University of Alberta

Climate, Culture, and the Environment in Northern Iceland

by

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Abstract:

This thesis is an anthropological study of how various groups of Icelanders express and contextualize qualitative analytical themes in relation to climate change. To identify these cultural themes I carried out fieldwork in northern Iceland and interviewed people about their concerns with the cultural impacts of climate change. The cultural impacts to which I refer are socioeconomic, political, and environmental issues being caused by, or existing issues being compounded by, climate change in Iceland. I analyzed these themes to elucidate interconnections between climate, culture, and the environment in Iceland. From an anthropological perspective, Iceland provides an interesting contrast to a majority of current social scientific approaches to the human dimensions of Arctic climate change research. The preliminary results of the ethnographic research I conducted in Iceland demonstrate that views of climate change by Icelanders are multiple, both optimistic and pessimistic.

Preface

From an anthropological perspective, Iceland provides an interesting contrast to a majority of current social scientific approaches to the human dimensions of Arctic climate change research. There are perhaps three main reasons why this is so. First, Iceland is geographically the only country located wholly in the North. Second, there were no indigenous peoples inhabiting Iceland before Nordic settlers arrived in the late ninth century. Third, Iceland has the longest recorded history in the Arctic, including historical accounts of noticeable climatic and cultural changes, and their consequential impacts. Therefore, unlike other circumpolar countries, researching the cultural impacts of climate change in Iceland involves only one cultural group of people living in Iceland over an extended period of recorded history, geographically isolated from the rest of the Arctic (although I acknowledge that recent, limited immigration to Iceland is contributing to cultural diversity and that perceptions of those recent migrants would make an interesting study). A section of my research elaborates on the interconnections between climate and culture in Iceland over this nation's history, but I have primarily focused on present day climate change. This elaboration will provide an historical background and emphasize the interconnections of Icelandic culture to the island's already variable and unpredictable climate, establishing a cultural baseline from which a better comprehension of contemporary climate change in Iceland can be understood.

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I will end by giving a special thanks to my mother for all her unwavering support of my research and my choice to pursue an academic career in anthropology, for the time and effort

spent reading and commenting on drafts of my thesis, and most especially for helping me of out of an unnerving situation in Iceland when it mattered most.

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Chapter One

Introduction: Climate Change and People

The reality of climate change has become a controversial issue for scientists, politicians, and people in general since this phenomenon was brought to public attention back in the 1980s (Dunlap 1998:489; Bord et al 1998:76). In the 1990s, and into the 21st century, scientists debated if climate change is occurring. And if it is, what is causing climate change? There have been many heated discussions regarding these issues, with some scientists stating that climate change is not occurring, while others are stating that current observations indicate climate changes are occurring naturally. However, the majority of scientists researching climate change at this time are highly confident that human activities related to industrialized nations have been the prime drivers of contemporary climate change (IPCC 2007:37). Further research into these debates uncovers the highly political and economical overtones behind the statements made by governments and certain scientists, especially by scientists associated with big energy companies and corporate think tanks (Ghelbspan 2004:48). The politics and the manipulation of media to shape the current public understanding of climate change would make for a worthy thesis in itself; however, in this thesis I assume the premise that climate change is happening, and will continue to happen in the long term. As Milton notes, anthropologists sometimes have to accept the social realities of scientific knowledge to participate in solutions to environmental problems. "By taking a different approach and choosing, for practical purposes, to accept the scientific arguments, anthropologists might play a role in effecting a solution." (Milton 1992; quoted in Herzfeld 2001:185).

This premise is based on the vastly accredited multidisciplinary scientific reports produced by such international organizations as the Arctic Council and the Intergovernmental Panel on Climate Change (IPCC). The Arctic Council published the *Arctic Climate Impact*

Assessment (ACIA) report in 2005, which consisted of a study of Arctic climate change conducted by over three hundred scientists. The IPCC is an international research consortium established by the World Meteorological Organization and the United Nations Environmental Programme, comprising over fifteen hundred scientists. This organization has been publishing reports on climate change since 1988 stating that climate change is happening at an alarmingly accelerated rate, and anthropogenic factors are the prime cause of these climatic changes (IPCC 2008). In the IPCC's latest assessment report released in 2007 it was firmly stated 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 GHG concentrations." (IPCC 2007:37; italics included) According to these reports, climate change is most evident in Polar Regions, and since the 1990s, the Arctic has received considerable attention by scientists studying climate change. The Arctic has been experiencing a warming trend since at least the 1980s, and this region has shown the most evidence of environmental and cultural changes linked to climate change. Initial research into climate change in the Arctic has focused on the interconnections between the physical and biological systems of the environment and climate change; and how humans are contributing to the causes of climate change. Missing from this research is the inclusion of humans as part of the local Arctic ecosystems in which they live. In many reports, scientists made very general conclusions that a warmer climate would open up access to the vast natural resources of the North, and that the impacts to indigenous peoples living in the Arctic would more than likely be negative (Center for Global Change and Arctic System Research 1995; Environment Canada 1997, Weller and Lange 1999).

In response to the absence of Arctic peoples' perspectives in climate change research, the human dimension of Arctic climate change research emerged in the early 1990s, with social scientists investigating how the impacts of contemporary climate change are impacting, or

potentially will impact, the indigenous peoples who live in the Arctic. Since the 1990s notable Arctic scholars, such as Krupnik and Jolly (2002), Nuttall (2001), Berkes and Jolly (2001), and Fox (1998) collaborated with indigenous peoples in the North to involve them in the political, economical, and environmental debates related to climate change at local, national, and international levels. A major focus of this type of social scientific research has been to show how indigenous peoples are observing, and responding to climate change in relation to their present socioeconomic, ecological, and cultural well-being (Fox 1998, Riedlinger 2001a). Furthermore, the traditional and/or local ecological knowledge that some indigenous people have of their local environments has informed scientists about subtle connections linking climate, the environment, and people not previously accounted for by Arctic researchers (Biewalski 1995; Riedlinger 2001b, 1999; Riedlinger and Berkes 2001).

Although there are still considerable gaps in Arctic climate change research, both in the natural and social sciences, collaborative studies between indigenous peoples and social scientists have incorporated a human dimension into this area of research. For instance, the research contained in the Arctic Council's ACIA devotes two complete chapters to address and clarify indigenous perspectives, concerns, contributions, and goals in regards to climate change research and policies; as well as in regard to adapting to climate change (Nuttall et al 2005; Huntington and Fox 2005). However, as comprehensive and extensive as the ACIA is, there is very little mention of the impacts and effects that climate change may have on non-indigenous peoples living in the Arctic. For example, in reference to Iceland, the ACIA provides three climate change scenarios, all indicating a warming trend. The most severe warming trend has the potential to collapse key Icelandic fisheries temporarily, crippling the nation's main industry. In each scenario the ACIA reports that the social impacts of a warming event will be minimal, causing increased unemployment and shifts in population, a situation that the Icelandic

government should be able to alleviate through its social programs (Vilhjalmsson and Hoel 2005:729-731). These authors also state more research is needed to investigate social impacts that may be influenced by climate change in Iceland in more detail.

The research presented in this thesis is an anthropological study with the goal of contextualizing cultural and environmental themes related to climate change as expressed by various groups of Icelanders. To identify these themes I interviewed Icelanders who directly interact and/or are concerned with cultural and environmental impacts of climate change, such as farmers, fishers, and scientists; namely socioeconomic, political, and environmental issues being caused by, or existing issues being compounded by climate change in Iceland. I analyzed these themes to elucidate the interconnections between climate, culture, and the environment in Iceland by focusing on observations, perspectives, opinions, and impacts of climate change to Iceland's people and environment.

From an anthropological perspective, Iceland provides an interesting contrast to a majority of current social scientific approaches to the human dimensions of Arctic climate change research for three reasons. First, geographically, Iceland is the only circumpolar country located wholly in the North (see Figure 1). Second, there were no indigenous peoples inhabiting Iceland before Nordic settlers arrived in the late ninth century. Third, in comparison to other circumpolar countries, Iceland has the longest recorded history in the Arctic, including historical accounts of noticeable climatic, environmental, and cultural changes; and their consequential impacts on Iceland's landscape and people (Pàlsson and Durenberger 1989:xi-xii). Therefore, unlike other circumpolar countries, researching the cultural impacts of climate change in Iceland involves only one cultural group of people living in Iceland over an extended period of recorded history, geographically isolated from the rest of the Arctic. A section of the literature review in this thesis elaborates on the interconnections between climate, culture, and the environment in Iceland over

this nation's history; however, I have primarily focused on present day climate change as the subject of analysis and discussion. The literature review will provide an historical background and emphasize the interconnections of Icelandic culture to this island's already variable and unpredictable climate, establishing a cultural baseline from which a better comprehension of contemporary climate change in Iceland can be developed.

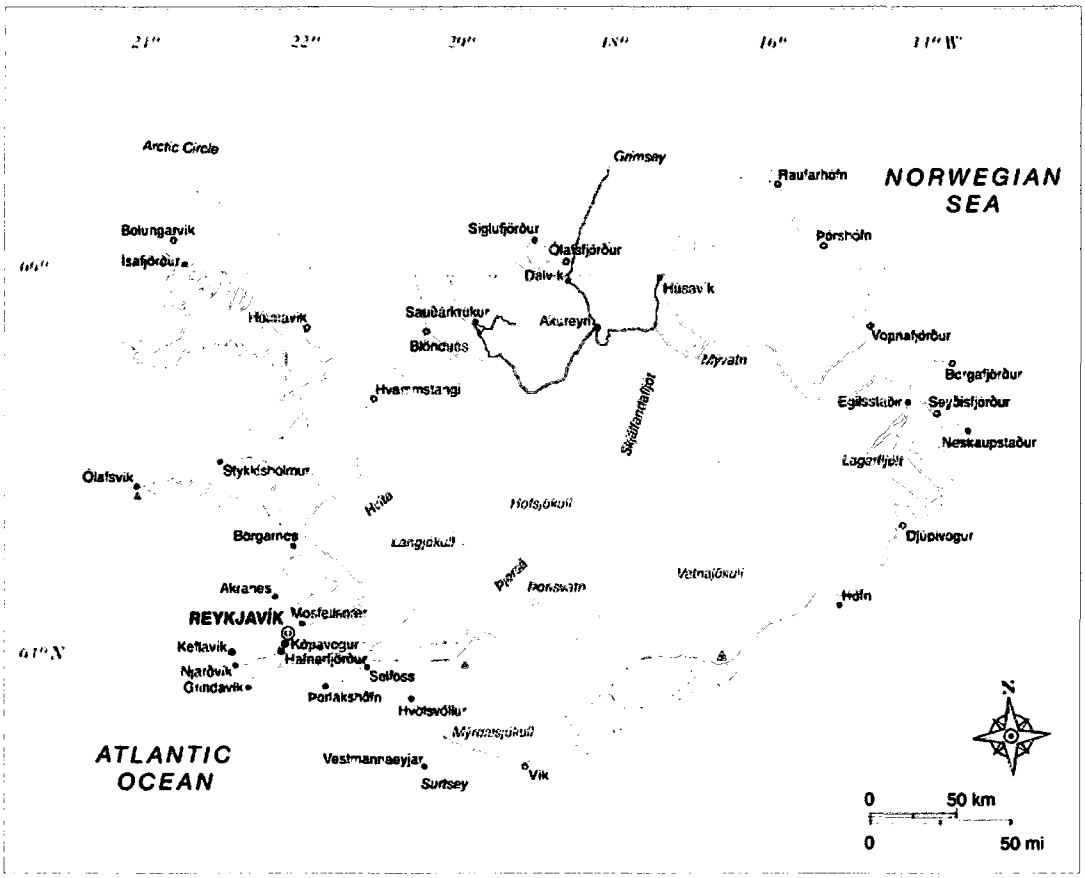

Figure 1: Map of Iceland. Available at http://commons.wikimedia.org/wiki/Image:Map_of_Iceland.svg. Image modified by author. Dark lines were added to show the travel routes to the communities where I conducted fieldwork.

