, interviews and informal talks has been an interesting experience and a valuable learning process. Initially, my knowledge about the Arctic, climate change, the petroleum sector and transportation activities was limited. My interest started with a focus on climate change and the emerging shipping opportunities in the Arctic, and I was intent on keeping a narrow research focus, which is a general recommendation when writing a master's thesis. I set out to assess what the impacts of increasing shipping activities might be, paying especially attention to ship safety and introduction of invasive species through the release of ballast water. It was at this stage in my research that the interviews and informal talks with researchers and actors were carried out. Eventually, however, the scope of the thesis evolved and grew to include much more fundamental questions of climate change. By digging deeper into the literature, it became evident to me that climate change issues are treated very partially, and I wanted to examine this closer through a discourse approach. The interviews that I had already done had a different focus and could not contribute satisfying data to answer the emerging research questions. At one point, I considered undertaking new interviews that might better reflect the different discourses. However, it became evident that it would be difficult to know who to interview, and which narrative within a discourse to chose to represent the discourse as a whole. As such, it proved more purposeful to tease out different narratives and discourses from attending seminars and conferences. Since I had recorded these events, it was also possible to carry this out at a later stage.

At the beginning of my data collection process in May 2006, I attended a conference on Norwegian climate research and climate politics from an international perspective. At an early stage of my research, it gave me a chance to get to know the different research institutions which are working with these questions. In January 2007 I stayed in Tromsø for nine days and attended the Arctic Frontiers Conference 2007. With ambitions of becoming the "most important" conference regarding Arctic issues, the organizers managed to collect an influential crowd of scientists, politicians and actors of society who presented different perspectives, new research, limitations and opportunities for the High North. It consisted of a two-day long Policy Making Conference that addressed responsibilities for sustainable development in the Arctic, followed by a conference on natural science research in the Arctic, which I did not attend. I prioritized using my limited amount of time to interview and talk to relevant people. As such, my stay in Tromsø represented a good part of my field work.

In the breaks and in the evenings after the conference presentations, there were opportunities to socialize, establish connections and exchange information. Beyond the pure

technical aspects brought up during the conference, it was interesting to notice who gets invited as speakers, what kind of angle the conference held, which themes were brought up, and just as importantly, which themes were not raised. During the breaks I conducted two interviews that were arranged in advance, as well as several open dialogues with others. In the remaining days I interviewed five other informants, as well as informal talks with others. As my initial interviews took place during the Arctic Frontiers Conference – in a period where I was still insecure regarding the research questions – the interviews reflected that insecurity. Although I have not used the information from these interviews explicitly, the informants provided me with inspiration and tips of whom I ought to contact for further information. In the following year, the Arctic Frontier Conference 2008 was broadcast live on the Internet and presentations were made available to download. Since the Arctic sea ice was at a record low in autumn 2007, I viewed selected presentations first and foremost to see if it was possible to trace movements within the different discourses towards realizing how closely linked to other issues climate change was, and how the new findings were being approached.

Importantly, attending the seven conferences and seminars was pivotal in my understanding of discoursers, and they have also identified some of the topics that are important to science and politics. These events helped me to become familiar with the different debates; they gave me the opportunity to talk to the experts and professionals; and they provided me with important information regarding where to get additional data for my research. They also showed me which issues that are brought up and which are not, but also who participates, who shakes hands, and who chats with whom. It gave me a deeper access to the many interests and actors involved and exposed different opinions and views on global change processes.

Secondary data

A considerable part of my data has also come from secondary literature.[8] Such data may be 'non-official' data, which have been produced privately by individuals, social groups, voluntary organizations or firms, or they may have been produced by government agencies or public authorities, so-called 'official' data (Cloke et al 2004). The content from the extensive number of reports and assessments I have used, cannot just be taken for granted. As all data are socially constructed, it is important to be aware of the motivations and interests of those who produced them. Official data, like the management plan of the Barents Sea and the High

[8] Secondary data means information which has already been collected by someone else and which is available for anyone to inspect (Cloak et al 2004).

North Strategy, are viewed as having particular authority, and they are often taken as "reliable and accurate simply *because* they are official" [emphasis in original] (Cloke et al 2004: 42). Yet despite the large body of staff and researchers to the state's disposal, they are not neutral; on the contrary, and as I discuss more in depth in later chapters, they are important players with agendas actively participating in society. Non-official data range from the most specialized and expensive company report, to a little notice in a shop window. The research reports I have used comprise invaluable sources of information. However, as a social researcher one should always seek to reflect over the information provided by the sources that produce them and keep in mind that the products are "the end result of deliberate social construction, and all purport to tell the truth about social events" (Cloke et al 2004: 64). The climate reports of IPCC and ACIA have been widely used. Despite the widely discussed consensus among the scientific community regarding the conclusions from these reports, there are skeptics who question them.

Chapter 5 presents discourses on climate change-related issues, which in part was developed on the basis of how actors and interests framed global change issues in the media through newspaper articles. Newspaper articles tell us what is going on in the world; and without further reflection, they are taken into account as 'neutral' facts that are collected, analyzed and reported in an objective fashion, without bias, and in unambiguous and undistorted language. In order to make critical use of newspapers as sources of information it is necessary to deconstruct the text and to realize that language in the news is used to suggest ideas and beliefs as well as 'facts'; that is, to realize how the news is socially constructed. One should therefore seek to establish the purpose behind the production of the source rather than just accept the record as 'somehow given'. Factual sources are not impartial and autonomous accounts of particular events (Cloke et al. 2004: 71). As a consequence then, I have tried to treat my documents as "social products". That is, they must be examined, not simply used as a resource. When I did the content analysis search and read the newspaper articles (Appendix A), I saw that there were five parallel discourses in the Arctic, which were related to the three processes of change – climate change, petroleum activities and shipping. Thus, the initial content analysis, together with secondary literature, conferences and seminars, gave me the basis for developing the discourses.

The findings of the newspaper content analysis outlined in chapter 5 are in part based on a review of 180 articles (Appendix A) from the Norwegian newspapers Aftenposten (The Evening Mail), Dagens Næringsliv (Today's Business), Nordlys (Northern Light) published between January 2005 and November 2007. The number of articles that have been published

on these issues during this period have increasingly received more attention, due to a number of events and records; the new and stronger evidence of climate change provided by the IPCC; the sea ice extent was record low in the Arctic in 2007; increasing opportunities for petroleum production north of 62º N; concern regarding oil shipments in the Arctic; focus on energy security; and new geopolitical disputes regarding resource. These are topical events on the national and international agenda. My project was to look at how these issues are being talked about in the public arena, in newspapers, in conferences and seminars where different people come together, and to observe which perspectives got the most space.

Credibility involves assessing how distorted the contents of a document are likely to be. As Scott points out:

> All accounts of social events are of course 'distorted', as there is always an element of selective accentuation in the attempt to describe social reality. The question of credibility concerns the extent to which an observer is sincere in the choice of a point of view and in the attempt to record an accurate account from that chosen standpoint (1990, in Cloke et al 2004: 69).

I view the data obtained as credible to the extent I have been able to follow the ideals of research methodology. I find the research I have conducted, including the data I have collected, to appear satisfactorily accomplished in accordance with the ideals of qualitative research. Validity refers to the appropriateness of a measure, that is; does it measure what it is supposed to measure?. Validity is used to suggest determining whether the findings are accurate from the standpoint of the researcher, the participant, or the readers of an account (Ragin 1994).

Applying different sources of data makes a more convincing and accurate presentation of the subjects investigated (Creswell 2003). Multiple types of information sources and different kinds of data sources have been useful to me. I have been subscribing to the newsletters from CICERO (Center for International Climate and Environmental Research - Oslo) that presents and discusses issues of climate change mainly from Norwegian sources. I have also been watching a number of TV documentaries related to my area of interest.

Limitations to participant observation may include that the researcher does not have good observational skills (Creswell 2003). Though I felt present attending the different events, I also used an MP3 voice recorder for all the proceedings at the Arctic Frontier Conference, and also for the sessions at the FNI-seminar. I have listened through the majority of the presentations while taking notes. I did not, however, transcribe them word-for-word as it is very time-consuming. At both of these events, the participants were provided with

material by the organizers, which presented the speakers and summaries of the speeches were also made available. Two of my interviewees, also gave me reports which I could borrow.

Summary

This chapter has attempted to account for the conduction of my research, the processes I have been through in completing the thesis, and the choices made along the way. My data consists mainly of secondary literature and information which was collected at different seminars and conferences. This information has contributed to identifying five discourses on the Arctic, which are presented in the next chapter.

5. Making Sense of Arctic Politics: A Discourse Approach

'who defines geography for what purposes and in whos interests' Castree (2001: 4).

This chapter discusses how the narratives and discourses treat climate change issues very narrowly, drawing attention to only parts of a bigger picture, which may very well contribute to positive feedbacks in the Arctic that exacerbate climate change. Environmental issues have generated a vast diversity of antagonistic and mutually exclusive discourses (Harvey 1996), of which some examples will be presented below. Despite the growing awareness of climate change, it is still a field of great controversy and dispute because it is a very complex issue. It constitutes a multi-scale global change problem since there are numerous diverse actors, multiple factors and time scales (Simonsson et al. 2008). Further, climate change issues do not present themselves in well-defined boxes; rather they are interconnected and multidimensional. In order to make progress in environmental politics it is important to understand why environmental issues are subject to continuing disputes between people who perceive the world in sharply different ways.

The complexity of both the natural world and human social systems makes environmental problems by definition difficult to address. The more complex a situation is, the larger the number of plausible perspectives on it, and the more difficult it is to prove the argument wrong in simple terms (Dryzek 2005). Climate change issues encompass matters of how humans treat the planet and its life. It also entails how people relate to each other through the medium of the environment, which involves questions of poverty, social justice, education, race, the economy, international relations, and human rights (Dryzek & Schlosberg 2005). There should be no surprise, then, that disputes develop over global change issues – ranging from deep seated questions of morality and ethics to more technical questions regarding disagreements of consistency or validity of climate data, the details of the implementation of policy choices in particular localities, disagreements over climate change definitions, and questions of poverty, social justice, education, race, the economy, international relations, and human rights.

Below, an investigation on how current narratives and discourses portray climate change is done. Of the regions of the world, the Arctic has especially received disproportionate attention in relation to climate change. A large part of the national debate concerning the High North has evolved around the opportunities and challenges of Arctic Norway as a future energy province. The Government's High North Strategy is one of the top

priorities of the current Government's politics (Ministry of Foreign Affairs 2006). I focus on three issues that are relevant to the Arctic region: climate change and the environment; transportation and trade; and petroleum activities. First I explore whether the relationship between them is reflected in the newspaper articles and in the discourses. Second, I investigate how discourses may contribute to positive global change feedbacks when the relationship between the processes is not connected. The chapter attempts to shed light on important climate change related issues; both on issues that are brought up and debated, but just as importantly, the way the different views often portray these complex issues in a partial way. In trying to uncover the different and conflicting views and perspectives, one starting point is to look at where people are coming from, whom they represent and what they are trying to achieve. This chapter will explore how different actors and interests address various climate change related issues published in Norwegian newspapers. Building and expanding on the newspaper content analysis, the next subchapter is developing five discourses in an effort trying to capture important aspects of discourses regarding the Arctic.

5.1 Five Discourses on the Arctic

One way of making sense about climate change issues is through reference to discourses. This chapter provides critical scrutiny of five distinct and sometimes competing climate change discourses in the Arctic, and dissects some of their key components, concepts and responses, as they are being presented and played out. These five discourses dominate contemporary debates about climate change related issues in the Arctic, and influence how Arctic issues are framed and discussed. Although they are highly stylized, the discourses illustrate how piecemeal and incomplete these issues currently are treated and understood. They are organized in a way that highlights the differences between them, but they may overlap and are not mutually exclusive. Nor are they homogenous, and disagreement and strong debates may well exist within each of them. There is a danger that the discourses may appear too simplistic and unsophisticated, and not really give a good enough account of the nuances which exists among and between them. Nonetheless, the main goal with this chapter is to show that there are different ways to understand and address climate change, and not necessarily give a exhaustive review.

In reviewing the frontiers of political ecology, Peet and Watts argue that discursive approaches are central to this emerging discipline (Bryant 2001; Forsyth 2003). A discourse may broadly be defined as "a shared meaning of a phenomenon. This phenomenon may be

small or large, and the understanding of it may be shared by a small or large group of people on a local, national, international or global level. The actors adhering to the discourse participate in various degrees to its production, reproduction and transformation through written and oral statements" (Adger et al 2001: 683).

As discussed by Dryzek (2005) there are constant struggles between the proponents of the different discourses to get their view accepted by others, to define reality and to set the agenda. The discourses itself can embody power when they condition the perceptions and values of those subject to them. As such, discourses are bound up with political power, which is expressed when actors can get the discourse to which they subscribe accepted by others. A discourse may be labeled hegemonic if it dominates thinking and is translated into institutional arrangements. Where there is one dominant or hegemonic discourse there is little room for other voices. Where there is legitimacy to some discourses over others, the disempowered and voiceless will not be heard. Alternatively, if none of them totally dominates perceptions on a topic they may be labeled leading discourses (Svarstad 2002). Castree sums it up when saying:

> "[w]e have to live with the fact that different individuals and groups use different discourses to make sense of the same nature/s. These discourses do not reveal or hide the truths of nature but, rather, *create their own truths*. Whose discourse is accepted as being truthful is a question of social struggle and power politics" (2001: 12, emphasis in original).

There are several ways of developing and using discourses (Adger et al 2001, Forsyth 2003). The discourses presented here are based on theoretical work and empirical studies, interviews, seminars and conferences. In offering a view of the Arctic, the discourses will be guided by some analytical devices and distinctions providing a template to structure each discourse – which is introduced here. Discourses enable stories to be told. The name of the discourse gives the first clue to its content as it may be understood as an abbreviated storyline. The real storyline gives a proper understanding of the discourse meaning. *Storylines* are basically:

> "essential political devices that allow us to overcome fragmentation and come to discursive closure.... The point of the storyline approach is that by uttering a specific element one effectively reinvokes the storyline as a whole. It thus essentially acts as a metaphor ... they allow the possibility for problem closure ... a storyline provides the narrative that allows the scientist, environmentalist, politician, etc. to illustrate where his or her work fits into the jigsaw" (Hajer 1993, in Forsyth 2003: 99).

Storylines require a *cast of actors*, often portrayed as *heroes and villains*. It is also common in discourses to use metaphors and other rhetorical devices to strengthen the arguments (Svarstad 2002). The *research approaches* and *responses* each discourse provides will be discussed. Finally, there will be given *empirical examples* of each discourse, which will help emphasize and contextualize the storyline.

5.1.1 The Earth System Discourse

Oil is the blood of the dinosaurs

Storyline

The Earth System discourse connotes a story of how to understand the changes in biophysical processes of the earth system. The physical, chemical, and biological global-scale cycles (biogeochemical cycles) are viewed as the most important determinants of outcomes. Examples of this may be temperature rise, changes in carbon cycles and melting of sea ice, which are often based on future general circulation model scenarios. The concept 'Earth System' is understood by scientists as a single, interlinked, self-regulating system, which means that global-scale cycles, for example the hydrological and the carbon cycles, each operate as planetary systems, and that these planetary cycles themselves are closely interlinked. Life itself is an active and necessary player in planetary dynamics (Steffen et al 2004). The Earth System discourse has been spread through Al Gore's film and lectures, which emphasize the science of climate change.[9] Having its roots in the Enlightment period, the Earth System discourse is based on a positivist science, and makes a sharp separation between "the natural" and "the social" worlds, where the social world receives considerable less attention (Castree 2001).

The heroes according to the Earth System discourse include the biophysical research communities and technological innovations. The villains in the Earth System discourse are people in general, that is as aggregates – population growth is often cited as a driver, along with human activities. A deep political analysis is lacking in this discourse. The oil industry,

[9] Al Gore has been concerned with global warming for years (Gore 1992). Through his books, slideshows and movie he is communicating and translating scientific work to a broader audience. On the background of knowledge provided by scientists about changes in the Earth system, he is appealing to our morality for action. He is a great admirer of scientists, in which he holds great faith, and he is especially elevating the hard sciences, and urges politicians and the public to listen to the researchers and react accordingly. He also draws attention to individual responsibility as important solutions to the climate crises.

for example, is not a villain *per se*, because it is assumed to change once the science is properly understood. Some within this discourse are criticizing the way politicians and environmental NGO's are making oil exploration a political and moral problem.

> Fear of an environmental disaster in connection with oil and gas extraction in the High North is more ideological than scientifically based.[10] [My translation]

The authors, perhaps making a controversial statement among some of their biophysical colleagues, are making a sharp distinction between the natural sciences and other spheres. Representing a positivistic approach they are claiming to be able to mirror nature as it really is, and claim to be independent and not influenced by political, economic and social aspects. Further, they are implicitly saying that if we could put all our opinions and beliefs aside and just put the biophysical evidence to ground, we could all come to a common understanding based on sound science.

Research approaches and responses

To address climate change issues, the proponents of this discourse claim that more and better knowledge is needed to understand how humans are affecting the Earth System. If all can agree on the driving forces of biophysical changes, the argument goes, there will be a consensus on how to respond (Leichenko & O'Brien 2008). For example, much research has been directed on the changes that contribute to increased greenhouse gas emissions. By reducing these uncertainties, it is believed that international agreements will be achieved, through binding treaties and regulatory regimes. Technological innovations and fixes are central in solving climate change issues. Political initiatives and will is needed to make global co-ordinated consensus, turn the scientific knowledge into action, and seal binding international treaties.

The main criticism of the Earth System discourse is how they fundamentally are ignoring underlying socioeconomic processes that are transforming nature. They see environmental change as the most important process, but they do not necessarily take on other processes, for example globalization. Within the biophysical sciences, which may be represented by ACIA and IPCC, little attention is given social science in the region. The IPCC, for example, has a prioritization of the physical and the technological over the social, and therefore gives the physical sciences primacy (Huckle & Martin 2001). This also means

[10] Knut Bjørlykke, John Gray og Per Aagaard; professors in biology and geology, University of Oslo. Faren for oljekatastrofe i nord Aftenposten, 09.02.2006

that the social dimensions of climate change are only considered relevant in relation to the responses to the impacts of climate change on society. Since they are missing the connections between climate change and economic globalization, and political, social issues, economics, geopolitics and power politics are ignored, they are not able to include the positive feedbacks from the social world. The discourse is also being attacked for their dominate view that global environmental problems are in some way solvable through globally co-ordinated action, of being top-down, interventionist and technocentrist, as well of using blue print on any location (Adger et al 2001). Nonetheless, the Earth system discourse must be considered an important discourse. It has been successful in influencing international environmental policy and due to its importance, it receives considerable research funding, which is proportionally discriminating the social sciences (Leichenko & O'Brien 2008).

Technological Solutions to Climate Change

The International Energy Agency (IEA) states that the world's consumption of petroleum products is increasing dramatically and that the global demand for energy will be 50 % higher in 2030 than today if drastic cuts are not made to lower consumption growth (IEA 2006). According to the IPCC, humans must reduce global GHG emissions to the atmosphere by 50-80 % within 2050 to avoid dangerous outcomes of climate change. Based on Article 2 of the 1992 UN Framework Convention on Climate Change (UNFCCC), where nations committed themselves to stabilize the concentration of greenhouse gases to prevent a "dangerous anthropogenic interference" with the climate system to avoid the most dangerous consequences of climate change (UNFCCC 1992), a consensus has been reached by the European Union to keep global average temperature rise below 2ºC in comparison to preindustrial levels (European Council 1996; 2005). However, in IEA's reference scenario the CO2 emissions will increase with 57 % until 2030, which is equivalent to an increase in the global mean temperature of 6ºC. Mitigation actions for stabilizing atmospheric GHG are crucial (IEA 2006). Examples of such actions may be to switch to less carbon-intensive fuels, nuclear power, renewable energy sources, enhancement of biological sinks, and reduction of non-CO2 greenhouse gas emissions (IPCC 2005). Nonetheless, IEA has argued that enhanced energy efficiency and increased renewable energy production is limited (IEA 2006). As a response to policy maker's dilemma to mitigate greenhouse gas emissions, technological fixes are viewed as central to solve the climate crises by scientists adhering to the Earth System discourse. As optimism is decreasing among some biophysical scientists, they feel there is no way we are going to be able to reduce GHG emissions sufficiently, there is serious talk about

artificially altering key processes of the Earth System. Carbon capture and storage are viewed by many to have significant potential to reduce carbon dioxide emissions, and geoengineering - artificially altering the composition of the Earth System - is seriously being discussed by some as possible solutions to climate change.

Carbon Capture and Storage

CO2 capture and storage (CCS) is defined as the process of separation of CO2 from industrial and energy-related sources, transport to a storage location and long-term isolation from the atmosphere. It is considered by many as a technology with potential for large reductions in CO2-emissions (Anderson and Newell 2004, IPCC 2005, Bellona 2007). The carbon dioxide would primary be captured from large stationary emission sources like power plants or industrial facilities, which in 2000 came to approximately 60% of the CO2 emissions due to the use of fossil fuels, and then stored at geological formations (IPCC 2005). This is a technology which also may be used in oil and gas extraction in the Arctic.

There are, however, worrying aspects regarding CCS. Although much of the technical feasibility of these technologies has been explored, it is still a new technology and currently under development which means that it will take time before it can be applied commercially and in full scale. It is therefore believed not to be available until approximately 2020 (Teske et al. 2007). In terms of safety, there are currently too many uncertainties and informational needs regarding ocean and geological storage and there is not a good enough understanding of the implications this may have on ecosystems (Johnston & Santillo 2002). And as for many waste problems, like nuclear wastes, CCS is to displace the problem elsewhere, and to another time. Moreover, investments in this technology contribute to setting the course for the future by continuing the financing and promotion of the fossil fuel sector leading to new fossil fuel developments (Teske et al. 2007).

Geoengineering

As a response to increasingly growing greenhouse gas emissions (IEA 2006) and a recognition that society will not be able to meet the goals necessary to avoid dangerous climate change, some scientists are promoting geoengineering. Geoengineering has been described as everything from ‘a climate change Manhattan Project’ (Michaelson 1998) to the solution of mitigating climate change[11]. The term ‘geoengineering’ is relatively new, but as a

[11] http://www.climos.com/about.html

concept it can be traced back to projects following the decades of the Second World War and the rise of climate and weather modification - including changing local weather, rainmaking, cloud seeding and climatologically warfare - often initiated by scientists and the military (Keith 2000).[12] Today, geoengineering is often understood as "the intentional large-scale manipulation of the environment, particularly manipulation that is intended to reduce undesired anthropogenic climate change" (Keith 2000: 245). Some examples of geoengineering revolve around either blocking sunlight or reducing carbon dioxide. Blocking sunlight may be done by either making clouds more reflective or stationing mirrors in space. For example, professor Roger Angel is proposing to put a giant glass sunshade in space which is believed by the scientist to deflect a small percentage of the sun's rays back into space, whereas the Nobel Prize winner in chemistry professor Paul Crutzen suggests to fire hundreds of rockets loaded with tons of sulphur into the stratosphere creating a vast, but very thin sunscreen of sulphur around the earth. Other ideas are aimed directly at reducing the excess carbon dioxide, which is the main cause of climate change, for example through ocean fertilization, which refers to growing large amounts of plankton by adding iron into the ocean.[13] These radical solutions, or emergency response button as the promoters of the technology calls them, are highly controversial. Through studies of the effect that sulphur aerosols from volcanic eruptions have on reflecting incoming sunlight, other consequences also were visible. The particles could contribute to depletion of ozone particles, causing acid rain, reducing global precipitation, strangling the monsoon and also altering the balance of radiation reaching the Earth's surface with unknown consequences for plants.[14] Importantly, most scientists are reluctant advocates of these ideas[15], but as faith in the ability to reduce the use of fossil fuels are diminishing, Crutzen argues that "research on the feasibility and environmental consequences of climate engineering […], which might need to be deployed in the future, should not be tabooed" (Crutzen 2006: 214). The bottom line seems to be; if humans cannot resolve the climate crisis we need technology to save us. Nevertheless, because geoengineering is very controversial and rests upon the fact that nobody knows the full scales of consequences of artificially altering global scales components of the Earth System, it seems contradictory to try to solve one problem, the climate crises, through geoengineering processes which will create new problems that nobody knows where will lead. Further, a market of geoengineering is being developed and the technologies and techniques

[12] Climate Modification Schemes http://www.aip.org/history/climate/RainMake.htm#N_1_
[13] Five Ways To Save The World. http://news.bbc.co.uk/1/hi/programmes/6298507.stm
[14] The 'Geo-Engineering' Scenario http://www.newsweek.com/id/71691
[15] Five Ways To Save The World. http://news.bbc.co.uk/1/hi/programmes/6298507.stm

developed by institutions and private corporations, like Climos[16], will eventually also lead to questions of who is going to decide what to be done? Will private cooperation's and institutes decide whether to use this technology on behalf of the whole planet?

5.1.2 The Fragile Ecosystem Discourse

Oil is the excrements of the Devil

Storyline

The Fragile Ecosystem discourse tells a story about the need for conservation and preservation of nature. The term "fragile" signals that ecosystems need strict stewardship in order to stop the destruction of natural systems so maintenance of ecosystems, biological diversity and survival of species can be achieved. Much of the climate science research, like IPCC and ACIA, is shared with the Earth System discourse. It incorporates perspectives within green social movements and research, often termed ecocentric or biocentric approaches. They have risen as critiques of the dominant anthropocentric western views on nature, which has celebrated and elevated humanity at the expense of nonhuman nature, making it easier to exploit resources (Eckersley 2005), and they are being criticized through a profound critique of existing systems of production and consumption (Castree 2001). These ecocentric or nature-first approaches operate with a sharp distinction between the social and the natural, calling to 'be at one' (practically and spiritually) with a rapidly-vanishing 'first nature' before it is too late (Castree 2001). It regards nature as having an intrinsic value and it holds a biocentric view of the world where humans are seen as one of many species, and not necessarily the most important. In fact, the discourse calls for a reevaluation of how we think about and relate to nature, that is, through changing our consciousness in a greener direction, social, political and economic structures and systems are expected to fall in place (Dryzek & Schlosberg 2005).

The fundamental linkages between the processes of climate change, petroleum and shipping are by proponents of the Fragile Ecosystem discourse less recognized, as they are looking too narrowly at local issues. Focus is on how climate change is seen as a great threat to wildlife and ecosystems in the Arctic and the whole world. In the Arctic, attention is drawn to oil spills, pollution, release of ballast water, ship accidents, and preservation of fragile areas through no go-zones for petroleum exploitation, all of which may cause damage to

[16] http://www.climos.com/

ecosystems. Nevertheless, the discourse receives significant attention and is one of the more visible discourses in the Arctic.

Research approaches and responses

The ideology of many environmental NGOs is based upon conservation of nature first and the use of the precautionary principle. Through developing scientific knowledge on ecosystem health the proponents can reach their goal of protection through local to global coordinated agreements. In addition to climate science research, ideas and strategies are based upon green philosophy – our consciousness and the way we think about nature and our relationship with it. Many of the subscribers to the discourse, like environmental NGOs, are also activists trying to draw public and political attention to their causes, through demonstrations and civil disobedience.

The conservation strategy as a form of stewardship is commonly used by environmental NGOs. Their concern is first and foremost conservation of ecosystems and biological wildlife which are seen as threatened by human activities. The Barent's Sea is one of the cleanest oceans in the world with its ecosystem more or less intact. It provides rich fisheries, possibilities for bioprospecting, and long-term utilization of renewable resources. The proponents of this discourse oppose petroleum activities; especially in the most vulnerable areas and close to shore, arguing that the consequences are too large and the long-term effects of large oil spills are too great.

> Should we not agree to "freeze" all extraction of new oil and gas deposits which may exist in areas outside national jurisdiction, that is, outside continental shelves and national economic zones? And make them global reservations?[17] [My translation]

From the Fragile Ecosystem discourse, Norway should not go into partnership with Russia, but rather lead by example by saying no to further expansion and strive to become a role model for the rest of the world. According to these narratives shipping and transportation at sea should be under the strictest regulations possible, with sea-lanes far from shore.

The heroes according to the Fragile Ecosystem discourse are forces and agents working to change our consciousness and our politics regarding nature. Examples are environmental NGOs, deep ecologists or green parties (Dryzek 2005). The villains are represented by those who see nature as merely a 'resource' to be used and destroyed. The

[17] Hans Blix. Tid for reservater? Aftenposten, 06.10.2007

liberalized global economy and free market forces and part of the world's consumption and production systems lead to destruction of nature for human benefit.

The proponents of the Fragile Ecosystem discourse, in particular the environmental NGOs, have been criticized for ignoring Arctic residents and instead focusing too much on the local environmental problems, such as oil spills, ship accidents, local pollution. Less attention is given to social, political and economic aspects. For example, the Arctic is home to about four million people, but the level of attention the environmental NGOs give them are scarce, almost to the extent to being ignored. Neil Hamilton, Director of the WWF Arctic Programme, argues that climate change issues are so important that indigenous people's interests must give way.[18] As such, critics have accused ecocentric theorists of being misanthropic or even fascist, and deep ecology, for example, has been criticized for attacking indigenous people's practices. More sympathetic critics have criticized the idea of intrinsic value as an objective property of nonhuman life forms (Dryzek & Schlosberg 2005).

Protecting the Arctic – No oil exploitation in the Barents Sea and the preservation of biological diversity

The fight for no-go zones in the Barents Sea

Since the 1990s Norway has experienced the classic conflict between protection and environmental interests on the one hand and exploitation of resources on the other. The possibility of petroleum production north of 62º N first became an issue in the beginning of the 1970s. In 1980 the first licenses for oil and gas exploration in the Norwegian Barents Sea were awarded, leading to the discovery of Snow White in 1984. However, it was not until the 1990s that the debate between those pro extraction versus those pro protection became particularly intense as petroleum extraction in the Barents Sea became a reality (Jensen 2007). A number of environmental NGOs have been heavily involved in the pro protection of the Arctic side of the debate. World Wide Fund for Nature (WWF) for example, has launched a number of proposals of how to manage and protect the northern areas. Hansson, Director of the Norwegian WWF, has proposed a holistic, ecosystem based management plan for Barents Sea based on sustainable development, including the proposal of establishing no-go zones for oil and gas activity in the Barents Sea. The management plan is based upon conservation first and the precautionary principle, in order to maintain the resources to the post-petroleum era

[18] Neil Hamilton, Director WWF International Arctic Program, stated that "the Arctic is more important than the people in the Arctic – it has become a global issue now". Arctic Frontiers Conference 2008.

and in such a way that the impacts do not exceed the total ecosystem tolerance limits. The maintenance and restoring of biology and ecosystems should, according to this proposal, always be the first priority and not short term economic interests (Hansson 2007). This suggests that local communities' plans or indigenous peoples long traditions must ultimately give way to principles of conservation and precautionary if they come in conflict.