To accomplish my analysis of the research outlined above I will first provide a literature review of primary and secondary sources pertaining to the interconnections between climate and culture in Iceland. This literature review starts with a brief description of the science of climate change, as well as the anthropology of climate change to situate the reader with a current context

of this issue both as a physical and cultural phenomenon with potentially serious consequences. The literature review ends with an overview of Iceland's history in relation to impacts climate and environmental changes and events have had on Icelanders. This overview establishes an historical and cultural context exemplifying these interconnections. Fortunately, researchers such as Ogilvie, McGovern, and Jónsson have conducted extensive research regarding the history of climate and culture in Iceland, and how these changes were perceived and experienced by Icelanders. Thus, there is a rich literature concerning climatic changes in Iceland and the resulting environmental and cultural impacts associated with these changes. Second, I will describe the methodology I adopted to conduct my anthropological research and fieldwork to demonstrate that; although understudied, the impacts that contemporary climate change is impacting Icelanders. These impacts are having consequences which have not been mentioned, or are accounted for, in previous research investigating issues of climate change in Iceland. Third, following the description of my methodology and present a thematic analysis of the results of my collection of Icelandic discourse, primarily from firsthand accounts, of observations and any associated cultural and environmental impacts related to changes in Iceland's climate, especially in the last twenty to thirty years. The Icelandic discourse shaping the content of this thematic analysis is based for the most part upon the thirty-three interviews I conducted in Iceland from April to June, 2007. Fourth, will be a discussion of the potential changes to Iceland's culture and environment if the North continues to become warmer. This discussion is also based on interviews with Icelanders, in addition to the actions and attitudes expressed in available primary and secondary sources concerning climate change and Iceland.

The literature review will also provide some background information describing the science and anthropology of climate change in plain language to summarize the leading theories explaining natural and anthropogenic causes of global climate change. This will include a

summary of what scientists have been reporting concerning current observations of climatic changes, and what scientists are predicting to be potential impacts of climate change in the short and long term for Arctic and sub-Arctic climates. I will also discuss the current status of the anthropology of climate change, emphasizing the need for more anthropologists and other social scientists to incorporate climate change into social and cultural research.

Chapter Two

Climate and Culture in Iceland: A Literature Review

2.1. *The Science of Climate Change*

Greenhouse gases (GHG's), such as carbon dioxide and methane, are not necessarily harmful gases to people and the environment. GHG's actually regulate the earth's temperature, but these gases are also capable of altering the earth's climate when their concentrations significantly increase or decrease. The theory behind anthropogenic causes is that the activities of industrialized nations are increasing the concentration of GHG's in the earth's atmosphere to the point where these gases are not escaping as fast they are accumulating. Since the 1960s, if not before, scientists have been reporting that there are too many GHG's accumulating in the atmosphere, not allowing incoming solar radiation to escape as fast as it accumulates (Riedlinger 2001b:12). This is referred to as the GHG effect, the prime driver of contemporary climate change, also known as radiative forcing. During warming trends this radiative forcing acts as a thermal blanket retaining solar radiation, thereby increasing global temperatures. Scientists have estimated that GHG emissions have increased by 70% from 1970-2004, with CO_2 accounting for 77% of this increase, or 53.9% of the total increase. The present concentration of GHG's in the atmosphere is higher than it has been in the last 650,000 years, and it has been suggested that a further doubling of GHG emissions could cause a 2.5°C to 4°C increase in global surface temperatures. Basically, anthropogenic factors stand above the other drivers of climate change, with the burning of fossil fuels being the most notable anthropogenic contributor that is accelerating the accumulation of GHG's globally (IPCC 2007:37-38).

Other drivers of climate change include aerosols (chlorofluorocarbons) and land cover, as well as other poorly understood factors that influence climate change, such as the feedback loop

related to how sea-ice reflects 80% of solar radiation away from the earth's surface when there are significant quantities of sea-ice. Conversely, when multi-year sea-ice melts there is a negative feedback loop causing solar radiation to be absorbed by ocean water rather than reflected, increasing ocean temperatures, potentially resulting in a 75% ice-free Arctic Ocean by 2050 (Istanes et al 2005:935). Furthermore, there are other factors such as the thermohaline cycle that regulates salinity levels and the direction of major warm and cold ocean currents. The importance of the thermohaline cycle to Icelandic perceptions of climate change will be discussed in more detail below, as this climate change driver could be potentially influenced by human activities. This is a prominent issue among Icelanders related to climate change, as a change in major ocean currents, such as the reversal in direction of the Gulf Stream, would have devastating consequences for these people (Kattsov and Källén 2005:125).

The Arctic was a region to first show signs of climate change and evidence supporting the theory that climate change is being caused by humans, and that climate change is affecting humans. The Arctic has become a key area in climate change research, acting as a canary in the mine, warning the world of significant climatic changes to come (Nuttall 2001:30). Under current climate change scenarios predicted in the ACIA and IPCC reports, temperatures in the Arctic could rise as much as 5°C on average, with a predicted 0.2°C rise per year in the next twenty years. Not all parts of the Arctic will experience the same warming, with places in the North Atlantic, such as Iceland, only expected to experience a 2°C increase. The greatest projected changes in warming will be in autumn with potential temperature increases of up to 9°C predicted for some regions of the Arctic. These reports also mention that ocean temperatures are expected to rise by 1°C in the Arctic Ocean, and up to 2°C in the Barents Sea and south of Iceland. Moreover, predictions of increases in precipitation and storms are expected in northerly regions, including Iceland (Kattsov and Källén 2005:100). There are many more indicators and

observations to list here, exemplifying the reality of climate change in the Arctic, but based on 29,000 plus observations documented by the IPCC, 89% of these confirm a warmer climate globally (IPCC 2007:33). For instance, scientists have identified many current and potential impacts to biological and physical systems. Commonly cited examples are the northward distribution of plant and animal species into sub-Arctic and Arctic environments, resulting in less habitable areas for plant and animal species adapted to current sub-Arctic and Arctic environments, as these species have to compete with new species for food in an altered habitat or move northwards (Anisimov et al 2007:696, Drinkwater 2005:1328-1329, Bjornsson and Pàlsson 2004:9-10). There is also mention in the IPCC's fourth assessment report of an initial loss of biodiversity in northern ecosystems, such as Iceland, as new and invasive plant and animal species gradually replace the current ones (Rosenzweig et al 2007:6)

What is more, Nuttall et al (2005) note that the preliminary and baseline research that has been conducted with indigenous peoples in the North has emphasized the fact that climate change will impact more than just physical and biological systems, and that people living in the Arctic have a knowledge of their local environment invaluable to the understanding of such a complexly encompassing issue as climate change. Many indigenous peoples, in their current cultural contexts, feel they are being, or will be, negatively impacted if their local environments are drastically altered by climate change. In the past, before contact with Europeans there is archaeological and historical evidence identifying the ways in which these peoples adapted to climatic changes in the past not available to them now, particularly migration to where subsistence resources can be located (McGhee 1987:14). Conversely, many governments of circumpolar nations envision opportunities for economic development and growth, increased access to natural resources, opening up of Arctic shipping lanes, and the expansion of agriculture and settlement in the Arctic. For many of the national governments located in southern regions of

circumpolar nations these opportunities appear to outweigh the existing, probable, and potential negative impacts to Arctic ecosystems and peoples that may be caused or compounded by climate change (Heininen 2004:31, Tennburg 2000:42-43, World Wildlife Fund 1996:6-7). Unfortunately, this trend has also developed in Iceland concerning rural communities that have almost exclusively resource dependent economies (McGoodwin 2007:47-48, Cameron 2005:34).

Additionally, the Arctic conceivably would become more conducive to the living conditions of non-Arctic peoples, resulting in possible north and south migrations of people from hotter and drier equatorial areas (MacKellar et al 1998:170, Valsson 2006:69). However, there has been some headway by researchers, indigenous peoples, NGO's, and others to make governments and corporations at least consider sustainable approaches to the development of resources and Arctic communities, by respecting the cultures and resources of the people who live in the region (Nuttall 2002:196).

2.2. *The Anthropology of Climate Change*

In anthropology, cultural perspectives of climate and climate change have received comparatively less attention than, say, cultural perspectives on the body, the environment, and ideology; and their respective impacts on the cultures in which these perspectives are formed (Strauss and Orlove 2003:2-3). This may be in part due to the attempts by early anthropologists such as Evans-Pritchard, Mauss, Kroeber, and Stenning to view climate as the primary factor that determined a peoples' interaction with their environment, and with each other; shaping and changing their cultures over time. Nonetheless, Herzfeld, a highly regarded anthropologist and social theorist, contends that these theories always yield interpretations and explanations from an after-the-fact perspective. Therefore, in Herzfeld's view, the influence of climate and weather on

culture was always observed in hindsight, and early deterministic theories based on the environment were criticized for excluding culture as something that impacts and changes itself and other cultures (Herzfeld 2001:176-177). Rayner also faults previous theorists of ecological anthropology for taking an overly deterministic approach to effects that the environment and climate has had on peoples and their cultures (Rayner 2003:286).

However, climate and weather are intrinsic parts of the cultural viewpoints of people around the world, and are talked about with great frequency in peoples' everyday conversations. With the looming issue of global climate change, anthropologists such as Strauss and Orlove assert that more anthropological research on the cultural perspectives of climate change is needed. This research is necessary because the impacts that climate change may cause will be experienced and perceived differently by people, depending on an individual's cultural perspective, socioeconomic status, and local environment (Strauss and Orlove 2003:2-3). Moreover, unlike Herzfeld's contention that impacts to culture caused by climate change are always from hindsight (Herzfeld 2001:185), contemporary climate change places anthropologists, and other social scientists, in a temporal context where change is occurring and social scientists have the opportunity to contribute to climate change studies, reporting the voices of communities from the ground level and dealing firsthand with already occurring impacts of climate change. But, as Rayner and Malone (1998a) assert, for anthropology and other social sciences to influence climate change research, individuals trained in the social sciences need to influence the policies and decisions being proposed and implemented by governments and nations at regional, national, and international levels. Thus, social scientists need to question the limitations of science, and demonstrate to decision-makers and policy-implementers that other ways of knowing about the 'natural world' by people other than scientists should also be acknowledged. This stance towards a more involved anthropology of climate change is reasserted emphatically by Crate and Nuttall

(2009) ten years later, emphasizing the need for anthropology to also look at the people involved in climate change from the top-down, in addition to the growing climate change research at the community level. Crate and Nuttall advocate that anthropologists investigate scientists and scientific knowledge of climate change and how this knowledge is beginning to be implemented in increasing regional, national, and international contexts by decision-makers. Policies and legislation based solely on scientific knowledge have the tendency to overlook cultural impacts to local peoples, as do government policies and laws; therefore, it may not be necessary to question the science confirming climate change, but to consider how this science is being applied to mitigate or adapt to climate change by top level decision-makers (Crate and Nuttall 2009, Lahsen 2007, Rayner and Malone 1998b).

For example, the existing resource management policies such as Iceland's individual transferable quota (ITQ) system was not designed, and it has not been changed, to account for climate change impacts on fishers operating on small boats. In fact, initially the ITQ system was to be implemented as a temporary regulation, yet it has become more rigid and integrated since its implementation in 1983 (Pàlsson and Helgason 1995:118). On the one hand, this could be viewed as an inevitable consequence of the industry, as big trawlers will always have the advantage of operating in most weather conditions, whereas small boats are very susceptible to weather and sea conditions, especially the wind, as will be discussed in more detail later. Furthermore, big boats also have the advantage of being able to bring in bigger catches, obviously due to their larger size and the fact they hold more quotas, and hence the rights to catch more fish. On the other hand, one has to wonder that if the Icelandic government kept ship sizes for fishing boats to a certain limit, would Icelandic fisheries be as depleted as they presently are. In this regard, from a ground-level viewpoint, if it were not for new technologies for building bigger and better fishing vessels such as trawlers, the overexploitation of Iceland's fisheries may not be as

depleted as they are now. In retrospect, a large fleet of smaller fishing boats may have potentially been a more sustainable approach to fishing, in regards to both environmental and cultural interests of Iceland in the long-term. More people would still be employed in this sector; however, as will be discussed later, climate change poses a potential direct and indirect risk to the Iceland fishing industry. A growing emphasis on tourism and the predicted surge in international shipping across the North Atlantic and Russian Arctic waters, which are opening up as sea-ice is rapidly receding, provide competing industries to traditional Icelandic industries of fisheries and agriculture.