On 31 March 2006, the Norwegian Government launched a white paper – Integrated Management of the Marine Environment of the Barents Sea and the Sea Areas off the Lofoten Islands – which draws up policies and prospects of non renewable resources (Ministry of Environment 2006). Environmental NGOs have argued strongly for no-go zones in Lofoten, Vesterålen, Tromsøflaket, Nordkapp and Bjørnøya/polarfronten as well as the areas which are ice-covered the whole or parts the year. The goal is to safeguard important habitat areas for birds and spawning ground for fish stocks, which in case of oil accidents could suffer greatly.19 Despite efforts by WWF and other actors sharing the similar views the implementation of permanent no-go zones in this plan has not fully succeeded. However, the current administration has made some of the most sensitive areas, proposed by WWF and others, unavailable to the oil-companies, at least for the time being. Economic, geopolitical, national and security issues are outweighing environmental and climate concerns. The income from petroleum is financing the welfare state, state retirement pension (AFP) and other important purposes. In a regional perspective, the politicians in Northern Norway mostly see development of petroleum activities in the Barents Sea area as beneficial. It is also important to remember that local and native people, as in the cases of Northern Norway and in Canada, welcome industries that create jobs. In Norway surveys have shown that the majority of the northern population is in favour of developing oil and gas industries in the Barents Sea. The example of the Inuit of Canada, which is discussed in the Resilient Ecosystem discourse, also suggested that the indigenous people supported the Mackenzie Valley pipeline project.

In terms of Norwegian geopolitics, a continued exploration is seen as important, because it is believed that a high Norwegian activity and presence in the region gives weight in difficult border issues. For example, the marine delimitation of the economic zone and the continental shelf between Norway and Russia has not been settled. National and international energy security is also central. The EU has made it clear that it regards the Arctic as an interesting region in terms of future energy supply.

[19] The Norwegian environmental NGOs, Naturvernforbundet, Natur og Ungdom, WWF and Bellona are supporting no go zones for parts of the Norwegian and Barents seas.

Biodiversity and polar bears

One branch of the Fragile Ecosystem discourse is deep ecology, founded by Arne Naess. He explains that "[i]n the deep ecology movement we are biocentric or ecocentric. For us it is the ecosphere, the whole planet, Gaia, that is the basic unit, and every living being has an intrinsic value" (Naess 2005:18). Deep ecologists reject dualism, and believe that humans are profoundly part of nature, as one of many species. This connectedness with nature means harming nature is harming yourself. As a result they believe in biocentric egalitarianism, the view that all parts of nature have an intrinsic and equal value, and an equal right to existence – a human being is not more valuable than any other species (Huckle and Martin 2001). Biodiversity in this respect does not favor or value the Arctic cod over the plankton, nor does it regard the remote Arctic ecosystems as less important than more familiar and closer ecosystems. The Arctic, with its relatively simple marine food webs with short food chains, will most likely experience reductions and even extinctions in biodiversity of some species as the future climate will change faster than the species can adapt. At the same time, this will give opportunities for other species from the south migrating to the north and change the biodiversity of the Arctic. Biodiversity is defined in the Biodiversity Convention drafted in Rio in 1992:

> "'Biological diversity' means 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 species, between species and of ecosystems" (CBD 1992).[20]

The polar bear is often used as the symbol of climate change in the Arctic. To illustrate, the WWF has been appealing to its members through letters which on the front read: "The ice is melting fast – the polar bear needs your help now!" [my translation] where they asked for a donation in order to help stop the climate crises and thus save the polar bear.

[20] CBD 1992. Convention on Biological Diversity. http://www.biodiv.org/convention/articles.asp.

The polar bears are currently numerous in the Arctic, approximately 22.000 (Amstrup et al 2007), and in the Barents Sea the Polar Bear Specialist Group determined in 2001 that the number of bears in the region is about 2000-5000 bears (IUCN 2001). The polar bear is facing many problems. Environmental pollutants drifting with wind and ocean currents have been established as having a negative effect on polar bears, leading to cancer, embryonic malformation, sterility, growth retardation, immunologic dysfunction, and reproductive abnormalities. The polar bear's almost exclusive diet of fatty ringed seals makes it one of the most highly contaminated of all Arctic mammals (AMAP 2002; Amstrup et al 2007). Persistent organic pollutants (POPs), such as polychlorinated biphenyls (PCBs) and chlorinated pesticides, that bioaccumulate in their fatty tissue and degrade very slowly. Ultimately, climate change may become the most serious threat which polar bears most face.

Polar bear holding on. Foto by Arne Nevra.

A recent study (Amstrup et al 2007) portrayed a rather gloomy outlook for polar bears. Two scenarios were sketched out. One possible outcome the bears might face is a chronic food gap as the ice free summer season expands due to earlier spring ice break-up and later fall freeze-up. The bears spend the majority of their time on sea ice foraging for prey, and their main feeding period is in the spring and early summer. This is a critical period for maintaining body condition and ensuring reproduction. Less sea-ice means less time to hunt seals, forcing them earlier on land with the result of food shortages and loss of weight through summer and autumn and this could weaken them. In terms of reproduction female bears may have to struggle even more to find food to her cubs. Another possible track is a swift collapse due to higher temperatures and transformations, leading to a rapid reduction in sea-ice. The reduction in summer sea ice in 2007 illustrates the severity, and if GHG emissions increase in the future two-thirds of the 22,000 bears will disappear by mid-century (Amstrup et al 2007). The proponents of the discourse argue that we have a moral obligation to save all species. Anthropogenic greenhouse gas emissions are to be blamed and strong mitigating actions are needed to save these animals.

5.1.3 The Resilient Ecosystem Discourse

Oil is the blood of the Earth

Storyline

Proponents of the Resilient Ecosystem discourse see nature and humanity as a dynamic and integrated system constantly interacting with each other. Entering an era dominated by humans, people are now a major force in the dynamics of ecological systems, and the proponents of the discourse calls for more holistic analyses of what is termed socio-ecological systems (SES) through building resilience locally, social-ecological learning, adaptation and combining different types of knowledge. Resilience, a concept originated within the field of ecology, may be defined as "the capacity of a system to absorb disturbance and re-organize while undergoing so as to still retain essentially the same function, structure, identity and feedbacks" (Folke et al. 2006: 259). The subscribers of the resilient ecosystem discourse criticize traditional perspectives, like the Fragile Ecosystem discourse, which attempt to control changes in systems that are assumed to be stable, that is, they question the notion of steady state equilibria (Holling 1973; Holling and Gunderson 2001; Forsyth 2003, Folke 2006). It is argued that ecosystems often do not respond to gradual change in a smooth way. On the contrary, human induced loss of resilience can lead to sudden switches to alternative states (Folke 2006). In order to absorb shocks associated with climate change, the resilient ecosystem discourse emphasizes adaptive capacity, which enhances the capability of a social-ecological system to cope with surprises and unexpected situations without losing options for the future. Adaptive capacity is the key to enhancing resilience. The discourse incorporates awareness of thresholds, tipping points and regime shifts which might occur on different scales and in different and interacting ecological, social and economic domains within social-ecological systems (Folke 2006).

The heroes, according to this discourse, are those who learn to manage change and work to enhance the capacity to build resilience through innovative cooperation between various actors and interests. Emphasis is put on the role that key individuals or groups play in promoting resilient and robust socio-ecological systems. Representatives may be local resource managers, entrepreneurs, multinational companies, or governmental institutions. The villains are those operating with a single equilibrium view, or 'the balance of nature view', which has traditionally dominated natural resource and environmental management. Representatives may be biophysical scientists and environmental NGOs operating with

command-and control strategies which perhaps is successful in solving resource problems in short term and for one variable, but which fails to operate successfully at other temporal and spatial scales (Folke 2006).

Research approaches and responses

The main focus of the proponents of the Resilient Ecosystem discourse is on how society anticipates and plans for the future (Leichenko & O'Brien 2008) and through developing new strategies for managing change, people and ecosystems are expected to become more resilient to shocks and stressors. They thus have a greater chance of coping with, adapting to, and shaping processes of change. Adaptive capacity is closely related to social learning and adaptive management, which are viewed as important responses to climate change issues. The latter emphasizes different management policies, collaboration between private markets, academia, organizations and governments. Cross-scale institutional responses to change are highlighted (Folke 2006). Parallels have also been drawn between indigenous knowledge and adaptive management (Folke et al 2002).

Resilient social-ecological responses to Arctic changes – Indigenous peoples and plant migration

The Inuits of Canada – Learning to live with change and uncertainty

Education and learning about new ecological, social, and economic environments will be essential for Arctic indigenous peoples to successfully adapt. Adaptation in this respective could through innovations and technological solutions be to invest in arctic infrastructure and education to increase the capacity of arctic peoples to diversify their economy and explore other options that enhance resilience (Chapin et al. 2006), as will be demonstrated below.

Robust, adaptive strategies of social-ecological systems accept uncertainty and change. Managing for resilience involves taking advantage of change and turn it into opportunities for development. Policies fostering economic diversification in the Arctic should encourage to entrepreneurship and diversify their economic activities which would help enhance resilience. Financial support for economic activities that are new in the Arctic is justified because of the knowledge gained, which typically is most important in early phases of new economic activities (Chapin et al. 2006). The example of the Inuvialuit, Inuits of Canada's Western Arctic, provides a good illustration of how small communities can be active and take charge in shaping their own future, in trying to cope with the transformations associated with climate

change and globalization that are expected in the future (Ford et al 2006). Examples of changes that can manifest themselves as shocks or blows to societies and ecosystems in the Arctic are sea line erosion, increasing and larger waves, oil spills and accidents, and oil and gas development.

The Northern parts of Canada experienced oil interest and activity already in the 1960s and 1970s, but it also ended abruptly back then. A current project involves a natural gas pipeline from the Beaufort Sea to markets in southern Canada and the United States, with three major fields in the Mackenzie delta. The project is not large by international standards, but in this relatively underdeveloped region it will have a major and immediate physical presence (Gartner Lee 2003). The cooperation between the Government of Canada and the Inuvialuit started in 1984 as the Inuvialuit Corporate Group signed the Inuvialuit Final Agreement (IFA). The basic three goals are to preserve Inuvialuit cultural identity and values within a changing northern society, to be equal and meaningful participants in the northern and national economy and society, and protect and preserve Arctic wildlife, environment and biological productivity. The IFA provided financial compensation and ownership of land with subsurface rights to oil, gas and minerals.

Nellie Cournoyea, chair/CEO of the Inuvialuit Regional Corporation, emphasized that, in a world facing climate change, indigenous people do not have to stand disempowered in its relation with governments, oil companies and NGOs (Cournoyea 2007). In recognizing that in a competitive global economy opportunities like the Mackenzie Valley pipeline project do not come around often, and since they understand that the final decision is not theirs to make, the Inuvialuit challenge is to develop the best strategy possible so they can manage the effects of the major changes that it will bring to their communities and ways of life. Today, as the major Mackenzie Valley pipeline project is evolving, they do not want to experience another pullout of business once again, as they did in the 70-80s, in fear of social and economic implications.
In realizing that change cannot be avoided, they must anticipate and plan for change, cooperate with the oil industry and Canadian governments, to place themselves in a position where they can participate and influence the decisions and development of their own future. A core concept was the capacity of humans and other resources of society that can be mobilized to enable individuals and communities to seize opportunities and to manage the forces that impact daily lives (Cournoyea 2007).

Biodiversity – plant adaptation and colonization of Svalbard

The increasing documented changes in Arctic and the vulnerability of ecosystems to the atmospheric buildup of greenhouse gases is creating quite a concern about the fate of many species. A recent study on plant migration shows how plants manage to adapt to a changing climate (Alsos et al. 2007). In the remote archipelago of Svalbard plants have repeatedly been re-colonizing the island since the last ice age some 20,000 years age. The finding suggests, at least in the Arctic, that some plants may be able to shift long distances to adapt to the changing climate. The study downplayed the optimism if the projections for rapid Arctic warming from the IPCC came to be true, and cautioned that the evidence for resilience and long-distance mobility in Arctic plants could be the exception, not the rule. More generally, it is argued by proponents of the Resilient Ecosystem discourse that many widespread plant species in the Arctic have survived previous climatic changes, due to their the long-lived clonal nature, so if the current dominant species remain abundant and manage to determine many of the properties and services provided by ecosystems, Arctic ecosystems might be relatively resilient to climatic change. Self-compatible breeding systems and high frequency of wind pollination also provide a flexible genetic framework for rapid evolutionary adaptation to change. On the other hand, slow growth and low fecundity of arctic plants will constrain their ability to compete with aggressive southern species (Chapin et al. 2006).

In contrast to the single equilibrium view, the Resilient Ecosystem discourse emphasizes non-linear dynamics and how periods of gradual change interplay with periods of rapid change. In this respect then, the advocates of the discourse do not view migration of species as a problem but as something natural and inevitable which human should not try to reverse. The important thing is to be prepared for the changes and learn to manage them (Folke 2006).

5.1.4 The Economic Opportunity Discourse

Oil is the bloodstream of the world economy

Storyline

The notion of economic growth has very much been the key mantra in modern industrial societies, and almost every government today sees its first task as promoting economic growth (Dryzek 2005). The Economic Opportunity discourse incorporates many directions and schools, ranging from ecological modernization to market liberalism to sustainable

development through corporate social responsibility. What unites them is a belief that environmental values and economic values are essentially compatible (Dryzek & Schlosberg 2005), and that economic growth can offer a way to solve environmental problems, or at least go hand-in-hand with them. The advocates of the Economic Opportunity discourse, when seen through the narratives of sustainable development and ecological modernization, believe that money can be made through a restructuring of the capitalist political economy along a more environmentally friendly and greener development path (Dryzek 2005). The proponents argue that a helping hand from the government and concerted collective actions are needed to successfully integrate economic and environmental values (Dryzek & Schlosberg 2005). Market liberal or neoliberal narratives, on the other hand, argue that environmental problems should be solved through the deployment of free markets, deregulation, and less state intervention, rather than regulatory or government-centered approaches (Dryzek & Schlosberg 2005, Leichenko & O'Brien 2008). Nevertheless, all the narratives within the Economic Opportunity discourse claims that it is no contradiction between economic and environmental values as growth, innovation and new and better technology continuously make operations safer and at the same time provides for ecological protection and sustainable ecosystems. Competition between human beings and companies in markets are seen as natural, and the natural world is seen as subordinate to human interests (Dryzek 2005).

Within this discourse, globalization is in general seen to have a positive effect to all societies as it will lead to economic growth, increasing production efficiency and transfer of technology (Leichenko & O'Brien 2008). It is also considered to have a positive effect on environmental quality and contribute to a more efficient use of resources. Open trade is particularly highlighted which will lead to an increase in total global production and the opportunity for economic growth in the periphery (Dryzek & Schlosberg 2005).

The global economy, free trade and market liberal governments represent the heroes. They emphasize initiatives of individuals, companies and businesses generating economic surplus, values and employment. The villains on the other hand are seen as those who restrict global trade and market liberalism, and those actors and interests that constrain economic growth through unnecessary regulations, exemplified by anti-globalization movements and social democratic governments with strong welfare programs.

In reviewing reports, like ACIA (2005), IPCC (2007) and the INSROP-study (1999), it is important to keep in mind the pervasive interests of the carbon economy within the global economic system. The subscribers of the Economic Opportunity discourse are unable, or even unwilling, to see the long term feedbacks and implications which economic globalization will

evoke both in- and outside the Arctic. The stress environment often is subjected to from economic activities are usually not shown in the economical aggregates, as the 'economy' and the 'environment' are put in separate boxes (Dryzek 2005: 52). Through the motivation of profit maximation, businesses are usually looking at project by project, and the subscribers of the Economic Opportunity discourse do not see the links between climate change and economic globalization and the effects this may have to the region in the long run. The discourse is very visible and the adherents, which in part are governments and multi billion industries, set the agenda for the development in the Arctic.

Responses and research approaches

The proponents of this discourse have strong confidence in humans and their ability to develop technology to overcome environmental problems (Dryzek 2005). Environmental quality is achieved through improvements in technology. Environmental problems should be solved through the free market. Voluntary, private-property-oriented responses are preferred corresponding to neoliberal ideology (Leichenko & O'Brien 2008). In addition, sustainable development and ecological modernization include political involvement from governments. Examples of free-market approaches, which apply to all the narratives within this discourse, include programs for tradable carbon emissions permits (Leichenko & O'Brien 2008).

Not unexpectedly, the majority of the newspaper articles investigated are related to economic activities, especially in relation to the petroleum sector. Issues of geopolitics, foreign policy, national security, energy security are central to this perspective, which all basically are issues of the economy. The core of the arguments represented within these narratives is that Norway, in a close relationship with other states, especially Russia, will benefit if Norway chooses to develop and exploit the petroleum resources in the Barents Sea.

Environmental problems are acknowledged, but they are considered manageable through new and better technology, strict environmental standards and regulation.

> Approximately 40 years of petroleum activities in the North Sea has shown that it is fully possible to engage in oil and gas exploration in a way that do not harm fishery resources. I mean that the same is fully possible in the North. With today's technology it is possible to engage in petroleum exploration off shore far more environmentally friendly and gentler than was the case when the pioneers started in the North Sea.[21] [My translation]

[21] Marianne Lie; CEO Norwegian Shipowners Association. På rett kurs med ny seilingsled. Aftenposten, 22.02.2006.

Drawing on the experience from the North Sea it is argued that we have the experience and technology needed to reduce the operational risks to such an extent that it can be done in a safe manner. However, these claims lack credibility as long as there has not been done an independent study of the long term consequences of petroleum activity in the North Sea. Ironically, the oil industry was alleging the same thing in Alaska. It took a commission from the National Academy of Sciences to conduct an environmental impact assessment to document the kinds of impacts that was affecting the terrain, plants, animals and peoples of the North Slope after two decades of activity.[22]

Technology is also an important argument when discussing Norway's relationship with Russia. As we have seen, the Russian shelf contains far more hydrocarbons than the Norwegian shelf. The economic opportunity proponents claim that Norwegian technology, regulations and standards are superior the Russians. Prime Minister Jens Stoltenberg, after StatoilHydro secured the Shtokman deal, was confronted with Russian environmental standards. As owners of the oil company, he was asked if the Government will demand special requirements from StatoilHydro in this project, to which he answered:

> One of the strengths of Norwegian companies participating is that it secures a high environmental standard [...] I am sure that they contribute to higher environmental standards. Norwegian companies bring with them such a competence. They are for example very good in avoiding accidents.[23] [My translation]

If Norway is able to collaborate on Russian projects, it can provide the best technology possible and thus contribute to a safer and more environmentally friendly exploration. This has been constructed as an issue where it is assumed that the Russians already have started a massive exploitation of the Barents Sea. The fact, however, is that the Russian operations in that area are only at the planning stage (Jensen 2007). But with a constructed impression that there are already massive operations in the Barents Sea, this narrative bases its argumentation on the fact that it is crucial that Norwegian companies participate on the Russian shelf and the sooner the better. Thus, Norway is in fact the one who is pushing to open up for more activities in the Barents Sea. Through this image, together with a construction of Russia as careless about environmental regulations and lagging behind in technology, the petroleum industry and their adherents have created a powerful narrative for pro exploration in the High North (Jensen 2007).

[22] http://www.nap.edu/catalog.php?record_id=10639
[23] Jens Stoltenberg; Prime Minister. Or journalist Anne Lindeberg. Ingen byttehandel med Russland. Dagens Næringsliv, 25.10.2007.

A few days after StatoilHydro signed the agreement with Gazprom, which secured a 24 % share in the Shtokman Development Company (the company which will develop the Shtokman field), the chief editor of Nordlys, still in ecstasy, but with a deep sigh to the critics of the project, wrote:

> In the long run the focus for developing the next generation of the oil and gas industry in Norway was moved to the Barents Sea with the two signatures in Moscow on Thursday. For North Norway it is even greater than when Norway became an oil nation a little over a generation ago. The Shtokman agreement signals a change of pace in Norwegian High North politics. [...] I am a little surprised that so many have made use of their time since Thursday to warn. Warn against believing in the Norwegian supply industry, against that a development harms the environment and against that North Norway at all will benefit anything from Shtokman.[24] [My translation]

The position of the regional newspaper Nordlys reflects a tremendous rapture/enthusiasm towards the positive development they believe will benefit the region, as well as downplaying the potential for unhealthy environmental outcomes. Further, a frequently asked question is why North Norway should not benefit from the oil reserves off their coast, just as western Norway has done the last decades.

> It is also a problem that we might end up with an oil and gas policy out of time with the will of the people in Nordland, Troms and Finnmark. A sovereign majority in the North is saying yes to oil and gas.[25] [My translation]

Experiencing depopulation, higher unemployment and lower economic growth than other parts of the country, they argue that a petroleum initiative in the Barents Sea could improve the situation for Northern communities.

Norway's position as an energy exporting country situated in a stable region of the world is also highlighted. We can provide secure deliveries of oil and gas to the EU and the US, reduce the world's dependence on oil from the Middle East, and at the same time replace the more damaging coal, it is argued.

> [...] it is not less oil exploitation in the Barents Sea which can or should solve the climate problems. The task of the Barents Sea is to reduce world dependence of oil from the Middle East in the future.[26] [My translation]

[24] Hans Kristian Amundsen; Chief editor Nordlys. En historisk uke i nord. Nordlys 27.10 2007.
[25] Hans Kristian Amundsen; Chief editor Nordlys or journalist. Tautrekking om olje på topplan. Dagens Næringsliv, 27.03.2006.
[26] Ola Storeng ; Journalist. Barentshavet mot Midtøsten. Aftenposten, 07.11.2005.

This would give a net reduction in greenhouse gas emissions, it is argued, and thus help curb the process of climate change. The EU, for example, is looking to the North for securing their demand for energy. The European Commission wants to help and support Norway in developing the gas resources in the Barents Sea, which can be read in EU's proposition to a new energy politics.

> The EU is in desperate search for securing its supplies of energy. In 20 years the EU must import 70 % of the energy its member states consume, and much of this will come from unstable suppliers from for example the Middle East.[27] [My translation]

Nevertheless, there are numerous voices arguing that a reduction in CO2-emissions demands completely new initiatives towards a more environmentally friendly energy policy that replaces fossil fuels with renewable energy sources (Huckle & Martin 2001).

Turning to shipping and transportation, the Norwegian maritime industry is large, with long traditions and strong interests. The co-operation with the oil industry is important to the shipping industry, and the High North is emphasized as an area where they want to assist the oil and gas industry.

> Increasing activities in the High North will also lead to increasing transportation at sea. It will contribute to an increase in employment and value creation in many of the districts along the coast. The Norwegian shipping industry will thus seize the opportunities, which will be present if the Government chooses to commit to a goal-oriented and positive development.[28] [My translation]
> In this picture Norwegian shipping can provide the world's most environmentally friendly fleet within all the areas that are relevant in the Barents Sea. Norwegian shipping will play one of the leading roles in the extraction of gas and oil [...][29] [My translation]

With Snow White in operation, and Goliat and Shtokman in progress, new ships are required for transportation of the products. Leif Høegh & Co, for example, has one of their two target areas on transportation of liquefied natural gas, LNG. The two new ships are scheduled to be the first ships operating in Norwegian waters in the High North, delivering LNG from Snow White (Aftenposten 5/12 2005). There is much focus on safety and security in order to avoid disasters like Exxon Valdez or the more recent Fedje accident off the coast of Norway. Therefore, large parts of the debates focus on local oil spills and pollution.

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[27] Alf Ole Ask; journalist Aftenposten. Desperat energijakt. Aftenposten, 08.03.2006.
[28] Marianne Lie; CEO Norwegian Shipowners Association. På rett kurs med ny seilingsled. Aftenposten, 22.02.2006.
[29] Marianne Lie; CEO Norwegian Shipowners Association. Team Norway klar for aktivitet i Barentshavet. Dagens Næringsliv, 11.04.2006.

> It will always be a risk attached to activities at sea. Norwegian Shipowners Association wishes of course to contribute to reduce this risk to a minimum. Renewal of the fleet, development of technology and strict environmental standards are some of the important actions the shipping industry wants to contribute with.[30] [My translation]
> Analyses state that the risk for acute pollution from the petroleum activities and the sea transportation are small in the Barents Sea and in the seas off Lofoten. When the petroleum activities increase and with that also the sea transportation, it will demand clever risk management in order to maintain the dangers of acute pollution low.[31] [My translation]

As the number of oil and gas tankers is predicted to increase, the responses to avoid accidents include binding international regulations, better emergency systems and traffic surveillance.

> Norwegian Shipowners Association thinks separation of traffic and better surveillance of the sea transportation is a far more accurate instrument than applying for status as a "Particularly Sensitive Sea Areas" for the Barents Sea.[32] [My translation]

> [The] shipping industry is an international business. It is only through international regulations that we can secure that the traffic in Norwegian waters takes place in an environmentally secure way. Through UN's International Maritime Organization, IMO, the Norwegian Government and Norwegian shipping industry are both the driving forces behind stricter international environmental requirements and standards. We will continue with this. The Norwegian Shipowners Association thus supports the Governments decision to apply the IMO to place the sailing lanes from Vardø to Røst outside the territorial waters.[33] [My translation]

Although these measurements are important regarding reducing local accidents, the narratives within this perspective fail to consider the contributions of shipping to the long-term effects of greenhouse gas emissions. Short-term economic opportunities in combination with strong technological optimism dominate these narratives.

According to the narratives within Economic Opportunity discourse, all the involved parties – the Norwegian petroleum and shipping industry, North Norway, the Russians and even the environment – will benefit. It is basically argued to be a win-win situation for all parties. However, the links between transportation, petroleum and climate change are not discussed or seen.

[30] Marianne Lie; CEO Norwegian Shipowners Association. På rett kurs med ny seilingsled. Aftenposten, 22.02.2006.
[31] Helga Pedersen; Minister of Fisheries. Sjøsikkerhet og oljevern i nord. Nordlys, 22.04 2006.
[32] Marianne Lie; CEO Norwegian Shipowners Association. På rett kurs med ny seilingsled. Aftenposten, 22.02.2006.
[33] Marianne Lie; CEO Norwegian Shipowners Association. På rett kurs med ny seilingsled. Aftenposten, 22.02.2006.

Shipping and Marine Activities in the Arctic – The Northern Sea Route seen through the eyes of research institutions and intergovernmental forums

Increasing temperatures will make the ice covered Arctic much more accessible, both to petroleum exploration and shipping. Less ice means longer navigation seasons and increasing transportation, as well as easier access to petroleum resources. The shipping and petroleum industries are mutually dependant of each other, and have a tight collaboration where both parties benefit. The proponents of the Economic Opportunity discourse emphasize and encourage this relationship. The Northern Sea Route provides an illustration of this discourse. Arctic shipping has increasingly received attention from different areas and a review of different assessments reveals a positive and wanted development of shipping and marine activities in the Arctic. It is considered to create many positive opportunities which will benefit the region, as well as the rest of the world.

The International Northern Sea Route Programme (INSROP 1993-1999) was a project whose purpose was to evaluate if the NSR could develop into a commercial viable trading route. In assessing the possibilities for a commercial trans-Arctic shipping route, the INSROP programme looked at almost every imaginable aspect of the NSR, except that they did not take climate change into consideration, which was a major weakness.

The Arctic Council is a high-level intergovernmental forum, which addresses issues faced by the Arctic governments and the indigenous people of the Arctic. Looking at PAME, one of the Arctic Council's five programmes, they write that: "It is *hoped* that this route [The North West Passage] will be opened for general shipping in the future as a result of the increasing effects of global warming. However, those effects are more apparent in the East Arctic Ocean [The Northern Sea Route] where the ice-sheet is shrinking more quickly" (PAME 2006: 13, my emphasis).

The Arctic Climate Impact Assessment (ACIA), written on behalf of the Arctic Council describes climate change and its consequences for the region. The ACIA report recognizes that shipping in the Arctic will increase as the result of climate change and economic changes and the NSR is considered a possible sea route in the future. The assessment points to future "opportunities for the export of natural resources and other waterborne commerce over new northern shipping routes" (ACIA 2004: 923). New transportation routes are viewed in connection with natural resources, especially oil and gas, and the report points to that the availability increases, but also to the fact that new challenges will arise such as coastal storms and drift ice. Regarding the effects of climate change on the sea transport they write: "Development of the offshore continental shelves and greater use of

coastal shipping routes will possibly have significant social, political, and economic consequences for all residents of arctic coastal areas" (ACIA 2004: 934).

Turning to the IPCC and reviewing the Fourth Assessment Report, WGII chapter on Polar Regions, it is argued (with very high confidence) that the components of the terrestrial cryosphere and hydrology are increasingly being affected by climate change. In discussing the impacts and outcomes the assessment claims that these changes "will have cascading effects on key regional bio-physical systems and cause global climatic feedbacks, and in the north on socio-economic systems" (IPCC 2007: 3). More importantly regarding shipping in the Arctic, they state that "[c]ontinued changes in sea-ice extent, warming and acidification of the polar oceans are likely to further impact the biomass and community composition of marine biota as well as Arctic human activities" (IPCC 2007: 3). They stress the importance of Arctic communities to adapt to the changes, although external and internal stressors challenge their adaptive capabilities.

The influential work of the UN coordinated IPCC and the Arctic Council's research groups provide important insights regarding climate change in the Arctic region and both of them can serve as narratives of how the Economic Opportunity discourse is framing shipping and transportation in the Arctic. The ACIA acknowledges the complexities faced by the Arctic, like the interplay between contamination, over-fishing, land use change that result in habitat destruction and fragmentation, rapid growth in the human population, and cultural, governance, and economic changes. Although they are recognizing that impacts on the environment and society do not result from climate change alone, but from the interplay of many changes (ACIA 2004), it does to a large extent emphasize the emerging economic opportunities. As such, the assessment fails to see the long-term outcomes from petroleum and shipping for the environment, and for climate change in particular.

These examples, including INSROP and PAME, illustrate that environmental problems and pollution from the industries are connected, but they are not recognized as insuperable. On the contrary, the risks associated with them can be minimized to an extent where they hardly do any harm. Further, they connote a belief that globalization in the Arctic will benefit all – even India and China. Consumers in the west will benefit because the garment industry has moved to Asia. Clothes in western countries are, for the time being cheap, due to imports from China. This may be even cheaper if the transportation costs decreases – which it might, if trans-Arctic shipping becomes a reality.

Globalization and geopolitical perspectives related to economic opportunity and energy security

The environment is increasingly being framed as a security issue to be assessed through military institutions, in addition to political and scientific institutions (Neumann 2005). National security is one of the central topics discussed by Arctic nation states, almost 20 years after the Cold War ended. Russia's economy is growing, partly due to the oil industry, and a new rearming is currently unfolding. Russia is resurrecting itself as a powerful economic and military state, and it will drive much of the development in the Arctic in the future (Borgerson 2008). As discussed above, an increase in exports of oil and gas from Russia and Norway is argued to reduce reliance on the Middle East and Central Asia for oil supplies. Although expensive to extract, it is argued that the political expense per barrel is less, as are the transportation costs.[34] There is much at stake for Europe and North America regarding energy security, and since the Arctic oil is considered to be more valuable oil than extractable oil elsewhere in the world due to the regions political stability, strong interests from both the industry and governments are working to explore the petroleum opportunities.

Nevertheless, the expansion of military presence in the Arctic signals a tension unfolding. Canada, for example, has increased its military presence along its coast and the Western Passage. Since 1988, there has been a disagreement between Canada and the US over the final disposition over the waters off the Canadian coast. The struggle for control over over sea-lanes of the Western Passage has made the Canadians invest in a satellite surveillance system designed to search for ships trespassing in its waters. Canada is frequently declaring its Arctic sovereignty, and does not welcome the U.S. Coast Guard and the U.S. Navy is especially in areas they insist are theirs (Borgerson 2008).