Perceptions of, and responses to climate change are shaped by the existing cultural and environmental conditions in which climate change occurs, as well as being shaped by previous instances of climate change culturally communicated through oral stories, historical texts, and more recently through scientific studies and popular media (T.V., internet, video, etc). Thus, as Strauss and Orlove state, when climate is thought of, and talked about, "... we must recognize that our perceptions as well as our reactions are shaped by our culture." (Strauss and Orlove 2003:6).

It should be noted here that throughout this thesis references to scientific or expert knowledge, and local or traditional knowledge, are used to describe certain individuals' ways of knowing, experiencing, and acting within their environments, be they academic, social, or natural environments. The distinction between these two types of knowledge systems is that scientific knowledge is very specialized and shaped by Western cultural traditions in the development of science. For instance, many scientific disciplines analyze and reduce physical and natural systems to their smallest components to understand how these systems are created and how they are interrelated. Traditionally, scientists have devised experiments to test hypotheses in their search for knowledge. The passing down of scientific knowledge has been institutionalized in universities, training individuals to be experts in a particular field. Expert knowledge also

includes those university graduates who have little or no formal scientific knowledge, but are considered experts and professionals such as lawyers, teachers, historians, and social scientists.

Local knowledge in its most general sense is the knowledge people have of the environment in which they live and interact. In most Western cultures this knowledge is not acquired as much from parents and family as it is from school teachers, who teach children about the world. In Western cultures science has become a superior knowledge over what people not trained as scientists know, and has come to dominate and silence the knowledge of these people. Basically, scientific and expert knowledge was initially rooted in the local knowledge systems of Western European cultures, but through cultural changes in a period in history referred to as the Scientific Revolution, scientific knowledge was developed and institutionalized. This development of science has progressed to scientific knowledge gaining hegemony over other bodies of knowledge in explaining the physical complexities and interrelations of the world. This has happened in Western cultures over the last few centuries, with scientific knowledge being the base or foundation of knowledge that people in Western cultures learn (Henry 1997, Fischer 1999, and Herzfeld 2001). For instance, most Westerners more than likely unquestionably believe in evolution, and that the earth orbits the sun while spinning on its axis at a tilted angle, even if they cannot explain the science behind such a belief. This acceptance of scientific knowledge to form a view of the world as most Westerners do, based upon what scientists say, does not mean these people have expert knowledge; though they do have local knowledge of science and of interactions with their own environment. This type of knowledge has been referred to commonly as 'layman's perceptions' or 'plain language', otherwise known as the public understanding of science (Yearly 1999:486-487).

However, in social sciences local knowledge has a deeper meaning, and is usually reserved for people who have an expert quality of knowledge pertaining to their surrounding

environments. This distinction of 'local' is tied into the recognition of the traditional ecological knowledge (TEK) of indigenous people by social scientists as an equally acceptable way of making sense of the world as is scientific knowledge. Caulfield et al (2004:127-128) define traditional knowledge as:

> "... a body of knowledge, practice, and beliefs about the dynamic relationships of living beings with one another and their environment, which has evolved by adaptive processes and been handed down from generation to generation. In some regions of the Arctic the phrase *local* ecological knowledge is more commonly used." (italics in original).

Iceland industrialized relatively late, after World War II, and activities such as fishing and farming modernized rapidly, but Icelanders still relied on the knowledge of fishing and farming passed to them from kin. In the 1960s Iceland's Marine Research Institute (MRI) was established, and that is when the scientific knowledge of marine biologists directed government policy concerning fisheries and the resulting quota system. The knowledge of fishers has become inferior to science in the view of the Icelandic government as I observed and was informed by Icelanders. It should be noted that scientists advised Icelandic government officials; however, the interests of people with large ITQ portfolios also played into government decisions regarding quota limits (Pàlsson 1991:145-148). This reliance on scientific knowledge for acquiring accurate information has increased markedly amongst Icelanders, but there are still Icelanders who have retained traditional Icelandic ecological knowledge, such as the renowned weather club in Dalvík, or the people who recall when this traditional knowledge was used in the past. As Ward and Bollason have observed, elderly farmers are storehouses of local and historical knowledge of the landscape where these people live (Ward and Bollason 2004:256). Pàlsson has also documented at length the knowledge Icelandic skippers possess in relation to their livelihoods, and how gradually this knowledge has taken a back seat, as it were, to scientific

knowledge and technologies. An atmosphere of distrust has developed between fishers and scientists when Iceland's MRI was established, with both groups being suspicious of each other's knowledge. Gradually the marine biologists have replaced skippers as the expert authority on Icelandic fisheries used by the government to provide information for management decisions (Pàlsson 1991:145-148). Skippers are now awarded an annual quota based on the scientific findings of the MRI, rely primarily on media and meteorological reports for weather conditions, and they use high-tech fishing boats to navigate and catch greater quantities of fish. Nonetheless, the subject of weather is a very integral aspect of traditional Icelandic ecological knowledge, as weather conditions, both short and long term, have had a heavy influence on the livelihoods of Iceland's two main ways of making a living up until the 1980s, namely fishing and farming. McGoodwin sums up the above dialogue appropriately in a quote he recorded from an Icelandic fisherman living on Heimaey Island:

> "I used to know that when the sea and the weather got colder it would be easier to get haddock. And when the wind was from the southeast, making bad weather, it would be easier to get cod. In the autumn, when the mountains over on the mainland began to look grey in the distance, it would be easier to get haddock – these were the signs. But knowing these things is not so important these days, because now the government tells us where the fish are." (Icelandic fisherman, as quoted in McGoodwin 2007:51).

The methodological approach I have adopted to guide my research is grounded in ecological anthropology, with a specific focus on Rayner's theory postulating that climate mediates peoples' cultural relationships with their environment, as well as with themselves (Rayner 2003:289). However, I should note that to acquire a working knowledge of climate change and understanding of Icelandic culture I utilized sources from many disciplines. Before describing further Rayner's theory in relation to my own research, I will briefly define ecological

anthropology. This sub-discipline explores how humans shape their environment, and how the environment shapes people's cultures. The foremost guiding principle followed by ecological anthropologists is that people and their cultures are tied into the ecosystems in which they inhabit. Changes to people, the environment, and climate all constitute changes to ecosystems, resulting in ongoing changes to people, environment, and climate; no matter the causes (Kehoe 1998:132-133). To distance myself from deterministic views of climate, culture, or the environment; I am making no claims, implicitly or explicitly, that any one of these elements is ultimately deterministic over the other. The position I hold is that climate, culture, and the environment are always in flux, whether it be from natural, cosmological, or anthropogenic factors; and therefore, there is always a constant interplay of these forces with one another, with certain elements playing a more determining role in the ongoing roles of the other elements under certain circumstances. Iceland is an excellent example of how the climate in the times of Settlement played a huge role in the migration of Nordic peoples to Iceland; as well as the impacts humans can have on the environment, transforming a mountainous island with forested coasts to being dominated by wasteland and grassland in a few centuries (Ogilvie and McGovern 2000). Furthermore, humans have played a role in shaping, or at least accelerating, global climate change; which will to varying degrees play determinist roles in ensuing environmental and cultural changes (IPCC 2007). As Rayner concludes, "We could add that 'A change in ourselves and the world is sufficient to recreate the weather. 'That might be an appropriate thought for a world reportedly on the brink of global climate change'." (Rayner 2003:289).

There is a two-way relationship between people and their environment, as changes to the environment, whether natural or anthropogenic, result in changes to the activities, thoughts, and feelings of people towards their environment and each other. The issue of climate change has added a taken-for-granted element to the relation between people and nature, with climate acting

as a significant mediator between people and nature. Hence, climate change alters how people mediate their actions and perceptions to each other and their environment. (Rayner 2004:289). I believe this is a very important connection when elucidating how people are a part of the ecosystems they inhabit, how people change these ecosystems, and how people then adapt to these changes. Some Arctic researchers have pointed out that there are many more pressing environmental, social, and economic issues that need attention in the Arctic than climate change (Einarsson et al 2004; Wenzell 1995). However, these social scientists do admit that climate change has become intertwined with these other issues, changing the relationships people are having with their environment, compounding existing environmental and cultural issues, as well as creating new issues and problems (Einarsson et al 2004). This is synonymous with Amorsi et al's theory of parametric and strategic contexts (which be discussed in more detail below); however, Amorsi et al placed climate change as a prime driver of major changes to current parametric contexts that will gradually change the strategic contexts of Icelanders (Amorsi et al 1997:506-507).

Without becoming mired in a theoretical justification regarding my methodology I will briefly state how I have come to view contemporary climate change theoretically, as based on the views of anthropologists such as Nuttall, Crate, and Rayner; scientific reports; and my own experiences interviewing Icelanders on the subject. First, in this thesis I am not questioning if the climate in the Arctic, or globally, is changing, and if these changes are being caused mainly by humans. The scientific and non-scientific evidence indicating climatic changes are happening, and will continue to happen, is overwhelming (IPCC 2007:33). Second, I must agree with Rayner in that climate change is a social construction in the sense, that climate change has become more than just a physical reality. The fact that some experts deny climate change is happening at all enforces this fact (Cameron 2005:31, Ghelbspan 2004). Climate change has different meanings

and ramifications for different people based on their location, culture, and present socioeconomic status; such as in the Arctic. Furthermore, scientists base future climate projections on computer models and simulations with often insufficient data to account for all variables (Rayner 2003:282-283). Therefore, as climate change becomes an increasingly important global environmental issue, decision-makers and stakeholders will be planning such policies as resource management, construction, economic development, land use, and conservation based on the social constructions of virtual models of future climate scenarios. Once more, this offers an opportunity, as Lahsen has learned, for anthropologists to ground the projections, long-term goals, and agendas of governments and scientists by providing professional advice about the social and cultural consequences of such actions on a variety of peoples and populations. This advice would be based on an anthropologists' understanding of the science of climate change, scientists researching climate change, and the people making decisions based on this science, as well as an understanding of the realities of people living with an abnormally changing climate at the ground or local level (Lahsen 2007:9-10).

An instrumental strategy employed by the few anthropologists researching the issue of climate change is interdisciplinary learning, going outside of, but not abandoning, traditional anthropological approaches and methodologies. Anthropologists such as Crate and Nuttall (2009), Rayner and Malone (1998a), and Lahsen (2007) uphold that anthropology, and other social sciences, need to bridge the knowledge and relational gaps with environmental scientists in a collaborative fashion. This is not a new argument; for instance, this issue has become a prominent argument in the present and future use of computing technologies such as geographic information systems and computer generated global climate change models (Rayner 2003:282-283, Aitken and Michel 1995:20-21). Fortunately, as Crate and Nuttall proclaim, anthropologists are experts in forming partnerships, and it has been environmental scientists who have resisted

listening seriously to other perspectives to the point of accepting them as valid and/or useful in scientific research (Crate and Nuttall 2009:395). Therefore, it is crucial for social scientists to push, persuade, worm, or otherwise persist in engaging with their academic equals by becoming familiar with their research to show the social and cultural factors unaccounted for in this research, as well as the consequences and contributions to future action concerning climate change that the social sciences can provide; by bringing people into the fabric of environmental sciences. The familiar cliché 'in the middle of the road' may come to mind as social scientists will need to develop methods to bridge not only the gap between social and environmental sciences, but social scientists must continue to bridge gaps between the cultures they are working with. In other words, social scientists studying climate change and other sociocultural issues tied to the environment need to be effective mediators, facilitators, and communicators bridging academic, geopolitical, governmental, and cultural gaps to reduce the sense of separation of these circles and emphasize their linkages and overlaps. I found early in my research that I would have to go beyond purely anthropological approaches to the topic of my thesis, namely because anthropology has been lagging behind in its involvement in climate change research (Crate and Nuttall 2009:394-395, Finan 2007:10).