Due to the melting ice in the Arctic, new maps have to be created. In August 2007 a new island was discovered in the archipelago of Svalbard. Places where there used to be glaciers are now leaving small islands alone in the open ocean. With the melting of the Greenland ice sheet new islands are suddenly emerging and coastlines are changing. A new geography is resulting, creating new questions and challenges, as countries are staking new claims over areas and resources.[35] These changes can make Greenland potentially the northernmost landmass in the Arctic, which means that Denmark may be able to lay claims to the North Pole. Another example, though not emerging from the melting ice, is the dispute over Hans Island, a small, uninhabited barren island (1.3 km²), located in the strait that

[34] Tom Lofthus, Arctic Frontiers Conference 2007
[35] The Warming of Greenland. John Collins Rudolf. The New York Times January 16, 2007.

separates Ellesmere Island from northern Greenland and is part of the Northwest Passage. The island is claimed by both Canada and Denmark, and the fight for it may turn into a test case on territorial claims in the Arctic (Jensen 2007).

5.1.5 The Social Justice Discourse

Oil is black blood

Storyline:

The Social Justice discourse is different from the other discourses because it directs the attention against underlying structures of how societies are organized. The proponents see environmental issues as fundamentally issues of social relations and they stress that social, political and economic aspects must be addressed before climate change issues can be solved (Leichenko & O'Brien 2008). Further, they question current relations of power and domination, but also point to a future where principles of social and ecological justice guide the society-nature relations, both locally and globally (Castree 2001). The Social Justice discourse sees outcomes of environmental change as a combination of ecological and social factors, but are particularly emphasizing that they are socially and politically generated. As such, they are less sensitive to the biophysical climate science, in contrast to the Earth System discourse which rarely takes into account humans and the human environment (Leichenko & O'Brien 2008).

Highlighting multiple dimensions of social difference such as gender, age, wealth, class, race and so on, it draws attention to how people are experiencing global processes of change differentially (GECP or GECHS). The term 'justice' correlates with fairness – equal treatment for equal cases. Equity – freedom from bias or favorism – is a key component of social justice, where the term "social justice" includes both fairness and equity in the distribution of a wide range of attributes (O'Brien & Leichenko 2006). Research in political ecology tends to reveal winners and losers (Robbins 2004:11) and in the literatures on globalization and global environmental change there is an understanding that both processes are producing winners and losers (Leichenko & O'Brien 2008). The proponents of this discourse are addressing how global changes are contributing to skewed costs and benefits for individuals and communities on all geographical scales. In so doing, attention is particularly drawn to winners and losers. O'Brien and Leichenko explain that:

> Winners are considered those countries, regions or social groups that are likely to benefit from the ongoing processes of climate change or globalization, while losers are those that are disadvantaged by the processes and likely to experience negative consequences" (2000:222).

In the research on climate change, there is often more attention on the losers, but there are also actors, social groups or nation states that will benefit from changes. The proponents of the discourse believe that winners and losers are socially and politically generated and that they are "deliberately created through processes that benefit some at the expense of others (O'Brien & Leichenko 2003). As such, they are seen as important because they involve questions related to equity and justice.

In recognizing that humans have always transformed the environment, the Social Justice discourse is acknowledging that changes to society are inevitable; as such, they question the contemporary market liberal vision which views globalization as "natural, evolutionary and inevitable" (O'Brien & Leichenko 2003: 93). In light of this, the global economy, free trade and market liberal governments are seen to contribute and strengthen the differences among individuals, societies and countries, and represent the villains. On the other hand, the heroes are those perceived to work towards a more fair and social just society, and see the need for significant improvements in human developments, alteration of how the global economy and the energy infrastructure is organized. These may include new social movements, such as the anti-globalization movements and the fair trade movement, and coalitions like EcoEquity, the Climate Crisis Coalition and the Global Justice Ecology Project (Leichenko & O'Brien 2008).

Research approaches and responses

As with climate change, economic globalization will also affect communities differentially, and the proponents of the Social Justice discourse emphasize that research must consider both of these processes of change. As such, they argue that the responses to global change issues must embrace a wider participation and involvement in the science and policy processes, which means that scientific research and development, economic enterprise and administrative bureaucracies, must be de-politicized (Huckle & Martin 2001). In this respect, it is related to post-normal science and risk society, as was discussed in chapter 3. The responses taken towards global changes are social, and includes the participation of and dialogue between governments, civil society and the private sector which then provides a more holistic perspective no science policy issues (Huckle & Martin 2001). The discourse

highlights and emphasizes other aspects on global change processes, like power politics and social injustices, which are often undetectable in the other discourses. Nevertheless, the discourse is one of the least visible of them, which can be attributed the biophysical factors as explanation for environmental changes.

Plundering of Indigenous Peoples

Looking at the industrialized countries' relation to indigenous peoples, the Social Justice discourse questions and criticizes contemporary behavior, especially in terms of exploitation of resources. In the Arctic, a vast area originally shared between many different peoples, has increasingly experienced injustice from nation states and other actors and interests. Traditionally, and perhaps still, the region is most interesting in relation to exploration, its resources, and the research it provides. Magga, a former Sami Parliament president, believes that for most people, the Arctic is still far away – a remote place up on the map – and he points to the fact and accuses many polar researchers of obviously wanting to talk more of ice and equipment and such rather than talking about indigenous peoples (Magga 2007: conference). The voices of the indigenous peoples of the Arctic can often be invisible in the face of strong economic interests and research agencies although they are the ones who are most heavily affected, which is unjust to the people exposed.

> In the polar and climate research it has been a far bigger focus on polar bears than on indigenous peoples.[36] [My translation]

Although, the focus on polar bears has lifted the attention towards climate change in the Arctic, from the perspective of the residents in the region they feel neglected and reduced. In describing the region in certain terms and connotations it can open up the door for others to who wants access to the region and its resources. Thus, symbolic meanings ascribed to lands and environments and how these imbricate with struggles over control and access to material resources, has received considerable attention. As Neumann notes, "[w]ilderness as nature is a powerful metaphor in struggles over the control and use of natural resources, one that reflects and reinforces deep-rooted political and cultural agendas" (2005: 57). An important aspect has been pointed out by Dahl[37] when arguing that "[t]he use of notions like 'The Arctic Wilderness' or the 'Arctic Frontier' violates fundamental territorial and cultural rights and

[36] Ole Henrik Magga; President Same Parliament 1989-1997. For lite fokus på urfolk. Aftenposten, 05.06.2007
[37] Jens Dahl, the former director of The international Work Group for Indigenous Affairs, made a report in 1993 to the Nordic Council for the Arctic Conference in Reykjavik.

aspirations of indigenous peoples" (Hoel 1993). It is argued that the use of terms like wilderness on the region is just an ethnocentric term, a label constructed by others. The concept of a frontier in an Arctic context is perhaps most well known in the dichotomy Northern frontier, Northern homeland[38], which recognized indigenous people's rights to their land. Aili Keskitalo, president of the Sami Parliament, a speaker on the Arctic Frontier Conference 2007 emphasized that the Arctic is their *homeland* as opposed to a *frontier*. A frontier, which forms part of the conference name, connotes to indigenous peoples of the Arctic a 'new' land to conquer and exploit.

Laduke argues that there is a direct relationship between the loss of cultural diversity and the loss of biodiversity. Wherever indigenous people live their lives, there is also a corresponding area of biodiversity. The argument is that native people are taught to respect and protect nature, because they grew up with nature close to them, and were taught to appreciate that plants and animals around them are as valuable as another person would be. The struggle to preserve what remains and recover what is damaged characterizes much of the native environmentalism. These relationships, it is argued, are what industrialism seeks to disrupt. According to Laduke, eighty-five percent of the population in the Inuit homeland, Nunavut, is native. They have been treated poorly and robbed of their historical lands, and even today their lands are subject to some of the most invasive industrial interventions imaginable (Laduke 2005), as the Resilient Ecosystem discourse describes more closely.

Thus, when Keskitalo (2007) asks for caution when using the term frontier, it is because the Arctic region has had, and still has, a history where it has been connected to the rest of the world mainly through extraction of natural resources. Heininen (2004) points out that most of the resources are extracted from the region and exported to other parts of the world by external actors. This is a form of plundering of resources on the land of indigenous peoples', which is familiar to them. Going from fur and whale exportation, now only used in customary economies, to vast quantities of oil and mineral resources, especially hydrocarbons, the resource exploitation seems likely to continue for many more years (AHDR 2004). A continuation of oil and gas development means intervention on ecosystems and interfering with indigenous peoples' way of life. The recognition that there are vast amounts of resources in the region does not necessarily mean that they should be exploited – let them be, is the Social Justice discourse' position, because the exploitation will lead to new winners and losers, where the oil industry is likely to benefit and the indigenous peoples likely to lose.

[38] The Berger Report entitled *Northern Frontier, Northern Homeland* (1977) recognized the indigenous peoples rights to their homeland in the dispute over the Mackenzie Valley Pipeline (AHDR 2004).

As such, resource exploitation in the region is viewed to exacerbate differences and increase inequities.

Looking ahead, with increasingly more knowledge about melting of snow and ice, indigenous representatives are contemplating whether or not this knowledge will contribute to a growing focus on the consequences for the indigenous peoples:

> I hope so, but I still do not feel secure. So many other processes with a larger economic range are happening so I am afraid that we easily can drown [...].[39] [My translation]
> Historically indigenous peoples have dominated the High North. We insist that we want to participate when the futures for our areas are decided for [...].[40] [My translation]

They are not contributing to greenhouse gas emissions, but they are the ones who are feeling the greatest changes, which are seen as an injustice. As Adger writes, "The greatest single equity issue, and the spectre which overshadows all debates on what to do about climate change, is that of the differential impacts of climate change and the highly skewed costs of adaptation at global and local scales" (Adger et al. 2001: 700-1). Adaptive capacity is not evenly distributed, and some people will always be able to adapt a lot more than others. The indigenous peoples of the Arctic are very vulnerable to climate change, whereas Norway with its wealth has a much higher adaptive capacity. Addressing who contributes to GHG emissions are important. As discussed by O'Brien and Leichenko (2006), there are many regions and groups that contributes very little to greenhouse gas emissions, who has no voice in climate change negotiations and have no influence on key policies, who are disproportionately vulnerable to climate change, and who are unable to adapt. For example, indigenous peoples-analyses show differential vulnerabilities for first nation peoples (Ford 2006). The peoples of the Arctic are a group who contributes very little greenhouse gas emissions. If climate change is to be truly framed as an equity issue, then inequities within countries and across different social and gender groups of peoples, for example indigenous peoples, also need to be acknowledged: "In fact, if we differentiate between rich and poor people, rather than rich and poor countries, we find that the human insecurities world-wide may look more alike" (O'Neill 1997 in O'Brien & Leichenko 2006: 230).

[39] Ole Henrik Magga; President Same Parliament 1989-1997. For lite fokus på urfolk. Aftenposten, 05.06.2007.
[40] Aili Keskitalo; President Same Parliament 2005-2007. Urfolkene må bli hørt. Aftenposten, 01.02.2006.

5.2 Are the Discourses Connecting?

Considering global change discourses, Leichenko and O'Brien (2008) argue that globalization discourses emphasize the growing spatial and temporal interconnectedness of economic, political and cultural systems, and stress the influences of space-time compression and a 'speeding up' of interaction on all facets of communication and interaction. Economic globalization is generally seen as a driver of climate change. Climate change, on the other hand, is normally not seen as a driver of economic globalization. On the contrary, climate change is often viewed as hampering economic activities and is by many seen as a threat to the global economy. The Stern review, for example, states concern that climate change can slow down economic growth in developed and developing countries alike (Stern 2006). What is less recognized in climate change discourses is how climate change can influence economic globalization (Leichenko & O'Brien 2008).

Typically, climate change literatures recognize many of the direct causal linkages between climate change and economic globalization (Leichenko & O'Brien 2008), which is also evident within the five Arctic discourses. They may agree upon that increased activities in the High North might lead to environmental degradation and pollution, but the solutions are different between the proponents of the discourses.

In deconstructing the different views and positions among actors and interests, discourses can help to reveal that the ways these questions are talked about and discussed are incomplete. Arctic natural resources, like fisheries, minerals and petroleum, and the transportation and trading have all been recognized (INSROP 1999, ACIA 2004; Bambulyak and Frantzen 2007). Still, the literatures on these subjects have not considered the consequences and the feedbacks of the changes now taking place. Some people do not see the connections, whereas others do not want to see the connections because the implications of recognizing them mean that different action must be taken. They have not thought about how transportation is enabling the extraction and distribution of petroleum resources, and thus contributing to global greenhouse gas emissions, and the feedbacks stemming from these processes are of the core debate regarding climate change in the Arctic.

It is striking to see how issues on Arctic challenges to the environment are missing the social science understandings of globalization, it is not even there, except, as we have seen, in the Economic discourse, where the proponents claim that all can benefit from the development of the Arctic and welcome the economic development that are associated with it. Some people argue increased globalization is a prerequisite to addressing climate change,

others argue globalization is the cause of climate change. The point is that economic activities will lead to environmental, geopolitical and social challenges. It will open the Arctic up to a whole range of issues, such as more pollution from ships, access and ownership to resources, increasing military presence, which are or will become sources of greenhouse gas emissions.

A significant theme of this thesis is to question how science, politics and different actors and interests are framing environmental issues. Because frames influence politics, we have to become more aware of them and how they are constructed and by whose actions (Forsyth 2003). Science is used to legitimate different environmental policies, but the biophysical uncertainties or political conflicts behind what are perceived as well-known problems are less recognized: "Applying inappropriate environmental policies may lead to social and economic problems for people affected, and fail to address underlying biophysical causes of problems" (Forsyth 2003: 10). The ways that environmental issues are framed influence the responses that are prioritized. This is the reason why it is important to see climate change, petroleum and transportation in the Arctic as interlinked. If the different discourses are missing the social science, then it may give the wrong consequences. "[T]he adoption of environmental science without acknowledging how it is affected by social and political factors undermines its ability to address the underlying biophysical causes of perceived environmental problems" (Forsyth 2003: 2).

Solving climate change issues depends on interdisciplinary collaboration with contributions from many different fields. A challenge is therefore to overcome the narrow fields of each discipline, which often have their own philosophical foundation and language. Discourses can constrain solutions, because they start off from different platforms with the result of making it difficult to understand one another, constraining the possibility to work together towards new and better solutions. In recognizing that there is no longer sufficient to treat climate change issues in isolation, this thesis is calling for a more integrated analysis'. This would basically mean to acknowledge and include multiple processes of change and not just treat climate change as an isolated process. Issues of globalization, power politics, social, economics cultural aspects must be included. The discourses presented all have weaknesses from the perspective of critical realism and political ecology. Political ecology with its inclusive approaches is able to address social, economic and political issues, and critical realism as an approach is a way for binding these issues together. Since global change is seen very differently among different actors and interests, as was illustrated through the discourses, critical realism is a philosophy which manages to integrate the discourses and different perspectives.

Summary

This chapter has shown that climate change and economic globalization in the Arctic are portrayed in a partial and insufficient way. It has argued that the reason for why this has not been talked about all together lies within the discourses. Actors and different interests are framing the problem in such a narrow way that they are not seeing the whole range of possible connections. Climate change in the Arctic is not only about the melting sea ice, opportunities for the shipping and petroleum industries, local oil spills and polar bears, although they are all significant in their own right. It is argued that when the focus is on narrowly bounded processes rather than on the linkages between climate change and economic globalization, political responses with a long-term vision towards a sustainable future are difficult to perceive. For the time being it does not seem like the relationships between climate change, petroleum hydrocarbons and transportation are being connected and taken into account in policy responses to global issues. The next section attempts to establish how these processes are related in the Arctic context.

6. The Three-Way Connection: Linking Climate Change, Petroleum Hydrocarbons and Transportation

Chapter 2 established the empirical background for three important changes taking place in the Arctic region: climate change, petroleum extraction and the expansion of transportation. It was argued in chapter 5 that these issues have been for the most part considered separately. The following section will discuss how these processes are closely related, and how they intersect and interact to profoundly affect each other.

6.1 Framing Multiple Processes of Change – Feedbacks, Responses and New Outcomes

As we saw in the chapter 5, the problem lies within the discourses and in the way we are talking about global change. Discourses on global environmental change and globalization tend to be framed and assessed as discrete processes, each with their own factors that drive them (Leichenko & O'Brien 2008). Discourses on climate change in particular emphasize connections and feedbacks between physical, ecological, and social systems (Steffen 2004). Likewise, discourses on economic globalization highlight its transformative dimensions, with a growing spatial and temporal interconnectedness of economic, political and cultural systems, as well as the speeding up of processes fueled by the communications revolution and space-time compression (Smith 1998, Held & McGrew 2000, Leichenko & O'Brien 2008). There are, however, connections and feedbacks *between* these processes, which often are missed in the literatures on global change. Drawing on the double exposure framework of Leichenko and O'Brien (2008), this section sets out to identify the connections between climate change, petroleum hydrocarbons and transportation in the Arctic region. By linking these processes together through the double exposure framework, an analysis of how global processes are transforming the Arctic can be undertaken. Importantly, the response to any one process at one time can create feedbacks to other processes that either accelerate or slow change. This type of 'feedback double exposure' will be of particular interest in terms of how the Arctic seems to be developing because it captures "how actions taken in response to either or both processes may contribute to the drivers of global change" (O'Brien & Leichenko 2008: 80).

The process of climate change is closely linked to economic activities, like petroleum extraction and transportation, and they affect each other in ways that can influence future outcomes. In the case of the Arctic, positive feedbacks are likely to happen as sea ice reduction, petroleum exploitation and transportation all will facilitate both increased hydrocarbon extraction, international transport and trade, and GHG emissions. The oil and gas industry is eager to exploit the resources of the region, adding increasing amounts of GHG to the atmosphere, and further accelerating climate change, which again may lead to an increase in shipping and international trade and petroleum activities.

Climate change in the Arctic is well documented (ACIA 2004, IPCC 2007). Ecosystems and humans are already experiencing changes, and it is manifested by sea-ice melting, thawing of permafrost, coastal erosion, the distribution of species and societal changes (ACIA 2004). Of all the issues related to climate change in the Arctic, the biggest focus is perhaps on sea ice, and scientists try through their models and projections to estimate how much and how soon the ice will melt. Some models project that summer sea ice will decrease by more than 50% in the Arctic Ocean over the 21st century (ACIA 2004, IPCC 2007). Other models claim there will be no more summer ice by mid-century. Others again, believe it will happen in the next few years[41]. What is certain is that future projections are uncertain. The changes are happening so fast, leaving many scientists startled at the rate and speed of change[42]. From today's 20-30 days of navigable water, a UNEP report (2007) projects an increase to 120 days of navigation through the NSR in this century. Based on what was presented above, and in the climate change section in chapter 2, the UNEP projections, along with the projections from ACIA and IPCC, are very uncertain. They may turn out to be correct. However, given how rapid the changes in sea ice have occurred in the last years, and the uncertainties related to future emissions of greenhouse gases, which are expected to increase substantially the next decades, these projections may very well turn out to be quite conservative. Even if the international community is able to reduce GHG emissions immediately and dramatically, a certain amount of warming will occur as the result of past emissions, which will contribute to a reduction of sea ice. Given the current retreat of sea ice, and considering the models presented by the American Geophysical Union, trans-Arctic voyages could be a fact within the next five to ten years (Borgerson 2008).

[41] The scientist, Wieslaw Maslowski, believes the ice in the Arctic will be gone before 2013.
http://www.aftenposten.no/klima/article2150019.ece
Norwegian climate scientists believe that the sea ice may be gone in 2009.
http://www.dagsavisen.no/innenriks/article348948.ece
[42] There was approximately 25% less ice in 2007 than in 2006.
http://www.aftenposten.no/klima/article2246788.ece

Moreover, the perennial ice is disappearing – between 2004 and 2005 the Arctic lost 14%, and over the last 23 years, 41% has disappeared. Perennial ice is the hard, dense and thick multiyear sea ice, which is the main obstacle to shipping (Borgerson 2008). The significance of disappearing perennial sea ice is important to Arctic shipping. If the perennial Arctic sea ice would melt completely away, there would be no more multiple-year ice formations. In other words, the thick and hard multiyear ice would be replaced by a thin layer of seasonal ice in the winter, much like the Baltic Sea today, making it fully navigable year-round (Borgerson 2008). For shipbuilding and standards, and for the further development of Arctic shipping, this would be very significant (Brigham 2007). The reduction of sea ice is creating a new biophysical context and will facilitate new opportunities for business. It is likely to have significant impacts on both resource extraction and international shipping and trade. Transport is currently playing an important part in the Arctic economy, and constitutes between 5-12% of the production value, depending on the region. Transportation is linking the Arctic to the rest of the world, shipping local products and goods out to the rest of the world and importing goods to local residents (Heininen 2004). The international merchant fleet already contributes significantly to global anthropogenic emissions (Dalsøren et al 2007) and is believed to emit as much as the international air traffic.[43]

A new phase of globalization may occur, as climate change has the potential to transform global shipping and energy markets. There are suggestions that about 90% of goods in the world, measured in tons, are transported by sea (PAME 2006). As much as 80% of the worlds industrial production is developed north of 30º N, and as much as 70% of the world's metropolis' with a population above one million is situated North of the Tropic of Cancer (23° 26′ 22″, North of Equator) (Østreng 1999). The transportation of cargoes originating south of Hong Kong is of no interest to shipping companies in terms of the NSR. North of Hong Kong, however, there are very significant savings in terms of distance for cargoes traveling north of Hong Kong through the NSR to northern-Europe. Some of the world's important countries in terms of economy and world trade flows are situated here – some of which have been the power houses over the last decades and some that most probably will become economic powers. China became a member of the WTO in 2001, and in 2004 about 90% of the Chinese international cargo was transported at sea. Together with Japan and South Korea, China is expected to play a significant role in the global economy and to be interested in using the NSR. China is expected to play a dominant role as the leading economic,

[43] According to Asbjørn Torvangerat CICERO.http://www.dagogtid.no/nyhet.cfm?nyhetid=1287

commercial and trading country in this century, and although its current comparative advantage is related to low labor costs, these may be higher in the future. One way to compensate for this is by reducing transportation costs, which may be possible by using the NSR. Regardless, these countries are important today, and they will be even more so in the future, both in terms of cargo generators and cargo receivers (Almklov 2007).

The obstacles to utilization, as have been discussed in chapter 2, are many. However, they may change. As has been discussed, climate change will most likely continue to change the physical landscape in the Arctic, making it more favorable for sea transportation. The draft restrictions may increase by moving into open water, and the ice conditions may also prove easier to maneuver through, benefiting from a longer ice free season (although drifting sea ice may cause problems). Operational costs, however, will probably still be considerable (Almklov 2007). The potential for cutting expenses because of the shorter distance traveling across the Arctic, may be as much as 20%, because of lower fuel costs, avoidance of canal fees, and other variables that determine freight rates (Borgerson 2008). A reduction from $17.5 million to $14 million would save the shipping industry for a substantial amount of money each year. The largest ships today cannot pass through the Suez or Panama Canals, and are forced to travel around the Cape of Good Hope and Cape Horn. The savings would be even greater if these mega ships could pass across the Arctic Ocean. Avoiding shipping checkpoints like The Strait of Malacca means that piracy can no longer dictate global shipping patterns (Borgerson 2008). Another aspect is related to the size of the cargo, which is decisive for economical profitability. A ship may be fully loaded from, for example, China to Germany, but is typically empty on return, which makes it less lucrative.

What many believe will replace the ice breaking fleet are new, highly sophisticated and independent ships that will be able to make the journeys without assistance from ice-breakers (Brigham 2007, FNI-seminar). In 2005, 262 ice-class ships were in service and another 234 were on order. The ships are double-acting tankers, which sail bow first in open water. In sea ice, however, they sail stern first and cut their way through the ice. This means they can reach oil and gas fields and ports without the assistance of icebreakers. Such innovations are revolutionizing Arctic shipping and making commercial projects and business on a large scale possible (Borgerson 2008). Helge Lund, CEO of StatoilHydro, explained that: "Prior, most of the gas went through pipelines. This is gigantic investments and a stiff system. The great advantage with LNG is that it is easier moveable and it gives us the opportunities to develop small scale sale via smaller LNG-ships" (Dagens Næringsliv 12/6-07. [My

translation]). As such, super tankers are under construction by StatoilHydro to serve Snow Whites LNG production.

A growing global demand for hydrocarbons and mineral resources, particularly in Asia, supports the expansion of oil and gas exploration and extraction in the Arctic region. If sea ice continues to disappear, new areas in the Arctic will be open for exploration and the extraction of resources through expansion of shipping, adding to the global supply of hydrocarbons. The Arctic produces about a tenth of the world's oil and a quarter of its gas (Arctic Oil and Gas 2007, 17). On a global scale more than 5% of the known oil reserves and more than 20% of the known gas reserves are located in the Arctic. In addition it is estimated that a quarter of the world's undiscovered oil and gas resources are situated in the region (Arctic Oil and Gas 2007). Energy politics, the way it has been the norm the last decades, is even more likely to continue if the Arctic is seen as a region for expanding exploration (Kristoffersen 2007). From this perspective, with an oil price exceeding $100 a barrel in early 2008, the Arctic is considered a relatively secure source of oil and gas compared to the Middle East, which makes the High North very important to the advanced industrial societies (ACIA 2004, AHDR 2004). Arctic reserves of hydrocarbons are increasingly interesting and important, and exploration is likely to continue. Further, the hydrocarbons from the Arctic are likely to come in addition to exploration and exploitation of other oil and gas resources in the world. According to the International Energy Agency (IEA 2006) the world's consumption of petroleum products is increasing dramatically, and the global demand for energy will be 50 % higher in 2030 than today, if drastic cuts are not made to lower consumption growth. Developing countries, especially China and India, are expected to increase their energy consumption drastically, and the United States is expected to continue its high use of energy.

The IPCC (2007f) states that society must reduce global GHG emissions to the atmosphere by 50-80 % within 2050 to avoid dangerous outcomes of climate change. A form of consensus is being reached, highly criticized though, that the global mean temperature must not exceed 2ºC, if dangerous climate change is to be avoided (EU White paper). However, in IEA's reference scenario, CO2 emissions will increase by 57% until 2030, which is equivalent to an increase in the global mean temperature of 6ºC (IPCC 2005). Mitigation efforts are needed to turn this development around, but if the current 'business as usual' regarding petroleum politics continues, it will become harder to shift to renewable energy sources, because investment and development of infrastructure and petroleum fields set up a form of path dependency for decades to come.

As figure 6.1 shows, the volumes of oil freight from the Russian part of Barents Sea Region along the Norwegian coastline prior to 2002 was very limited, but in 2002 it increased significantly when 4 million tons of oil were carried across the northern region. In 2003 the amount doubled to 8 million tons, in 2004 the number of oil tankers sailing off the coast of Norway was 295 and it almost reached 12 million tons. In 2005 it dropped to 9.5 million tons when 278 tankers passed the Norwegian coast and in 2006 it rose to more than 10 million tons. At present there is on average one 30,000-ton oil tanker from Northwest Russia sailing the coast of Norway at any given time. Projections estimate that this will increase to three 100,000 ton ships within a few years (PAME 2006). The importance of oil shipments is evident.

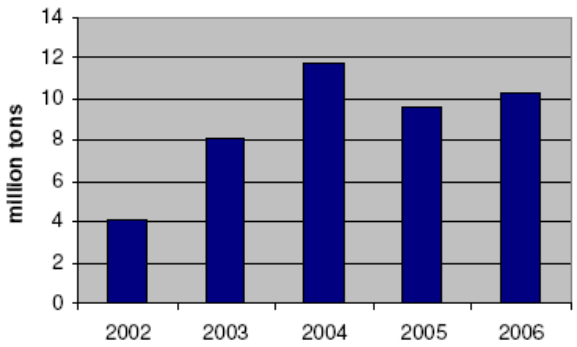

Figure 6.1: Russian oil shipped along the Norwegian coast in 2002-2006, million tons a year. Source: Bambulyak & Frantzen 2007.

Although expected volumes for future oil and gas production cannot be guaranteed, it can be estimated by looking at state and private companies' plans to construct and expand pipelines, railroads, ports and terminals. The private oil companies are also motivated to export as much as they can, and Russia is arranging for an expansion of this development. It has been estimated that Russia will have transportation facilities to export 80 million tons of oil through the northern routes, and thus along the Norwegian coast, by 2010. In 2015 the total capacity of the Arctic oil terminals can reach between 100-150 million tons (Bambulyak & Frantzen 2007, LDKN 2006). In 2002, major oil companies proposed to build an oil pipeline from the Western Siberia to Murmansk with a capacity of 120 million tons, but the plans are still on hold. Even if the pipeline is not built, the capacity to transport oil on railways to the ports of the White Sea and the Barents Sea is considerable, and the northern railways are currently undergoing modernization. From this perspective it seems clear that oil

transportation off the coast of northern Norway will increase significantly (Bambulyak & Frantzen 2007).

The infrastructure and transport systems in the Arctic are currently too underdeveloped to facilitate the volume of expected activities in the future. There is a need to develop clear and predictable regulations and laws for international shipping in the Arctic. Search and rescue services and better monitoring of ice conditions are needed to be in place (Almklov 2007, Jensen 2007). If the Arctic resources are developed, then investments in infrastructure, like ports and hinterland connections, are required, both on and off land (Almklov 2007). Through oil and gas extraction and the development of the cargo base, this will in turn make the facilities to transport goods better within the Russian high north (Østreng 1999). In fact, major development of ports and oil and gas installations are expected. Houses, buildings for residents and workers, infrastructure and services are also expected to improve. These changes will contribute to greater overall development of the Arctic. Much of this development will be financed by capital and investments from outside the region and the result of the resource exploitation will contribute to economic growth in other areas (Heininen 2004). Earlier there was an orientation from the Arctic and outwards, but now, there is an orientation going both ways.

In this section I have shown that responses to sea ice reductions caused by climate change and international shipping and the extraction of hydrocarbons facilitated by sea transportation will contribute to increased greenhouse gas emissions and may be the driving force behind further climate change in the future. According to the double exposure framework (Leichenko & O'Brien 2008), the relationships and feedbacks stemming from one event or process can result in outcomes that influence another process. The "dangers" of what might happen when operating with an incomplete understanding of these interrelated processes is that the actions taken in response to the changes occurring might eventually lead to new and unexpected outcomes. Since it is very likely that the Arctic will experience both an exploitation of oil and gas resources, and increasing transportation in relation to international trade as well as the shipment of petroleum resources, both of theses changes are expected to further drive the increases of greenhouse gases. Moreover, the increasing greenhouse gas emissions and higher temperatures, including the ice-albedo feedback, will lead to an accelerated warming of the earth. Further, the melting of sea ice and thermal expansion of oceans will contribute to sea level rise which will have significant impacts to coastal areas and produce coastal storms. Thus, in directing attention to multiple processes of change, it becomes evident that a continued globalization along the Northern Sea Route is

actually driving the changes associated with climate change. Importantly, these outcomes are eventually going to have consequences and increasingly affect more and more people, as will be discussed in the next section.