In regards to narrowing my theoretical perspective on the cultural realities of climate change, I opted to explore what Icelanders are observing in relation to changes in their climate, and how these changes affect the social realities being perceived and experienced by these people. To clarify, not all Icelanders perceive and experience climate change in the same way. However, there are some commonalities represented in the Icelandic discourse identifying several themes that are to some degree collective perceptions shaping an overall social reality of climate change to Icelanders, consisting of consensual, complementary, and conflicting views.

2.3. *Interconnections Between Climate and Culture in Iceland over Time*

Before focusing on the literature review relevant specifically to the historical interconnections between climate and culture in Iceland, it is necessary to summarize briefly the main areas of anthropological research that have been conducted in Iceland to demonstrate how this discipline has evolved and expanded upon the traditional anthropological roots on which anthropology in Iceland was founded.

The study of the anthropology of Iceland developed late as an academic discipline within Iceland in the 1970s, with its establishment as an academic discipline at the University of Iceland. Durrenberger and Pàlsson (1989) attribute the inspiration for Icelandic anthropology to the now famous early ethnographies on Inuit peoples written by Vilhjalmur Stefansson. Stefansson was a North American born and educated Icelander who travelled extensively throughout the Canadian Arctic, writing about the indigenous peoples living there. However, the study of people, or *mannfræði* in Icelandic, has roots deep in Iceland's history, written by Icelanders and non-Icelanders alike (Pàlsson and Durrenberger 1989:xv-xix). Icelandic history, kinship, folklore, and language were all topics well researched by academics from other disciplines; as well as by Icelanders themselves. Icelanders are very proud of their history, in the sense that they have recorded their own history by their own historians, despite Iceland being the political property of other kingdoms, and later nations, from the 13th century up until Iceland became independent in 1944. Icelanders are even more proud of their independence and are somewhat wary of 'others' or 'foreigners', as these types of people have historically exploited Icelanders for their land, resources, and services (Hastrup 1998:47).

Hence, the development of anthropology was one overseen prominently by Icelanders who studied their own or other cultures based on issues of human-environmental relationships,

kinship, gender issues, ideological transformations of economic activities, and identity. These trends in the anthropological research continue to this day, and have been influenced and modified by national and international changes and interactions since the 1970s (Pàlsson and Durrenberger 1989:xviii-xix).

After anthropology became an established discipline at the University of Iceland in the 1970s, anthropologists, mainly Icelanders, in the 1980s began to research cultural issues connecting Iceland's historical cultural contexts with its ever shifting contemporary cultural context (Pàlsson and Durrenberger 1989:xviii-xix). Traditional social/cultural anthropological subject areas were researched such as kinship and linguistics (Rich 1989; Pàlsson 1989a). However, at this time Icelandic anthropologists were trained in American or European traditions leading to other subject areas including human and environmental interactions. Specific areas examined focused on how people viewed both their terrestrial and marine environments, and how these views have changed over time, as the 1980s brought economic, political, and social changes with the introduction of the ITQ system. Spearheaded by anthropologists such as Durrenberger, Pàlsson, and Helgason, (Helgason and Pàlsson 2005; Pàlsson 1991; Durrenberger and Pàlsson 1989; Pàlsson 1989b) the ITQ system provided an immediate and current example of cultural changes due to environmental and ideological changes at the time. Identity issues were also important in anthropological studies, as anthropologists attempted to elucidate what constituted 'Icelandicness' (Pàlsson and Durrenberger 1989; Magnússon 1989). Moreover, gender issues figured prominently in Icelandic anthropology in the 1980s, exploring the roles of men and women in shaping Icelandic society, and the role of Icelandic society in shaping women and men (Kristmunsdóttir 1989; Björnsdóttir 1989).

In the 1990s, the anthropology of Iceland continued to explore issues of Icelandic identities, and how ideological concepts such as nationalism and independence were integral to

what it means to be Icelandic (Lacy 1998; Hastrup 1998; Pàlsson and Durrenberger 1996). This included shifting identities to seem more 'Icelandic' to tourists, while honouring more personal cultural traditions in the presence of friends and family (Einarsson 1996, Ward and Bollason 2004). Gender issues also developed in Icelandic anthropology during this decade, focusing on such issues as women's economic status (Skaptdóttir and Rafnsdöttir 2000) Human-environmental interactions were, and still are, an area of anthropological research, and political movements such as environmentalism and anti-whaling campaigns became politically charged issues amongst Icelanders well documented by anthropologists such as Pàlsson, Helgason, and Einarsson. These anthropological investigations additionally focused on revealing how the transition to a capitalist society alters peoples' relations with their environment and each other (Einarsson 1996; Helgason and Pàlsson 1997; Eythorsson 1998; Pàlsson and Helgason 1995; Pàlsson 1998, 1996, 1991).

As environmental and social issues have become pan-Arctic issues into the 21st century Icelandic anthropology has widened its view of Icelandic human-environmental interactions in a broader framework of human-environmental interactions in the Arctic and globally, best exemplified in sections of the AHDR (Einarsson et al 2004). Kinship has also been sustained in Icelandic anthropology (see Helgason et al 2008), at times under the transparent guise of medical anthropology. A majority of this kind of anthropological research has looked into the anthropological and cultural significance of such genetic research such as the Genome Project, being conducted in Iceland; once again spearheaded by Pàlsson and his colleagues, but also under the anthropological lens of a number of other anthropologists. (Arnason and Simpson 2003; Pàlsson and Helgason 2003; Pàlsson 2003, 2002; Pàlsson and Haroardottir 2002; Simpson 2000; and Pàlsson and Rabinow 1999). It should be noted that Gisli Pàlsson is a key figure in Icelandic anthropology and he has set a precedent for social and cultural anthropologists in Iceland in a

number of research fields. Additionally, there are many more anthropological works concerning Iceland than mentioned above, including anthropological works written in Icelandic.

Surprisingly, the anthropology of climate and climate change has until recently been confined to the realm of archaeology and history. Archaeological and historical research concerned with Iceland's prior climate, land-use, population distribution, archaeofauna, etc. is vast in comparison to any other anthropological research, as will be demonstrated below. This invaluable research has provided one of the most complete climatic, environmental, and social histories and reconstructions of a region populated by people in the Arctic over the last thousand plus years. With the exception of researchers such as Ogilvie and McGoodwin (2007), an anthropology of contemporary climate change in Iceland has not yet become prominent, but this area is rich in background material and ecologically minded anthropologists can take the initiative and contribute to current social and cultural understandings and responses to changes in the environment and climate by elucidating their interconnections, and not the determinacy of changes caused by people, environments, or climates. An objective to my thesis is to show that anthropological research and insight into scientifically complex understandings of such phenomenon as climate change can expand upon anthropological theories based on ecological approaches, but more importantly anthropological understandings of climate change may also ground scientific knowledge, when it becomes unwieldy and conflicting.

For the purposes of the literature review I will explore the interconnections between climate, the environment, and culture in Iceland over time. I consider work with a focus on historical Icelandic perspectives and responses to climatic changes over the country's history based mainly, but not exclusively, on the research of Ogilvie and her colleagues. Ogilvie has conducted extensive research into the history of Iceland's climate and culture to reconstruct a climate timeline to compare with Iceland's human history. Her research includes a number of

analyses of Iceland's unusually rich collection of historical sources, including the Sagas, annals, administrative reports, weather diaries, and the accounts of travelers who visited Iceland. Moreover, Ogilvie uses these historical records to verify the results of climate proxy data collected from ice cores and marine sediment cores by scientists, and vice versa (Ogilvie 2005, 1986, and 1984; Ogilvie and Jónsson 2001; Ogilvie and Jonsdottir 2000; and Ogilvie and McGovern 2000). Thus, through the efforts of these scientists, Iceland's climate history has been extensively researched and analyzed, including comparisons with Iceland's historical records. This has provided me with suitable sources, verified for their historical accuracy, from which I was able to research relevant historical accounts pertaining to climate change by Icelanders. Ogilvie and Pàlsson assert that even though historical accounts may be untrue, exaggerated, or personally biased they can be analyzed by anthropologists as if they were accounts from informants; as these accounts are still an expression of an historical cultural perception. These two authors identify three ways that climate and weather were perceived by Icelanders as expressed in the Icelandic sagas. Climate and weather were recorded as an actual fact, used as a metaphor to create mood, or associated with magic (Ogilvie and Pàlsson 2003:252-253). For the purposes of this literature review I will limit my research to the historical accounts of climate and weather which Ogilvie and others have verified as being for the most part factual.

In reviewing the literature, I was concerned with how, throughout this island's history, Icelanders have perceived and responded to climatic changes and their consequent impacts. The abovementioned data to be reviewed will be from primary sources discussing historical Icelandic discourses pertaining to climate and weather. I divided this chapter into four sections, each covering a specific time period. The first section will cover 871 – 1299 AD, the time when Iceland was first discovered and settled by Viking explorers. The second section covers 1300 – 1599 AD, a period when a cooling climate begins to noticeably impact Icelanders. The third

section, covering 1600 – 1899 AD, the coldest time period in Iceland's inhabited history, also contains the most complete historical information relating to climate change previous to the twentieth century. The fourth section will describe climate and culture in Iceland in the twentieth century. In each section I will provide a brief overview of the Icelandic climate and how Icelanders responded to the impacts of climate change in each of these time periods, whether it was responses to short term, or to more long term climatic changes. Furthermore, I will comment on the ways that weather and climate events are framed by the authors of these historical accounts. To conclude, I will discuss the present situation of climate change research in the first years of the 21st century in Iceland, including Iceland's position towards climate change, and identify gaps in climate change research pertaining to social and cultural impacts in Iceland. The conclusion will also emphasize any similarities and differences between contemporary and historical climate change in Iceland.

2.3.1. *Iceland AD 871 – 1299*

During this time period the North Atlantic region and northern Europe were undergoing a warming trend that would last approximately until the 14th century. According to many Arctic researchers, this warming trend is similar to the warming trend in the 20th century. This warming trend also caused considerable melting of Arctic sea-ice, allowing Vikings, mainly from Norway and England, to explore the North Atlantic and settle in Iceland, Greenland, and Vinland (Newfoundland). Thus, climate change was initially responsible for the exploration and colonization of the North Atlantic region by Nordic peoples (Ogilvie and McGovern 2000:386).

For approximately three centuries after Icelanders first settled, the Sagas mention very few references to actual climate or weather events. Unfortunately, there are no historical

documents from this time period, but some references to Iceland's climate and environment at this time were made in the *Book of Icelanders*, an Icelandic Saga written between 1122 – 1133 (Ogilvie 1984:140). 1145 was recorded as being a cold year and the first unquestionable account of sea-ice, and in 975 and 1056-1057 news of famine were reported, possibly due to severe winters; however, these accounts are exceptions rather than the norm in the early documentary sources (Ogilvie et al 2000:39). In the 13th century there are a few more references to weather and climate in the sources, with more frequent observations of sea-ice by the end of this century, as well as reports of famine (Ogilvie 1984:141). Of particular interest were the reforms made to the Icelandic law books, *Grágás,* at the end of this century. These reforms included restrictions on the trade of fish and wool out of Iceland in times of food shortages caused by severe winters, as well as laws outlining management policies for common pasture lands to prevent overgrazing (Ogilvie 1984:141, Simpson et al. 2001:181-182).