6.2 Differential Exposure

This section is addressing how climate change, petroleum exploitation and transportation in the Arctic will affect individuals, communities and ecosystems differently and contribute to geographies of inequities. The most vulnerable to climate change are likely to be the ones that experience the greatest changes to their livelihoods. Adaptation can reduce vulnerability to climate change, but there are significant differences in terms vulnerability and adaptive capacity, and some people can adapt much more than others (Conca 2002, O'Brien et al 2007). The global emissions of greenhouse gases are originating elsewhere, or through economic activities from the petroleum and shipping industries in the region that are initiated by external actors, transnational companies and nation-states from outside the region (Heininen 2004). Wherever they originate, the emissions are going to have local consequences for Arctic residents, whose livelihoods, identity and culture are based around snow and ice, making them especially vulnerable in terms of expected changes (Krupnik & Jolly 2002). For example, hunting on the decreasing ice will be more demanding and dangerous; it will be more difficult to build their traditional snow houses, the igloo; and reindeer herding will be more demanding (ACIA 2004, Laidler 2006). As such, indigenous peoples and the long-time residents of the Arctic are expected to increase their vulnerability, because they are experiencing negative impacts from both climate change and globalization. Now however, the changes are forcing them to adapt to new ways of living (Krupnik & Jolly 2002, Laidler 2006). As there are stronger corporate and nation-state involvement in the region, the residents living there are increasingly more involved in economic and political arenas, and thus integrated further into the global economy (Heininen 2004). Examples of collaboration with governmental nation states and transnational companies were discussed in chapter 5, which also highlighted strategies that they have taken to influence they own future. Whether these strategies, voluntary or not, are sustainable in the long run, is questionable, since it is the activities associated with economic globalization that are responsible for contributing to climate change in the first place.

Within the context of global changes, the identification of winners and losers is not straightforward. Through dynamic feedbacks in the Arctic the processes of globalization and

climate change will contribute to produce "new or modified sets of winners and losers" (O'Brien & Leichenko 2000:222). As we have seen, global changes are not likely to benefit those who live in the Arctic. On the contrary, subsistence economies and resource-based livelihoods, such as reindeer herders, fishermen and hunters, and individuals and communities who cannot adapt to rapid change will become the losers of the region. At the same time there are people who will earn a lot of money on increasing trade and oil exploration. Russia, for example, is currently experiencing growing economic prosperity, in part because of its oil and gas enterprises, which is soon expected to move off-shore, for example into the Barents Sea. The sea lanes of the NSR are mostly within Russian territory and the country are likely to benefit from the shipping and international trade sailing in its waters. Thus, countries, such as Norway and Russia, and companies that have rights to oil and minerals, are expected to be winners. Even the fast growing Chinese economy may directly benefit from the NSR, as the country relies on considerable exports which are mainly transported by sea. Exports from China through the Arctic are expected to benefit northern countries in terms of cheaper consumer goods. Determining who will be the winners and losers is not straightforward, as it also depends on the level of geographic scale. On an aggregate scale, a nation-state may be viewed as a winner in terms of increasing GDP. De-aggregated to the level of individuals, there are also individuals who invest in projects in the High North who may also benefit. On the other hand, as discussed above, viewed at the perspectives of individuals, the majority of the Arctic residents are the likely losers.

Climate change in the Arctic is an example that points to the world's skewed costs and benefits, where some are expected to win and some to lose, due to the feedbacks from economic globalization and global environmental change. Nevertheless, looking further ahead, it is not given who the winners and losers will be in a longer timeframe (O'Brien & Leichenko 2003). Since adaptive capacity and vulnerability are dynamic variables, those individuals, communities and ecosystems who used to be winners, may later become losers. This can be associated with Beck's 'boomerang effect', as those who are contributing to climate change and initially benefit from it, such as the oil and shipping industry, may later be subjected to greater risks. Extreme weather events, dramatic sea level rise and higher waves may cause considerable damage to shipping and petroleum activities. Further, the thawing of ice-rich permafrost may also lead to great impacts on the infrastructure in the region, as much of it is build on the hard and frozen ground (ACIA 2004, UNEP 2007). Affected infrastructure includes existing buildings, roads, oil and gas installations on land, pipelines, airports and industrial facilities (ACIA 2004).

Considering ecosystems and wildlife, the biophysical changes from human activities will have significant impacts on Arctic biodiversity and on species. Due to increasing temperatures species will migrate from the south to the north as oceans get warmer. Many species are dependent on cold temperatures and snow and ice to exist, which now might lead to extinction for some animals, and the emigration for others. Moreover, release of ballast water may introduce new and invasive species. Some of the species in the Barents Sea today, may be replaced by new ones. Higher temperatures lead widespread permafrost degradation and will have consequences for natural ecosystems like draining of lakes, wetland development, toppling of trees and collapsing of ground surface, and thawing tundra will be replaced with temperate forests (ACIA 2004).

A Short Circuit of Norwegian Climate Policy?

Norway is an oil and gas producing nation, but it also considers itself as a leading nation on environmental issues. The high north is, according to the Norwegian Government, its country's most important strategic priority area in the years to come (High North Strategy 2006). The prestigious project is articulated in the High North Strategy, which draws up important priorities for the region. Considerable attention is given to petroleum and marine activities, and the strategy promotes the opportunities associated with these activities. It states that the Government of Norway will "provide a suitable framework for further development of petroleum activities in the Barents Sea, and will seek to ensure that these activities boost competence in Norway in general and in North Norway in particular, and foster local and regional business development" (High North Strategy 2006: 8). It has both a regional and global perspective, emphasizing spin-off effects to northern Norway and northwestern Russia, but also a global perspective highlighting the contributions that oil and gas from the southern part of the Barents Sea may make to energy security in Europe and the United States. The strategy also states that the government is in favor of an active licensing policy, and will respond to the need for further areas for exploration. Being in favor of increasing shipping and transportation in the Arctic, the High North strategy argues in part for better monitoring along the coast of North Norway, particularly due to oil transport and the establishment of ships' routing and traffic separation between Vardø and Røst (Ministry of Environment 2006). "Regulations are in force allowing for sailing just inside the twelve mile zone but this is likely to be pushed out to 30 miles" (PAME 2006: 47). In the High North Strategy there is a proposal that states that all tankers and cargo vessels with a gross tonnage of more than 5000

dwt that are engaged in international trade will be routed further away from the coast, to about 30 nautical miles from land (Ministry of Environment 2006).

The development of the Norwegian shelf in the high north has caused controversies, because oil exploitation is seen as a harmful activity. The expansion in the High North is likely to have global consequences. Norway as an oil producing nation must consider its climate policy carefully, as climate change is triggering a global response to climate change. Climate policy is also going to be affected by this global response. Business-as-usual politics are likely to further exacerbate the feedbacks between processes and lead to new and most likely unexpectedly outcomes. With this scenario, the Arctic will continue to globalize through climate change, as transport and hydrocarbons both contribute to climate change. The failure to see the interlinkages between the separate processes is one reason why the feedbacks are not seen. This thesis has argued that failing to see the feedbacks from global change is bound to have large-scale negative consequences. The separate discourses on climate change, oil and gas exploitation, and transport are not trivial, and they have important implications for the global community. As such, the notion of Norway as an oil producing nation may become more and more of a contradiction in the years ahead.

Summary

This chapter has examined and analyzed how the three-way-connection interact and affect each other to profoundly transform the Arctic. It has also argued that the responses taken today will lead to new and possibly new and unexpected outcomes in the future. Further it has been considered how climate change facilitates winners and losers, both in a shorter and longer perspective. The final chapter discusses the need for what can be considered a new perspective or a new way of thinking about climate change issues in the Arctic.

7. Conclusion: Redefining perspectives on climate change in the Arctic

The recent year's drastic sea ice reductions and the future projections have not gone unnoticed and 2007 was, in this respect, pivotal in many ways. These biophysical changes, which create new opportunities, have made different actors and interests look to the north. As such, petroleum exploitation and new shipping routes across the Arctic, as is suggested in the subtitle of this thesis, 'an emerging transport route,' have received considerable attention for quite sometime. These economic opportunities are highly problematic because they can lead to dramatic changes through the feedbacks they create. Moreover, what happens after the sea ice melts? The title 'The Arctic Express' connotes a change of pace and visions of ships across the Arctic oceans, transporting petroleum resources and goods and merchandise between Asia and Europe. Many involved actors and nations will make claims for the continental shelves and lands of the Arctic in order to get their share of the resources, and this fight will raise security issues. The resources of the Arctic are at the heart of the Economic Opportunity discourse. The adherents of the discourse, however, have to take into account the knowledge from all the other discourses as well: the Earth System discourse directs attention to the climate science; the Social Justice discourse focuses attention on political and social aspects; the Fragile Ecosystems pays attention to ecological conservation; and the Resilient Ecosystems draws attention to adaptation processes. As such, a main challenge is to see the interlinkages between the separate processes.

Climate change skeptics argue that "[g]lobal warming, though its size and future projections are rather unrealistically pessimistic, is almost certainly taking place, but the typical cure of early and radical fossil fuel cutbacks is way worse than the original affliction, and moreover its total impact will not pose a devastating problem for our future" (Lomborg 2001: 4). Since global warming is a long and slow process skeptics argue that even if we stopped all greenhouse gas emissions now, it would take centuries before it would stop getting warmer. Lomborg thus argues we should stop thinking about quick and expensive solutions and rather focus on other important issues; like policies to attack hunger and malnutrition, the spreading of HIV/AIDS, clean drinking, malaria etc., which he argue is a much better way of spending money (Lomborg 2007). With the focus only on clear and present dangers, although these issues are very important by themselves, Lomborg fails to see climate change as an additional stressor that may significantly increase all the problems he is advocating. With the

impacts of climate change, these and other issues will exacerbate significantly. There has also been a shift among skeptics from moving away from the discussion about whether climate change is real or not towards questioning if climate change is good or bad. Skeptics are now increasingly arguing that the current weather for humans is not optimal and that a warmer climate may be beneficial (Lomborg 2007). According to this reasoning, more people die from cold than from heat in northern Europe, and perhaps regions such as Scandinavia will experience a better climate in the future. On a world basis in 2050, it is argued that the direct impacts of climate change will mean fewer dead as there will be "1.7 million fewer cold deaths" (Lomborg 2007: 218). Compared to the countries close to the Equator, higher average temperature in Northern Europe are more tolerable. But in the South, where the temperatures already are high, additional increases will be catastrophic for human wellbeing in general; in other areas water supply, agriculture, and the negative outcomes will by far exceed the positive effects. Importantly, and which are missed by skeptics; climate change and other global environmental change issues are interacting with social, economic and political issues and will exacerbate existing problems and create new challenges for human security (O'Brien 2006).

The significant changes in the Arctic and the world at large discussed in this thesis might work as a trigger that could draw people out of their narrow discourses to consider a more integral and holistic approaches to climate change issues. Three examples regarding how people today look at climate change-related issues differently compared to earlier, are noted here in the concluding chapter.

Firstly, at this year's annual Petroleumsdagen (2008) at the University of Oslo, there were for the first time contributions from the social sciences and the humanities, whereas previous events included only representatives from the natural and technological sciences. This can be understood towards a greater recognition that petroleum-related issues must be criticaly assessed in relation to climate change.

Secondly, at the same seminar, a StatoilHydro representative spoke openly about reflexivity, or "meeting yourself in the door" when contemplating some of the projects his company either is, or plans to get involved in, most notably the dirty oil-sand business in Canada. He also assured the audience that other employees in the company felt the same way. Statements like this reflect a growing awareness of climate change and its implications for humanity.

Thirdly, when Dr. Robert Corell, Global Change Director of the Heinz Institute and chair of the ACIA, held the Thor Heyerdahl International Speech 2007, he expressed a shift in

the roles of the biophysical sciences vs social sciences and the humanities. He was introduced to the audience as a researcher "concerned with the sciences of global change and the interface between science and public policy, particularly research activities that are focused on global and regional climate change, related environmental issues, and science to facilitate understanding of vulnerability and sustainable development" (Programme 2007). Corell argued that biophysical scientists traditionally have been interested in the knowledge foundation of the earth system, but have not been able to address solutions to climate change. He argued that biophysical scientists are now more aware of the political realities, different values, policy issues, moral, social and economic aspects as factors related to climate change. This makes them, in his opinion, more capable on focusing on solutions. Moreover, he argued that the social sciences and humanities must play a much more central role in the future, which points in the direction of a more integrated approach to climate change.

Actors operating within different discourses are realizing to a larger degree than before that considerable changes are taking place in the Arctic, and connections between processes are starting to be made. Whereas normally it may take a long time for people to change how they perceive the world, the dynamic situation in the Arctic might make people change their worldview faster, This is positive, but at the same time; it is important to ask whether people still just seeing these connections from within their own narrow discourse?

An Integrated Perspective on the Arctic

The literatures on globalization and global environmental change have taught us that we have to view the world differently today (Leichenko & O'Brien 2008). Processes of globalization and climate change are changing the Earth system, and the Arctic holds—or should hold—a particularly important place in debates about climate change. Since greenhouse gases emitted from one place will contribute to climate changes in other places, location may become an increasingly subordinated factor in climate change policy (Berntsen et al. 2006). In terms of global climate change, regions and people are part of a larger context. Viewing the world in this respect leads to looking at the Arctic not as just a regional concern, but as a global issue, with dramatic implications for Tuvalu, China, Holland and the world at large. If we want a better understanding of global change processes, the way forward is to identify the linkages and connections between issues and develop a more integrated understanding of the world. Moreover, there is need for a new way of thinking about the Arctic, because the Arctic is more than just as a region. The Arctic represents a nexus or convergence of many important global issues, such as the future of oil and gas, the transport of resources and goods,

community livelihoods, and complex feedbacks and tipping points. Should the tipping point scenarios become a reality in the future, it will have consequences for the future of humanity. It will have enormous implications for the planet, especially coasts and low-lying areas. The Arctic is important, but the way that we think about the Arctic is perhaps more important.

Appendix A

The search was done on-line on the newspapers websites in the period 14-16. November 2007. To retrieve a set of search terms covering issues of climate change, shipping and petroleum I did preliminary searches in order to retrieve a set of key words which reflected what I was interested in. All the articles were categorized in terms of author, content, narrative, and response, solution or purpose. The size of the newspaper tend to reflect how many articles that has been written on the subject, and thus also reflect the number of "hits" received in the search process. It is also worth noting that the newspapers represent different ideologies and interests. For example, Dagens næringsliv has a big focus on business in general, and covers what happens in the petroleum and shipping industry in Norway.

To find articles which turn on climate change, transportation and petroleum, certain search words have been used. The newspapers search sites differed in how advanced the search options were. Nordlys, for example, did not have the *-option, which resulted in only searcing by complete words. The star means that it will incorporate any word which begins with it. For example, nord* might include nordområdene (northern areas) and nordpolen (the North Pole). Third, there was considerable overlap between the different search options. The articles were, when overlapping, of course only selected once. The searches done in Aftenposten were done under the option "relevance", and not to "date". The search options on Nordlys' website did not allow the *-option, which led to that I changed the key words. Instead I used the key words nordområdene and skipsfart (northern areas and shipping).

A content analysis done in this way is selective, and the selection reflects what I find relevant in relation to my thesis. A flaw is that many of the articles were very recently published, often the same month as the search took place. It then reflects what was happening in that month. For example, in November, StatoilHydro became a partner in the Shtokman project, which was reflected in the media.

Appendix B

Climate change in the Arctic

Aftenposten: (*klima* *endr* *arktis*) (klima* endr* barents*)

Key words: (*klima* *endr* *arktis*) 11 articles
Hvor er de gamle bamsene? Aftenposten, 06.11.2007
Tatt av nordavinden Aftenposten, 06.11.2007
Hjalmar Johansens øy? Aftenposten, 13.10.2007
50 tøffe år for isbjørn Aftenposten, 14.10.2007
Trenger vi drivisen? Aftenposten, 17.09.2007
Sot og varme smelter isen i Arktis Aftenposten, 20.09.2007
Hva skjer med fisken? Aftenposten, 15.09.2007
Norges rolle, sett fra nord Aftenposten, 17.08.2007
Smelter raskere Aftenposten, 08.07.2007
- For lite fokus på urfolk Aftenposten, 05.06.2007
- Isfritt i Arktis i 2040 Aftenposten, 12.12.2006

Key words: (klima* endr* barents*) 4 articles
Makrellen forsvinner fra Norge Aftenposten, 30.09.2007
Hvor går vi etter Stockman? Aftenposten, 17.11.2006
Innfør en global karbonskatt Aftenposten, 02.03.2006
Nordpolen kan være isfri om 65 år Aftenposten, 23.01.2006

Dagens Næringsliv: (Klima* endr* arktis*) (klima* endr* barents*) (klima* polar*)

Key words: (*klima* *endr* *arktis*) 3 articles
Tinende bombe dn.no, 19.10.2007
Alle vil se isen smelte dn.no, 03.09.2007
Det nye Atlantis dn.no, 01.09.2007

Key words: (klima* endr* barents*) 3 articles
Frykter total torske-kollaps dn.no, 15.03.2007
Spår russisk innmarsj i nord dn.no, 02.01.2006
Mindre mat gir mindre fisk i Nordsjøen dn.no, 10.04.2006

Key words: (klima* polar*) 2 articles
- Dramatiske og ugjenkallelige dn.no, 18.10.2007
Klondyke i Nord-Norge dn.no, 23.08.2006

Nordlys: (klimaendringer arktis) (klimaendringer barentshavet)

Key words: (klimaendringer arktis) 14 articles
Miljøet er taperen Publisert 03.11 2007
Helga er klimaoptimist Publisert 01.10 2007

Sikkerhet som fokus i Arktis Publisert 27.09 2007
Hvordan håndtere endring i nord Publisert 26.09 2007
Vil dempe striden om Arktis Publisert 13.09 2007
Tysk partnerskap i nord? Publisert 05.09 2007 09.09
Frøken Nordpolen og hennes beilere Publisert 13.08 2007
Et nytt hav smelter fram Publisert 19.06 2007
Klima, liv og lære Publisert 05.06 2007
La frem skrekkrapport Publisert 04.06 2007
Klimavinneren Publisert 02.06 2007
Klimautvikling i Arktis Publisert 21.04 2007
Stort potensial Publisert 13.04 2007
Nordområdestrategi på tynn is Publisert 23.03 2007

Key words: (klimaendringer barentshavet) 10 articles
De oljefrelstes skylapper Publisert 08.06 2007
Skreien rømmer nordover Publisert 14.03.2007
Fra Nord-Norge til nordområdene Publisert 20.02 2007
Katastrofer kan unngås Publisert 19.01 2007
Nordområdene – mer enn prat Publisert 16.01 2007
Gå mot nord Publisert 30.12 2006
Satsing i nord Publisert 27.12 2006
Strategi med vekt på livsgrunnlaget Publisert 18.11 2006
Et Svalbard i endring Publisert 17.11 2006
Helhetlig grep om miljøet i Barentshavet Publisert 06.11 2006

Transportation and shipping in the Arctic

Aftenposten: (skip* arktis*) (skip* barents*) (transport* arktis*) (transport* barents*) (transport* nordområd*)

Key words: (skip* arktis*) 7 articles
Skatten på Nordpolen Aftenposten, 27.08.2007
Russland skal utforske bunnen under Nordpolen Aftenposten, 25.07.2007
Et globalt skippertak Aftenposten, 04.03.2007
Gigantflak revet løs Aftenposten, 29.12.2006
Atomavfall ute når frosten tiner Aftenposten, 09.04.2007
Vil ha tog til Russland Aftenposten, 29.11.2006
Kamp om nye ressurser Aftenposten, 08.12.2005

Key words: (skip* barents*) 1 articles
Et helt hav av muligheter Aftenposten, 23.02.2006

Key words: (transport* arktis*) 3 articles
Canada og USA krangler om smeltende havis Aftenposten, 16.10.2007
Barentshavet, fisk og oljeutvinning Aftenposten, 13.03.2006
Skogbranner truer Arktis Aftenposten, 20.06.2006

Key words: (transport* barents*) 9 articles
Full fart nordover Aftenposten, 01.12.2006
Lekset opp for EU-toppene Aftenposten, 24.11.2006
Olje i Barentshavet - hvor er nyansene? Aftenposten, 19.03.2006
På rett kurs med ny seilingsled Aftenposten, 22.02.2006
Finnmark vil ha oljen Aftenposten, 02.02.2006
Miljøutfordringer i nord Aftenposten, 16.01.2006
Nordområdene i et perspektiv Aftenposten, 06.09.2006
Fremtiden ligger i nordområdene Aftenposten, 01.02.2006
- Mulig å bli enig med russerne Aftenposten, 22.11.2005

Key words (transport* nordområd*) 2 articles
Høegh vil satse 6 milliarder Aftenposten, 05.12.2005
Norge sier nei til felles oljeleting Aftenposten, 29.03.2006

Dagens Næringsliv: (skip* arktis*) (skip* barents*) (transport* arktis*) (transport* barents*)

Key words (skip* arktis*) 5 articles
Isfritt på Nordpolen dn.no, 12.06.2007
Også USA sender skip til Arktis dn.no, 14.08.2007
Øver på utslipp i Barentshavet dn.no, 05.03.2007
Truseltoppen dn.no, 14.02.2006
Hurtigruten går rett vest dn.no, 26.06.2006

Key words (skip* barents*) 3 articles
Ruster opp til russisk vekst dn.no, 06.11.2007
Støre talte til oljetoppene dn.no, 19.06.2007
-Er på de jæveligste steder dn.no, 01.02.2007

Key words (transport* arktis*) 2 articles
Hevder Nordpolen er russisk dn.no, 30.06.2007
Ja til prøveboring dn.no, 28.12.2006

Key words (transport* barents*) 5 articles
Støres mageplask dn.no, 01.12.2006
Vil ta ledelsen i nord dn.no, 04.01.2006
Bygger Shtokman-rør gjennom Østersjøen dn.no, 19.01.2006
Team Norway klar for aktivitet i Barentshavet dn.no, 11.04.2006
Shtokmanrør langt unna dn.no, 20.06.2006

Nordlys: (skip arktis) (skip barentshavet) (skip polar) (transport arktis) (transport barentshavet)

Key words (skip arktis) 7 articles
Statoil forberedt på OLJESØL Publisert 06.03 2007
Det trengs et nytt isgående forskningsfartøy Publisert 19.12 2006
Hurtigruta fra pol til pol Publisert 28.11 2006
Strategiske verdivalg Publisert 31.05 2006

Titanic i Arktis? Publisert 11.01 2006
Oljeaktivitet i nord krever kompetanse Publisert 18.10 2005
12 mill. dollar for å løse klimagåtene Publisert 09.08 2004

Key words (skip barentshavet) 1 articles
Satser i nord Publisert 12.09 2007

Key words (transport arktis) 3 articles
Rekordlite is i Arktis Publisert 21.08
Et stormkast fra Paris Publisert 03.02 2007
Barents 2020 – utfordringer og muligheter Publisert 31.03 2006

Key words (transport barentshavet) 6 articles
Shtokman og norsk nordområdepolitikk Publisert 11.10 2006
Grenseløs kamp Publisert 29.08 2006
Grip mulighetene i nord! Publisert 22.05 2006
Russerne vil øke oljetransporten Publisert 22.05 2006
Samarbeid med Russland om en helhetlig forvaltning av Barentshavet Publisert 06.05 2006
Sjøsikkerhet og oljevern i nord Publisert 22.04 2006

Petroleum and energy politics in the Arctic

Aftenposten: (olje gass nordområd*) (olje gass arktis*) (olje gass barents*) (olje gass polar*) (energi* nordområd*) (energipolitikk* barents*) (energi* *sikkerhet* barents*) (energi* *sikkerhet* arktis*)

Key words (olje gass nordområd*) 8 articles
Slutt i 2046? Aftenposten, 24.09.2007
Knoll og Tott leker sammen Aftenposten, 24.06.2005
Når `tåka letter` i nord Aftenposten, 25.11.2005
- Urfolkene må bli hørt Aftenposten, 01.02.2006
Mørketiden er over Aftenposten, 24.06.2005
Nytenkning tvinges frem Aftenposten, 28.03.2005
Høyre gir full gass i Barentshavet Aftenposten, 06.05.2005
I dag er gode råd billige Aftenposten, 01.02.2007

Key words (olje gass arktis*) 1 articles
Bråk når isen smelter Aftenposten, 17.09.2006

Key words (olje gass barents*) 1 articles
Svømmer i olje og gass Aftenposten, 27.01.2005

Key words (olje gass polar*) 4 articles
Tid for reservater? Aftenposten, 06.10.2007
Faren for oljekatastrofe i nord Aftenposten, 09.02.2006
Ny oljeutlysning provoserer Bellona Aftenposten, 21.02.2006
Måneferd eller slag i luften Aftenposten, 26.10.2006

Key words (energi* nordområd*) 5 articles
Jobber for nordområdene i NATO Aftenposten, 23.10.2007
Drøfter sikkerhet med nordiske naboer Aftenposten, 12.09.2007
Kald krigs test i nord Aftenposten, 27.08.2007
Nordområder setter spor Aftenposten, 30.08.2007
Ingen trussel i dag Aftenposten, 24.02.2007

Key words (energipolitikk* barents*) 5 articles
Desperat energijakt Aftenposten, 08.03.2006
Søker nye gassleverandører Aftenposten, 30.11.2005
Energi er også utenrikspolitikk Aftenposten, 05.10.2005
Barentshavet mot Midtøsten Aftenposten, 07.11.2005
Vil ha mer norsk gass E24, 19.08.2006

Key words (energi* *sikkerhet* barents*) 1 Articles
Ville høre om Norge og Stockman Aftenposten, 13.11.2007

Dagens Næringsliv: (olje gass nordområd*) (olje gass arktis*) (olje gass barents*) (olje gass polar*) (energi* nordområd*) (energipolitikk* barents*) (energi* *sikkerhet* barents*) (energi* *sikkerhet* arktis*)

Key words (olje gass nordområd*) 5 articles
Ingen byttehandel med Russland dn.no, 25.10.2007
Vinn-vinn på Shtokman dn.no, 30.01.2007
Vil ha togforbindelse med Russland dn.no, 30.11.2006
Vil drøfte pomorsone med russerne dn.no, 08.01.2007
Frykter fall i olje-investeringene dn.no, 28.11.2005

Key words (olje gass arktis*) 4 articles
Kamp om Arktis dn.no, 08.08.2007
Bygger dypvannshavn i Arktis dn.no, 10.08.2007
Sibir neste for Statoil? dn.no, 05.06.2007
Mer norsk gass enn olje fra 2009 dn.no, 21.04.2005

Key words (olje gass barents*) 6 articles
Miljødrøm gir oljemareritt dn.no, 24.09.2007
Stopp for oljeutbygging på Snøhvit dn.no, 26.09.2007
- Historisk for oljenasjonen Norge dn.no, 26.05.2007
Vil samarbeide, men vet ikke om hva dn.no, 22.01.2007
- Fornuftig å ta ut oljen dn.no, 11.02.2007
Frykter ikke nedtur etter Snøhvit dn.no, 04.02.2007

Key words (olje gass polar*) 1 articles
Tautrekking om olje på topplan dn.no, 27.03.2006

Key words (energi* nordområd*) 3 articles
- Høyere risiko enn Snøhvit dn.no, 25.10.2007
- Viktig for nordområdene dn.no, 25.10.2007

Bondevik-regjeringen ga blaffen i miljøråd dn.no, 09.03.2006

Nordlys: (olje gass nordområdene) (olje gas arktis) (olje gass barentshavet) (olje gass polar) (energi nordområdene) (energipolitikk barentshavet) (energi barentshavet) (sikkerhet nordområdene) (energisikkerhet) (energi Arktis)

Key words (olje gass nordområdene) 12 articles
En klimaplan Publisert 07.11 2007
Ærlig analyse Publisert 01.11 2007
Jevnt tempo på sokkelen Publisert 31.10 2007
Holmgang om Svalbard Publisert 13.10 2007
Rettssikkerhet eller «arktisk kald krig»? Publisert 05.10 2007
Fast marine? en saga blott? Publisert 03.10 2007
Verd å lytte til Publisert 03.10 2007
Klimatisk oppvarming og fiskeriene i nord Publisert 25.09 2007
Publisert 25.09 2007 Publisert 24.09 2007
Overvåking under vann Publisert 24.09 2007
Olje i nord Publisert 03.09 2007
Bare prat? Publisert 29.08 2007
Nordnorsk deltakelse i nordområdene Publisert 13.08 2007

Key words (olje gass barentshavet) 6 articles
Sameksistens fisk og petroleum Publisert 07.11 2007
Andre veien? Publisert 29.10 2007
En historisk uke i nord Publisert 27.10 2007
Ingen enkle svar Publisert 24.10 2007
For en overraskelse! Publisert 10.10 2007
Mange hunder om beinet Publisert 16.07 2007

Key words (olje gass polar) 6 articles
Å balansere på line Publisert 06.06 2007
Russland? en militær trussel? Publisert 22.02 2007
Goliat kan bli stedet der oljeeventyret starte Publisert 05.12 2006
Et dokument til å bli klok av Publisert 27.11 2006
Kan få oljeomlasting i Repparfjord Publisert 24.08 2006
Fiskevernsona og gråsona Publisert 21.10 2005

Key words (energi nordområdene) 2 articles
Høyres alternativ Publisert 16.11 2007
Små skritt, riktig retning Publisert 06.10 2007

Key words (energipolitikk barentshavet) 1 articles
Gevinster ved norsk-russisk samarbeid Publisert 26.08 2006

Appendix C

Seminars and conferences	
Name	The Climate Conference 2006: Climate research and climate politics – Does Norway make any difference?" [My translation]. ("Klimakonferansen 2006: Klimaforskning og klimapolitikk - Gjør Norge noen forskjell?")
Topic	Climate change
Organizer	The Research Council of Norway
Date	May 2nd 2006
Name	Arctic Frontiers Conference: Balancing human use and ecosystem protection. Attending Policy Making Conference 22nd and 23rd of January: Addressing responsibilities for sustainable development in the Arctic.
Topic	Climate change
Organizer	Akvaplan Niva, University of Tromsø.
Date	January 22nd - 26th 2007
Name	Future (Trans) Arctic Shipping: Legal, Regulatory and Administrative White Spots
Topic	Arctic shipping and transportation
Organizer	Fridtjof Nansen Institute
Date	April 10th 2007
Name	Beyond Apocalypse – Can Scientists, Businessmen, Politicians and Humanists Save the World?
Topic	Climate change
Organizer	Centre for Development and the Environment (SUM), University of Oslo
Date	October 8th 2007
Name	Oil, climate and justice
Topic	Climate change and petroleum
Organizer	ATTAC.
Date	October 12th and 13th 2007
Name	Globale miljøutfordringer og polarområdene by Dr. Bob Corell
Topic	Climate change
Organizer	Thor Heyerdahl International Speech
Date	November 8th 2007
Name	Petroleumsdagen (Petroleum seminar) "Vil du være med å skape energifremtiden?" Ethics, reputation, social responsibility and climate (Etikk, omdømme, samfunnsansvar og klima).
Topic	Energy and climate change
Organizer	Norsk Petroleumsforening Oslo and Polyteknisk Forening Oljegruppe in collaboration between Matematisk-naturvitenskapelig fakultet, Humanistisk fakultet and Samfunnsvitenskapelig fakultet at University of Oslo..
Date	February 8th 2008

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