According to Ogilvie and McGovern, the first settlers of Iceland had access to an untouched 'bank account' of natural resources to draw upon for their settlement needs, as no other people had ever settled there before. The author(s) of *The Book of Icelanders* makes references to large stands of birch forest when the settlers first arrived. "In those days Iceland was clad with trees and bushes between shore and sea" (*Book of Icelanders*, quoted from Ogilvie and McGovern 2000:390). Furthermore, the climate and environment were described as very suitable for farmers to grow barley and support their livestock, which included sheep, cows, goats, and pigs. Evidence of a warmer climate in the North Atlantic during this period has been confirmed by scientific research, supporting second-hand historical sources. Ice cores, marine sediment cores, pollen analysis and other interdisciplinary linkages all indicate a warmer climate at this time (Ogilvie and Pàlsson 2003:258-259).

Vikings arrived in Iceland around 871, becoming Iceland's first settlers (*Landnamsmen*). These settlers were politically organized into chieftainships, where chiefs ruled by force. Feuds between chiefs were common in Iceland at this time, impacting where people could settle, and who had access to the best farm lands. In 930 the Icelandic parliament, *Althing,* was formed, making it the oldest parliament in Europe. In early times the function that the *Althing* provided was a place where chiefs and their followers were obliged to gather annually and form, break, or reaffirm alliances in attempts to gain or retain prestige and power (Durrenberger 1989:232). Around 1000 Christianity spread to Iceland, and building churches became a symbol of a chief's status. Church building culminated in the building of two massive wooden cathedrals at *Hólar* and *Skalholt* in this time period, requiring the importation of timber, stained glass, and large bronze bells. The building of these churches indicated the wealth and prestige Icelandic chiefs had at this time. In the 12th and 13th centuries bishops started to exercise their own control over the church holdings (Amorosi et al. 1997:494).

By the end of the 12th century the clearing of forests, establishment of farms and churches, and the resultant soil erosion caused by these activities limited Icelandic agriculture to the growing of fodder to feed sheep and cattle, with very little barley being grown. It is also believed that pigs and goats contributed significantly to soil erosion (pigs eat roots), and the clearing of forests (goats eat trees and shrubs), as the presence of pig and goat bones in archaeofauna collections declines sharply after the twelfth century (Amorosi 1997:501). In 1262 Iceland lost its independence to Norway, causing no major changes to Icelandic society, with the exception that the power of Icelandic chiefs diminished, who now had to pay tribute to the King of Norway. Land owning farmers became the elite of Icelandic society, renting their land to tenant farmers. Land owners also owned most fishing boats, and they owned the shores where ships could be landed, thus controlling fishing activities. This basic structure of land-lord/tenant

farmer relationships in Icelandic society lasted for most of Iceland's history until the late 19th century (Pàlsson 1991:87-88, Ogilvie and McGovern 2000:388-389).

Although there is little historical data describing Icelandic climate in this time frame, it is important to keep in mind possible strategic and parametric contexts that contributed to the transformation of Icelandic culture and environment over time in the face of climatic changes. According to Amorosi et al, strategic contexts are the situations where people in the past make certain decisions based upon their interactions with other people. For example, settlers chose, or were forced, to settle at particular farmsteads and practice agriculture. Parametric contexts are situations where environmental or climatic changes or events occur, where people need to respond, and possibly adapt to these changing conditions. Using the previous example, if climatic changes caused crops to fail at these farmsteads, the farmers would need to supplement their subsistence by fishing more, or even abandoning their farms in search of better land. Therefore, the strategic contexts of the past influence the strategic contexts of the future in broader parametric contexts (Amorosi 1997:506-507). In other words, the choices people make in the past have a direct influence on the choices available to these people's descendents in the future. The *Landnamsmen* made several choices in a strategic context to take advantage of the parametric context of a warmer climate, such as introducing new flora and fauna to Iceland, and organizing themselves agriculturally and hierarchically. Moreover, these settlers cleared away most of Iceland's forests to build farms, churches, boats, and to feed their animals. These choices would later have impacts on the strategic contexts available to Icelanders when the parametric context of Iceland changed due to climatic and environmental changes. For example, the introduction of pigs and goats, and the cutting down of trees for building materials and for developing agriculture lead to considerable land erosion. This land erosion circumscribed the available land people deemed suitable for farming, reducing the amount of land-owners, while

increasing the amount of landless Icelanders. Thus, as the Icelandic environment became more circumscribed, landless Icelanders became more dependent on land owners for survival in times of crisis (McKinzey et al. 2005:331). As I shall discuss later, this has a contemporary manifestation in the ITQ system in Iceland's fisheries in the twentieth century.

2.3.2. *Iceland AD 1300 – 1599*

At the beginning of the 14th century many *Landnam* farms were abandoned due to barrenness or destruction by landslides, a result of land erosion. Farmers who lost small and medium sized farms were forced to become tenants of larger land owners. Large land owners were able to deal more easily with the impacts of land erosion, namely by having the resources and labour to 'ride out' periods of dearth and famine, or to relocate farms if necessary (McKinzey et al 2005:331). Dearth years occurred when, "... there was famine and deaths from hunger all over the country" (Ogilvie 2005:280). The further circumscription of habitable land in Iceland would continue into the 14th century due to the onset of a cooler, but highly variable, climate than that of the previous period. Much of the land in Iceland at this time was owned by the Church and by large land owners. Common Icelanders were struggling with issues of land erosion, attempting to mitigate its impacts by using dung as fertilizer and by constructing irrigation canals (Simpson et al. 2001:187). However, the parametric context of Iceland changed as a harsher and more unpredictable climate came to dominate Iceland.

It was in the late 13th and 14th centuries when weather events are first reported in a contemporary context in the Sagas of Iceland. The most important indicator of a changing climate in the sagas, and a recurrent theme in the historical literature, is the presence of sea-ice. The occurrence of sea-ice becomes more frequent in the 14th century than previously, and with

the sea-ice came cooler seasonal temperatures. When sea-ice reached the shores of Iceland it would cool the seasonal temperatures on land greatly, causing crops to be less productive or to fail altogether. Boats for trade and fishing were also unable to enter or leave Iceland in some seasons due to the presence of sea-ice. Furthermore, even during years without sea-ice, cold winters caused dearth and famine (Ogilvie 1984:142).

The climate of the 14th century was highly variable with the first half of the century being rather mild with only six years being singled out as having severe weather and sea-ice: 1306, 1320, 1321, 1323, 1331, and 1341. From 1350 – 1380 incidences of sea-ice and severe weather were recorded more frequently than the first half of this century (Ogilvie 1984:142). One bishop, Gudmundur, described the landscape and climate of Iceland in the 1350s, stating that at times sea-ice surrounds this island, only small amounts of barley are grown, and there was little in the way of forests left in Iceland (Ogilvie 2005:263). This account illustrates how the changes brought about by both people and climate have impacted Iceland's environment since the island was settled.

The last two decades of this century and into the 15th century are reported to be mild. Reports of famine and sea-ice years are few and far in between. From 1430 – 1560 contemporary sources of data are very few. One possible explanation for this decline in Icelandic scholarship postulated by Ogilvie was the outbreak of the bubonic plague in Iceland in 1402, and again in 1492. It is interesting to note that the few sources that do mention weather events during this time period are framed in an especially negative context. For instance, one historic account states that successive years of dearth and famine preceded the outbreak of the bubonic plague in 1492: "...that a sign for this plague (in 1492) had been severe dearth years in the land. There were no fish in lakes and rivers so neither trout nor salmon was caught. This lasted for three or four years before the epidemic started." (*Biskupa Annalar Jons Egilssonar* 1856, quoted in Ogilvie

2005:267; parentheses in original). Ogilvie suggests that from 1412-1470 the climate was relatively mild, indicated by the lack of food products being imported to Iceland from this island's most important trading partner at the time, England. Ogilvie assumes that if food products were not being brought to Iceland, than crops must have been fairly successful in these decades, indicating a mild climate (Ogilvie 1984:142).

The climate history in the first half of the 16th century is very limited, but there were reported famines in 1508 and 1543, as well as severe winters in 1519, 1521, 1525, and 1552. In regards to the last four decades of the 1500s, the climate was relatively cold and harsh, with frequent sea-ice years (Ogilvie 1984:143). Around 1560, Icelanders resume writing contemporary and historical documents regarding life in Iceland. The most important of these texts in the latter half of the 16th century were the geographical works of Agrunimur Jónsson and Oddur Einarsson. The first geographical work, *Brevis Commentarius de Islandia*, by Jónsson, written in 1592, describes the variability of sea-ice annually and also mentions the hunting of seals on the ice. Thus, although sea-ice was considered an 'unwelcome visitor' Icelanders did develop coping strategies, such as hunting marine mammals, in efforts to offset the worst of the impacts caused by severe weather years and by sea-ice. Einarsson writes of similar climate conditions regarding Iceland at this time in his geographical work written in 1589, *Qualiscunque descriptio Islandiae*. Einarsson refers to sea-ice as an 'unwelcome and terrible visitor' to Iceland in many of the years in the 16th century, and he sees the coming of sea-ice as a punishment sent by God for sins which Icelanders have committed (Ogilvie 2005:270-272).

It should be noted that from the 14th century onwards fish became an important export item to Europe from Iceland, in addition to supplementing the subsistence diet of Icelanders. However, fishing did not become the primary economic activity of Icelanders until the late 19th century (Ogilvie and Jonsdottir 2000:387). A further note is that Denmark established rule over

Norway and Iceland in 1380, imposing significant restrictions on the economic development of Iceland (Ogilvie 2005:273). Overall, as the climate became colder and sea-ice 'visited' Iceland with more frequency, Icelandic perceptions and responses to the impacts of a colder climate were associated with fear, unpredictability, plagues, famine, and divine punishment. Periods of mild weather were blessings, the Grace of God, fortunate, and otherwise less reported than were years with severe weather and sea-ice.

2.3.3. *Iceland AD 1600 -1899*

From the 17th century onward, sources pertaining to climate and weather are far more numerous and consistent in the Icelandic historical records. The most important of these historical sources, according to Ogilvie (2005), are the annals of the 17th century and the administrative letters of district sheriffs in the 18th and 19th centuries. For whatever reason, writing of annals stopped in the 15th and 16th centuries, and then resumes again in the 17th century, presumably inspired by the annals written in medieval times. The authors of the 17th century annals recorded annual events, including weather and other environmental events that had noteworthy impacts on Icelanders. These authors were careful to document years of severe weather, sea-ice, famine, and dearth. Ogilvie states that many of the authors of the annals were ministers and educators, as well as farmers, who were particularly concerned with the climate conditions as these greatly influenced the success or failure of their crops, and consequently the yields of crops and numbers of livestock the farmer could support (Ogilvie 2005:267).

Ogilvie identifies three annals that provide the most complete record for the 17th century. Unfortunately, she does not provide details regarding any important references to weather or climate. However, from using these sources to verify proxy data such as ice cores and marine

sediment cores, Ogilvie and Jónsson have constructed a climate index for this century. In summary, Ogilvie and Jónsson postulate that Iceland's climate in the 17th century was variable, but there was a relatively mild period from 1640 – 1680. In this span the presence of sea-ice was rare, and appeared not to have come at all in the 1650's. The 1630s and 1690s were decades with the coldest years in this century. However, as Ogilvie notes the presence of sea-ice in the 1630s was rare. Therefore, severe weather is not always caused by the presence of sea-ice (Ogilvie and Jónsson 2001:31). Although Ogilvie does not elaborate on climate descriptions from the annals for the 17th century in the sources I have researched, Ogilvie and Jonsdottir do comment on the state of the Icelandic fisheries for the last two decades of this century. These last two decades were cold ones, particularly the 1690s where the presence of sea-ice was not uncommon. Fishing was poor in these decades as reported in the historical documents, contributing to the hardships people were experiencing on land (Ogilvie and Jonsdottir 2000:390). Overall, Iceland's climate was variable in the seventeenth century, but not overly severe with the exception of the 1630s and 1690s.

Moreover, through historical and ethnographic research, McKinzey et al (2005) focus on reports of glacial movements in south-eastern Iceland starting in the 17th century. For the 17th century, Iceland's glaciers in this region were relatively stable, but they did show signs of advancing. Around 1650, people reported in documents that access to inland roads and pastures were being blocked by ice. At the end of the 17th century the advance of *Breidamerkurjökull* caused people to abandon their farms at *Fjall* and *Breida* in 1695 and 1698 respectively. These farms had been established in 874, indicating that this particular glacier was relatively stable up until the 17th century. This was also during years of severe weather and sea-ice, further compounding these farmers' plight in their search for viable land (McKinzey et al 2005:323).

The 18th century is characterized by many historical and contemporary scholars as the most severe century in Icelandic history in regards to climatic changes and other environmental impacts, such as glacier movements and volcanic eruptions. The primary historical data for this century comes from the monthly reports of Iceland's district sheriffs to the Governor of Iceland, who was appointed by the Danish Crown. Throughout this century there were numerous letters written by sheriffs reporting severe years resulting in dearth and famine caused by very cold winters, sea-ice, glaciers, and volcanic eruptions (Ogilvie 2005:273). In regards to the climate, Ogilvie states that from 1700 – 1710 the frequent presence of sea-ice continued from the 1690s. However, in contrast to this latter decade the first decade of the 18th century was relatively warm. Conversely, the 1730's were very cold with low incidences of sea-ice. It was also in this decade that a definite long-term cooling trend set in, lasting into the 19th century, with the 1740s and 1780s being exceptionally harsh decades (Ogilvie 1984:146). For example, in twenty four of thirty six years spanning from 1730 – 1766 there were many deaths of livestock and people from starvation due to successive years of severe weather (Ogilvie and McGovern 2000:389). During this period, a sheriff's letters from one of Iceland's districts, written in 1753, stated that many Icelanders were starving due to years of dearth, resulting in livestock being culled for food. People who had no food were said to have resorted to eating roots and sea weed, while others capitalized on opportunities to hunt marine mammals such as seals and whales brought by the sea-ice (Ogilvie and McGovern 2000:388). In 1761 another historical account, that of Jon Jónsson's weather diary, refers to people eating sea weed in times of hardship (Ogilvie 2005:276). With the exception of eating sea weed and roots, Icelanders have resorted to culling livestock in the past, as well as the intensification of the exploitation of marine mammals to cope when the climate was cold. Fishing increased in this century as well, and became another option for Icelanders to turn to when conditions were poor for farming. This is evident in the growing

number of fishing communities established independently from land owners. Icelanders in these communities would hire themselves out as fishers to foreign boat owners from England, Germany, and the Netherlands; at least until a law was passed by the Danish Crown in 1783, which forced landless Icelanders into tenancies with land owners (Ogilvie and McGovern 2000:390).

Compounding the impacts caused by the exceptionally cold climate of the 18th century were the advancement and retreat of glaciers, and the Mt. Laki eruption of 1783. The eruption of Mt. Laki produced a thick and massive cloud over most of Europe. In Iceland this eruption blanketed fields with volcanic ash, and the fog blocked the sun, causing widespread dearth (Ogilvie 1986:71). Glaciers advanced very little, disrupting trade routes at most in the first half of the 1700s. *Breidamerkurjökull* was visible from the farm of *Reyniveller* around 1730, and it was described as 'large and horrible' (McKinzey et al 2005: 303). In the latter half of the century there was a noticeable advancement of *Breidamerkurjökull*, causing the tenant farm of *Fell, Brennhólar*, to be abandoned in 1794. Icelanders referred to the end of this century as the 'great sea-ice years' (McKinzey et al 2005:323-324).

The 18th century was the coldest century in Icelandic history impacting Icelanders' cultural lifestyles and livelihoods in a highly negative manner. This is reflected in the titles of some of the major historical documents contemporary to this time period. For instance, Finsson wrote the *Loss of Life as a Result of Dearth Years*, which described the climatic and environmental conditions that seemed to cause dearth and famine. Thorarensen, Governor of eastern and northern Iceland from 1783 until his death in 1823, wrote another book on the subject of dearth years in an attempt to identify the causes of dearth years. More importantly, Thorarensen proposed strategies for mitigating dearth years, such as setting up food stores for reserves in times of famine (Ogilvie 2005:280-281).

In the 18th century Icelandic fisheries failed on several occasions. The major factor for bad fishing years was the presence of sea-ice, preventing fishers from reaching their fishing grounds, causing many fishing communities to be abandoned. Another factor that had a major influence on the economy of Iceland at this time was the outbreak of smallpox in 1707 – 1708, decimating Iceland's population by a third. Labour was in short supply as is evidenced in a description of farmers in one community who were only able to man two out of fifteen boats for fishing in 1732. Consequently, boat sizes became smaller, from 10 – 12 man boats to six-man boats. This reduction in boat size may also be due to a shortage in timber as merchant ships found it difficult to access Icelandic ports in years when sea-ice was present (Ogilvie and Jonsdottir 2000:390-391).

The most significant cultural response influenced by climate change in the 18th century was the passing of the Tenant Act of 1783. This law required landless Icelanders to become tenants to farmers who owned land. This law provided the small number of land owners with guaranteed labour, and exclusive control over the domestic fishing industry as landless Icelanders could no longer form independent fishing communities (Durrenberger and Pàlsson 1989:4). The restriction of trade and land use were common adaptation strategies that Icelanders employed in the past to mitigate the impacts of dearth years; however, the decisions on what and how to restrict the trade and use of essential resources, and by whom, almost always favoured the land owners of Iceland. Politics and ecology are closely tied in the responses of Icelanders to changes in environmental conditions. As many farms were abandoned, and fishing was poor in this century, this caused an increase of landless Icelanders, and a decrease in land-owning Icelanders (Simpson et al 2001:188). The land owners took advantage of this situation to consolidate their land holdings and guarantee themselves access to labour. Thus, access and distribution of

resources became restricted to an Icelandic agrarian elite who decreased in numbers, but increased in power.

The 19th century was not as severe as the previous century, but it was still cold in comparison to the twentieth. Severe weather and sea-ice years continued into the 1800s, especially in the 1810s and 1830s. This is reflected in the historical literature, as sheriffs reported the failure of crops and times of famine. From 1840 – 1855 a mild period is observed in the records. This was short lived and replaced by a colder, but less harsh climate, with the exception of the 1880s, a severely cold decade with sea-ice being a frequent visitor. In 1880-1881 many sheriffs reported severe cold and fogginess for these two years, leading to poor conditions for crops. These reports foreshadowed the harsh climate conditions that came to dominate this decade. The 1890s were less cold with few occurrences of sea-ice (Ogilvie 2005:283-284). Farmers in the early 20th century are quoted as saying, "that by 1893 the worst was over." (Ogilvie 2005:285).

As an industry, fishing became increasingly important, as new fishing and boat technologies were introduced to Icelanders, such as motor-boats and trawlers. Moreover, the climate was slightly warmer than in the 18th century, with fewer reports of bad fishing years. In 1894 the Icelandic government abolished the 1783 Tenant Act, freeing landless Icelanders from their obligations as tenants if they so chose. Within a few decades fishing replaced agriculture as the main industry in Iceland, with most people being employed in the fishing industry (Durrenberger and Pàlsson 1989:6-7). As in previous centuries a common coping strategy for Icelanders during successive cold years was to cull livestock so that they did not overgraze, and so people did not starve. Other Icelanders left their farms because they became unviable. Two innovative coping strategies developed by Icelanders in this century were the introduction of

potatoes to Icelandic agricultural system, and the emigration of Icelanders, mainly to North America (McKinzey 2005:331).

Glaciers retreated in the first half of the 19th century, opening up land to Icelanders that was abandoned in the past, but this lasted only for a few years. In the latter half of the century Icelandic glaciers advanced, destroying at least one major farm, *Fell*, and its outlying tenant farms. However, this farm was relocated higher upslope at a safer location (McKinzey 2005:331).

2.3.4. *Iceland – 20th Century*

In the 20th century, glaciers in Iceland receded rapidly, so much so that some peaks of mountains were seen for the first time in Iceland's human history (McKinzey et al 2005:329). Furthermore, in the 20th century Iceland underwent a number of major cultural changes, the most significant being the transition from an agriculturally based society to an industrialized fisheries based society, and the independence of Iceland in 1944. Although the 20th century had a variable climate, just as in all the other centuries, there is a definite warming trend. This trend is most prominent from the 1920s to 1950s, the warmest period in the century (Hanna et al 2004:1208). Icelandic fisheries boomed during this period, harvesting quantities of fish in the hundreds of thousands of tons for the first time. These fishermen invested in bigger and faster boats with the latest fishing technologies, allowing them to travel farther and catch more fish. The Icelandic economy flourished under these conditions until the late 1950s and 1960s, when a sharp cooling in the Icelandic climate occurred. Several of Iceland's fisheries collapsed, most importantly the herring industry, while other fisheries were near collapse (Pàlsson 1991:135). This climate

change caused a depression in Iceland's economy, as fishermen struggled to catch enough fish to make a living.

The town of Siglufjörður, in northern Iceland exemplifies the sudden boom and subsequent bust of the herring industry in the first half of the 20th century, brought on by over-fishing and climate change. Up until the bust in the herring industry this community was known as the "Herring Capital of the World" (Hamilton et al 2004:326). Hamilton et al interviewed residents of this community and consulted historical records to determine what combination of factors influenced the rise and fall of the herring industry. The 1920s to 1950 were signalled as a 'golden age' for Siglufjörður, as many people moved there in search of employment in the booming herring industry. The population swelled from less than a hundred people in 1890, peaking at 3100 people in 1949. The bust came when the climate became markedly colder and the herring stock disappeared. Unemployment was rampant, and the golden age of Siglufjörður was over, with most people moving away from this town in the 1950s and 1960s. The remaining residents still rely on fishing for their livelihood, but fishers concentrate their catches on other species of fish, such as capelin and cod, as well as shrimp (Hamilton et al 2004:331-333). Since 1987 another warming trend has been observed in Iceland (Ogilvie and Jónsson 2001:32-33).

In response to the drastic declines in the fisheries, the Icelandic government instituted policies that at first restricted foreigners from fishing in Icelandic waters. This culminated in the 'Cod Wars' with England in the 1950s and 1970s, and the establishment of Iceland's 200 mile EEZ in 1978 (Pàlsson 1991:135). However, fishing stocks were still dwindling due to over-fishing by the Icelandic fishermen. Therefore, the Icelandic government implemented fisheries policies restricting access to fishing grounds amongst Icelanders.

The most recent fisheries policy is the ITQ system, giving boat owners exclusive access to fishing grounds. Since the implementation of ITQ's in 1983, owners of large ships have gradually bought out the quotas from smaller boat owners. Small boat owners could not afford to maintain their fishing enterprises based on their small quotas in years when total allowable catches were set at very low limits by the government. Thus, the ITQ system has developed in a manner similar to Iceland's agricultural system. This similarity is seen in Icelandic responses to the collapse of key fisheries in the 1960s as a result of climate change and over-fishing. As the resources became scarcer, Icelandic decision-makers restricted access to these resources. As with agriculture in the past, when climatic conditions worsened and access to resources became more restricted, the control, access, and distribution of these resources was concentrated in the hands of an elite class of people. In the case of the 20th century the elite class in Iceland became boat owners, and later, owners of ITQ's. In this case, owners of large boats or fleets of boats were in possession of most of Iceland's ITQ's, as small boat owners sold their quotas to avoid bankruptcy when fisheries collapsed again in the 1980s. To gain access into the fishing industry today, Icelandic boat-owners must now rent quotas from the ITQ owners and give a share of their catch to the owner of the quota. It is no wonder that Icelanders refer negatively to owners of large ITQ portfolios as 'quota kings' and 'lords of the sea' (Pàlsson 1991:141). This is similar to Icelandic farmers who owned small farms in the past, who were forced to abandon their farms due to climate change and overgrazing, and then had to become tenant farmers to large land owners.

As a possible result of the implementation of the ITQ system, which drastically restricted the numbers of people who could participate in the fishing and fish processing industries, Iceland's economy since the 1980s is transforming. Formerly, Icelanders worked primarily in the fisheries. Now, they are primarily employed in the services and energy industries. According to Statistics Iceland only 2.7% and 2.2% of Icelanders employed in 2006-2007 were fishers and fish

processors, respectively. Employment in agriculture is also low in Iceland, contributing to 3.8% of employment. The main sectors of employment in Iceland presently are the services sector, employing 72.2% of the population, and the industrial sector, employing 21.2% of Icelanders (Statistics Iceland 2007:8). However, it should be noted that although very few Icelanders are actually employed by the fisheries, this industry provides over 13.5% of Iceland's GDP and 70% of its exports, making Iceland's economy the most fishery dependent economy among all other industrialized nations in the world (McGoodwin 2007:40). The point to be made here is to reiterate Hastrup's statements that Iceland has become a modern industrialized country since World War II, competing in world markets, developing and applying new technologies, and being integrated into global economic and political systems as an independent nation (Hastrup 1998:47).

Around the turn of the century, scientists began to study Iceland's climate from a variety of approaches, including climate change impacts on fisheries, glaciers, agriculture, land erosion, flora and fauna, and to a lesser extent on the accounts of Icelanders themselves. Much of the research pertaining to the impacts of climate change on Icelanders has focused on reconstructing Icelandic climate history to identify how and why climatic changes have impacted Icelanders in the ways that they did in the past. It is on the basis of this research that social scientists have surprisingly only just begun to turn their attention to the human dimension of contemporary Arctic climate change in Iceland. It is evident from the content of this literature review of the interconnections between climate and culture that Icelanders have been very susceptible to the impacts of climate change in the past. Although a warmer climate has historically boded well for Icelanders, the contemporary warming trend being experienced in most Arctic regions may have severe and sudden impacts on people and environments in these regions (Nuttall et al 2005). Furthermore, contemporary climate change is being greatly influenced by anthropogenic factors,

such as the unprecedented consumption of fossil fuels that were non-existent in previous instances of climate change. For instance, the ACIA does not include potential extraneous factors that may complicate, exasperate, or complement the impacts of climate change, such as changes to Iceland's fishing management system. This conclusion is rather naïve and short-sighted considering Iceland's long history of environmental changes caused and compounded by both climatic and anthropogenic impacts, such as land erosion and the collapse of certain fisheries. Therefore, climatic and environmental changes are tied with cultural changes, and these changes should be studied in relation to each other, and not separately.

Thus, the Icelandic government and researchers have proposed to take a leading role in research that investigates the interactions of climate change with the human dimension of Arctic research (Arctic Council 2004). However, these areas of research are based almost exclusively on investigating *environmental* changes being caused or influenced by climate change in Iceland, and developing climate friendly technologies; however, how these environmental changes will translate into changes for Icelanders are usually excluded from this research (Fialka, 2007; Steinsdottir, 2007; Vliet-Lanoë et al, 2007; Government of Iceland, 2006; Hanna et al 2006; Gisladottir et al, 2005; Jónsdóttir et al, 2005; Björnsson and Pàlsson, 2004; Björnsson and Jónsson, 2003). There is a noticeable absence of the human dimension in climate change research in Iceland, both in what Icelanders are observing, and how they are being impacted by climate change. This absence may be accounted for by the fact that, unlike in the past, most Icelanders are not employed in industries which will be more directly impacted by climate change, such as fishing and agriculture (Statistics Iceland 2008:8).

As demonstrated in this literature review past changes to Iceland's climate usually have had a direct and serious influence on Iceland's environment and people, for better and for worse. Hence, research and decision-making concerning current and future climatic changes in Iceland

ought to consider the social impacts that such changes may cause, even if these changes in climate appear to only impact a small proportion of Icelanders. This mentality of being concerned with the needs of the majority to the point of dismissing the minority is reminiscent of how certain circumpolar nations are viewing Arctic climate change in relation to indigenous peoples. That is, governments of other circumpolar nations are concerned more with the economic opportunities their northern landscapes will afford with a warmer climate for their countries, rather than how the people who live in these Arctic regions are being, and will be impacted by climate change directly and indirectly (Heininen 2004:31, Tennburg 2000:42-43, World Wildlife Fund 1996:6-7). Recently this has been changing, and as mentioned above the concerns and issues of indigenous peoples of Arctic countries have started to be incorporated into research and decision-making pertaining to climate change; however, as Thompson (2008) has observed in his research of Russian settlers of the Arctic, there still remains a considerable gap representing the concerns and issues pertaining to climate change and non-indigenous peoples who consider the Arctic their homeland.

Therefore, to address this absence in the human dimension of climate change research in Iceland, I have conducted preliminary anthropological research to identify obvious and subtle interconnections between contemporary climate change and culture in Iceland that are either being fleetingly mentioned, overlooked, or understudied in key Arctic reports produced by such international organizations as the Arctic Council, Northern Research Forum, and the Intergovernmental Panel on Climate Change. It should be noted that it is not that the scientists of these reports are unaware of the impacts climate change is having, or may have, on indigenous and non-indigenous peoples alike in any of the circumpolar nations. The ACIA acknowledges the need for more social scientific research looking into the vulnerabilities of Arctic communities to climate change impacts, and what options these communities have to adapt to these changes

(Nuttall et al 2005:685; Vilhjalmsson and Hoel 2005:730-731). Therefore, the following chapters will describe and explain the methodology guiding my ethnographic research and the results from this research as a thematic analysis highlighting some observed and perceived impacts of, and responses to, climate change as reported by Icelanders at the ground level. I chose to collect my data primarily through ethnographic methods to represent Icelandic views of climate change absent from the literature, as scholars such as Berkes, Riedlinger and Fox have done with indigenous peoples.

Chapter Three

In the Field: Methods and Reflections

To conduct the research for this thesis, I employed several qualitative methods for the three stages of research involved in my efforts to contextualize cultural themes of climate change in Iceland. These stages were the preparatory research stage, the ethnographic research stage, and the analysis stage. These stages of research centred on the main focus of my thesis, elucidating the interconnections of climate, culture, and the environment in Iceland; which required traveling to Iceland to interview Icelanders themselves rather than relying on secondary accounts. The paucity of secondary accounts is enough to encourage ethnographic research, especially since the secondary documents that are publicly available mainly focus on economic implications on a national scale. As Helgason and Pàlsson suggest, "The proximity of the ethnographic gaze is better suited to the data at hand than the detached neo-classical view from afar." (Helgason and Pàlsson 1997:467). The methods used and their applications in each of these research stages will be discussed in the following sections.

3.1. *Preparatory Research Methods*

The approach I followed to prepare for my fieldwork is in accordance with Devereux and Hoddinott's steps of preparatory research and procedures to be completed before entering the field. These steps include choosing a location; conducting a literature review of pertinent current and historical primary and secondary documents (In my case this was limited to documents in English related to climate change and Iceland); receive ethics clearance; secure funding for travel, food, and accommodation expenses for a two month stay in northern Iceland; and taking a preliminary visit (Devereux and Hoddinott 1993a:6-11).

Coming into my Master's program I had already decided to research perceptions of climate change by non-indigenous Arctic peoples, and specifically Icelanders. I include Icelanders as Arctic peoples based on the Arctic boundary line defined by the *Arctic Human Development Report* (AHDR) (Young and Einarsson 2004:17-18). Iceland offers a unique location in the North for conducting social-scientific research, especially in relation to human-environmental interactions, such as Pàlsson's anthropological work (1991), *Coastal Economies, Cultural Accounts,* describing Iceland's fisheries based culture in the twentieth century; or Einarsson's anthropological research (1996) concerning Icelandic perceptions of fish and fishing, whales and whaling, and environmentalists. The choice of northern Iceland for my research is based on the fact that this region is at a high latitude, and thus influenced more by Arctic weather circulation than by Atlantic weather fronts, as is more common in southern Iceland. Therefore, climatic changes in northern Iceland should be more observable to the people living there, and therefore may be more consequential than in southern Iceland, but this is speculation based on geographic proximity rather than scientific evidence.

Moreover, my supervisor, Dr. Mark Nuttall holds the position of Senior Associate Scientist at the Stefansson Arctic Institute (SAI) in Akureyri, Iceland. He helped put me into initial contact with the director of SAI, Dr. Níels Einarsson, whom I contacted, telling him of my research and my plans to conduct fieldwork in Iceland for my Master's thesis. Dr. Einarsson replied with a courteous and generous invitation for me to conduct my fieldwork as a visiting researcher at SAI, with access and privileges to this fine institute's facilities and library. Establishing this contact with Dr. Einarsson was very important as I knew I had a least one contact when I arrived in Iceland, (which proved very useful during my preliminary visit to Akureyri) and I would not be without total guidance, as many anthropologists feel when they do fieldwork in an unfamiliar place for the first time. Thus, upon arrival in Akureyri I had a place to

base my research from, and people willing to talk with me; reducing the time, effort, frustration, and anxiety of attempting to establish contacts in an unfamiliar setting resulting in what Devereux and Hoddinott refer to as the 'fieldwork blues' (Devereux and Hoddinott 1993a:15).

I will not reiterate the content of my literature review here, but this research method of gathering, analyzing, and synthesizing information from documentary sources was an integral step in the formulation of my research design, including a tentative interview guide that I prepared before leaving, and during my first week in Iceland. This interview guide contained a list of general questions and topics to prompt, more than to ask, informants to talk at leisure in an attempt to stimulate open-ended responses. Additionally, all participants were provided with a letter of introduction, both in English and Icelandic, describing the intentions of my research and the role of the participant in my research. This letter established the parameters of my research to participants in an open and clear manner, and led to interviews proceeding more smoothly as interviewees came into the interview with some idea of what types of questions that I would be asking them. Consent forms were also provided to participants who agreed to participate, reiterating my research objectives and their rights as participants involved in my research (See Appendix). To respect the rights of the individuals who participated in my research I will use pseudonyms when mentioning them in my research.

Reviewing literary sources also assisted in formulating interview questions pertaining to topics on climate change. For instance, issues such as sea-ice, fishing, farming, and glaciers have historically been impacted and altered by changes wrought by both climate and people. Review of documentary sources also provided basic information about Iceland's landscape and climate. Worth repeating here is that Iceland is mostly mountainous, covered by glaciers, and riddled with volcanoes. Deep fjords cut into the coastlines of northern Iceland and consist of the majority of Iceland's vegetated and populated areas in this region of Iceland (Wake 1998:3). Much of

northern Iceland's non-mountainous terrain is either barren land or grassland. There are also several wetland areas and freshwater lakes, as well as patches of woodland areas (Statistics Iceland 2008:3). The climate of Iceland is classified as a maritime climate, but with a high variability in seasonal weather patterns influenced by Iceland's proximity to the Arctic. Scientists attribute the high variability of weather patterns in Iceland with the location of the North Atlantic Oscillation (NAO), the place where Arctic and Atlantic weather fronts collide (McBean et al 2005:24). Some years the NAO is above Iceland, making the climate usually warmer, and vice versa when the NAO is below Iceland. In some years the NAO is overtop of Iceland creating great variability in regional weather patterns for this country. As such, northern Iceland tends to experience a colder climate with less precipitation, when Arctic weather systems come closest to, northern Iceland, or completely cover this region in some years (Anonymous 2001:2884; Malmstrom 1960:117-119). Preliminary research of the city of Akureyri was also beneficial as this community boasts a university, research centre, and it is in close proximity to smaller fishing and farming communities, initial target locations of my research. Therefore, having a research base in Akureyri provided access to a variety of people with local, scientific, and expert knowledge of the climate and environment in the surrounding region.

After confirming a research location as a base to carry out my fieldwork I applied for ethics clearance from the University of Alberta's Faculty of Arts, Science & Law Research Ethics Board. This organization cleared the ethical conduct of my research based on my commitment to abide by this council's ethical researching regarding human subjects, as outlined in the *University of Alberta Standards for the Protection of Human Research Participants* [GFC Policy Manual, Section 66], and to abide by these standards in conducting my research (See Appendix). I queried Dr. Einarsson about any ethics clearance needed from an Icelandic institution for the type of research I wished to conduct, and he informed me that ethics clearance from the University of

Alberta was sufficient. The next step in preparation for conducting my ethnographic research was to secure funding for travel expenses to Iceland, and expenses for two months of food and accommodations. The main source of funding I received, covering a majority of my expenses was from the Canadian Boreal and Arctic Research and Northern Scientific Training Program grants I was generously awarded by the Canadian Circumpolar Institute. I also received a generous grant from the Canadian-Scandinavian Foundation for funding of travel expenses. I also received funding to conduct my research at the University of Alberta and in Iceland, including the travel costs for my preliminary trip to Iceland, which were graciously provided by the Henry Marshall Tory Chair research program in the Department of Anthropology at the University of Alberta.

There was one final preparatory step before I started my ethnographic research in Iceland. I was fortunate enough to have the opportunity to take a brief preliminary trip to Iceland from March 20th – 31st, to 'test the waters' as my supervisor advised. Devereux and Hoddinott also recommend that a preliminary visit to the field has several advantages including, reducing fear of the unknown and establishing contacts and research locations (Devereux and Hoddinott 1993a:10). As it turned out this was very good advice, as I was able to meet with Dr. Einarsson who was a most cordial host, helping me through some of my initial blunders as a first-time international traveler. During this preliminary visit I was able to become somewhat spatially familiar with the community of Akureyri, and more personally familiar with the staff at SAI. Furthermore, during this visit Dr. Einarsson offered me the opportunity to attend the *Breaking the Ice* conference, which provided me with further insight into potential areas of interest directly related to my thesis. The central theme in this conference was the future of a trans-arctic shipping route with Iceland being a potential location for an international depot harbour along this route.

This revealed a response to climate change that I had not considered during my review of the literature.

Moreover, as a result of this preliminary visit I happened to establish a first contact with an elderly couple in Iceland when I returned to Iceland in April 2007. Unexpectedly, it was when I was back in Edmonton, Alberta from my preliminary visit to Iceland, that I visited with two members of the Icelandic Society of Edmonton who put me into contact with a couple they knew in Akureyri. This couple in Akureyri provided invaluable assistance in putting me into contact with many of the people I interviewed in Akureyri, Dalvík and Grímsey; as well as making me feel very welcome and comfortable during my stay in Akureyri. This couple partially compares to what Hammersley and Atkinson refers to as gate-keepers, key informants providing access to social networks in a community where an ethnographer is researching (Hammersley and Atkinson 1995:64-65). This couple were also gracious hosts, and brought me along on tours of Akureyri and its outlying areas. However, unlike Hammersley and Atkinson's description of some gate-keepers, this couple was not my only access to groups of Icelanders, and therefore I was not limited to the people they suggested as potential participants in my research.

3.2. *Ethnographic Research Methods*

After preparing to conduct ethnographic research I arrived in Iceland on April 20th, 2007 in Reykjavik. From here I caught a flight to Akureyri, a short forty-five minute commute over central Iceland. During the flight the aerial view of central Iceland is dominated by mountains, snow, and ice with rivers and roads criss-crossing occasionally over the terrain. It was only when leaving Reykjavik and approaching Akureyri that areas of relatively flat, vegetated, and populated areas came into view, along with the fjords and the sea. Upon arrival at Akureyri, when I had the

chance to take a moment and survey my surroundings, the day was partly sunny and windy, but most stunning were the mountains front and center on either side of the fjord (*Eyjafjörður*), with Akureyri nestled on the western slopes. Also quite noticeable was the freshness of the air in Iceland when taking a breath. When I arrived I was recovering from pneumonia and I noticed a distinct difference in the air quality between Edmonton and Akureyri. In fact my pneumonia completely cleared up within a couple of weeks.

Akureyri is Iceland's second largest community (population: 17,200), established as a city in 1778. During the 20th century Akureyri has grown to be the unofficial capital of northern Iceland, providing surrounding communities and districts with many services and goods not accessible in less populated districts of northern Iceland. Akureyri boasts a university, social and natural science research centers, churches, movie theatres, theatre halls, a hospital, swimming pools; among a number of cafes, restaurants, hotels, tourist enterprises, and shops. In addition, this community has had a reforestation program in effect since the 19th century, and Iceland's largest forest, *Kjarnaskógur*, is just to the south of Akureyri. Based on Akureyri's geographic location and its importance economically, socially, and politically in northern Iceland; this city acts as a hub of communication and transportation of people, goods, and services throughout northern Iceland (Akureyrarbær 2008). As such, I was able to access the neighbouring districts of Skagafjörður to the west, where I conducted interviews in Hólar and Sauðakrókur, and in Húsavík the largest community on Skulfandi Bay, over the mountains east of Akureyri. The communities of Dalvík, and on Grímsey Island, north of Akureyri, were also easily accessible. These communities were all locations where I interviewed people who participated in my research.

According to Hammersley and Atkinson, ethnographic research is a combination of usually qualitative research methods applied to social and cultural studies (Hammersley and Atkinson 1995:1-2). The two methods I primarily used to collect firsthand accounts of climate

change and any associated observations and impacts were participant-observation and unstructured semi-directed interviews. Additionally, I researched documentary sources that were in English at the SAI and University of Akureyri's libraries, sources which were unavailable through the University of Alberta's library network. However, for this section I will only discuss how I applied methods of participant-observation and unstructured interviewing to collect and analyze the data, in an ethically appropriate manner, for my ethnographic research.

3.2.1. *Participant-Observation*

This method is an inescapable avenue of ethnographic research, as the researcher becomes both a participant and observer to some degree when directly studying other peoples' ways of life. Like ethnographic research, participant-observation is a mix of methods, rather than just being one method, involving both genuine social interactions and field observations pertaining to the topic of the research with subjects in the field (Devereux and Hoddinott 1993b:31) Hammersley and Atkinson identify a range of roles commonly adopted by researchers using participant-observation. These roles range from complete observer to complete participant and a researcher adopts the role that best suites, or at least does not offend or compromise, the research setting, subjects, and the ethics of the research being conducted (Hammersley and Atkinson 1995 101-108). Here I will focus on the particular role I adopted in my approach to participant-observation while in Iceland.

The role I adopted was that of an 'observer as participant', a role which places the researcher in a more objective and detached relationship with his or her participants (Hammersley and Atkinson 1995:108). I decided to adopt this role for several reasons. First, the main focus of my research, climate change, has become a contested political issue internationally, despite both

scientific and non-scientific conclusions that strongly suggest that climate change is occurring (Anisimov et al 2007, Ghelbspan 2004). When approaching Icelanders on the subject of climate change, it was not my intention to prove or disprove theories of climate change, or to identify causes of climate change. Generally, interviewees had their own personal opinions on the issue of global warming, opinions I wanted to limit in favour of what these people are actually observing and experiencing locally concerning changes to the weather and the environment. I simply wanted information regarding weather, observable short and long term changes in climate in northern Iceland, and any possible changes to the environment, or to Icelanders, recently or over the last two decades as a result of the changes in weather.

Second, to take a more participatory role in the two months I had in Iceland would have confined my research to a single community, or a single group of individuals, such as fishers and farmers; as more time and participation would have to be expended with these people to gather more detailed and extensive data concerning a particular group or community of Icelanders. I am interested in Icelandic perspectives from a variety of livelihoods and communities, favouring current reflexive trends in ethnographic research towards multi-cited and multi-vocal perspectives when studying cultural issues (Fischer 1999:458). I view my own research as preliminary in respect to current anthropological studies concerning climate change in Iceland, and I intend to demonstrate that climate change will impact more than just farmers and fishers in Iceland. This decision was further based on the paucity of research concerning climate change regarding Icelandic communities, with the exception McGoodwin's (2007) research in Heimaey (more details on McGoodwin's research is discussed in following chapters); therefore, a multi-cited approach seemed an appropriate method to collect a variety of perspectives from a people composing one cultural group, rather than being restricted to the viewpoints of a specific group or

sub-culture of Icelanders. As Herzfeld notes, there is as much diversity within cultures as between cultures (Herzfeld 2001:18).

Third, the short period of time I had to conduct fieldwork, April 20th – June15th 2007, in Iceland, as well as the time taken to travel and stay briefly in other communities in northern Iceland, did not provide many opportunities to significantly participate in the lives of the people in the communities where I visited. However, I did make an impression when I was in Grímsey, where after I interviewed a participant I was asked to be interviewed in turn with regard to the research I was conducting in Iceland. A few days later, I was featured in an article in Iceland's leading national newspaper, *Morgunblaðið.*

Fourth, there were not many opportunities to participate in activities related to climate change. I did observe abnormal seasonal temperatures while in Iceland, such as record-breaking highs in late April, a unseasonably cold May, followed by a snowstorm at the end of this month; events that became points of conversation about weather and climate change when interviewing some people. My role as an 'observer as participant' was participatory in the sense that I interacted with Icelanders daily giving me a sense of how important weather, and conversations concerning weather, are to Icelanders. This importance is best exemplified by what the founder of the weather club in Dalvík told me during an interview when I asked him why the weather club was founded. He told me that the weather club was not so much about predicting the weather accurately as it was about bringing the elderly people at Dalbær together to give them something in common to talk about, and to challenge their minds. This daily interaction reinforces Strauss and Orlove's statements regarding the importance of climate in the lives and cultures of all peoples (Strauss and Orlove 2003:5-6), as well as Rayner's theory that climate and weather mediate peoples' relationships with each and with their environment (Rayner 2003: 289). Moreover, this also exemplifies the importance of weather and climate to the everyday lives of

Icelanders, as Lacy has observed, "But no matter what the weather, it is a frequent topic of conservation." (Lacy 1998:25). Lacy's book (1998), *Ring of Seasons,* describes Icelandic culture and history framed around the four seasons of spring, summer, autumn, and winter; evolving in a cyclical way, again illustrating the influence that weather and climate has on even the perceptions and interpretations of Icelandic culture by non-Icelanders.

3.2.2. *Interviewing*

Upon arriving in Iceland I had no formal contacts with anyone in Iceland, with the exception of the staff at the SAI and the contact information for a couple living in Akureyri mentioned previously, but I did prepare a checklist of topics and questions that I wished to incorporate into my interviews. Moreover, I had created a flexible sampling criterion to narrow the participants in my interviews to Icelanders who I thought would have an intimate local or expert knowledge of, and/or relationship with their local environments, such as farmers, fishers, environmental scientists, professionals, outdoor enthusiasts, bird-watchers, and tour guides. The selection of these types of informants is inspired by research with Arctic indigenous peoples where social scientists targeted particular individuals to interview who had a strong traditional ecological knowledge of their homeland and its connections (Crump 2008; Krupnik and Jolly 2002; Riedlinger 2001a; Fox 1998).

With relatively few contacts I began to research individuals in Akureyri who seemed to be suitable candidates for interviewing, starting with a lead provided to me by a professor from the University of Manitoba, whom I met during my preliminary trip to Iceland. He advised me to contact the professors at the University of Hólar, which I followed up on; travelling to Sauðakrókur and Hólar in early May, where I conducted eight interviews with these academics

and other residents of Hólar, over the course of a couple of days I was in this community. Another method to contact potential participants was through my contact with the couple I was put into email contact with when I was in Edmonton. This couple was very friendly and hospital, inviting me into their home where we talked over dinner about the type of research I was planning to conduct among other things. After this initial meeting this couple became key informants, as they continuously contacted me regarding people they knew who they thought could be suitable participants for my research. In fact, this couple was responsible for putting me into contact with a majority of my interviews during my two months, usually by providing me with the email addresses of the people they suggested, who I then proceeded to contact and invite to participate in my research.

At first, this method of contacting potential informants seemed unsuccessful, as for two weeks I waited impatiently to be contacted by my first interviewee. In the end, emailing Icelanders and inviting them to participate in my research proved to be a very effective method, as many of the people I emailed did finally respond, with most respondents confirming their willingness to participate. Emailing potential participants proved to be far more effective than attempting to contact people by phone or via a direct meeting, as I discovered first-hand. The staff at the SAI also provided me with a list of people I could ask to interview from the University of Akureyri and the Borgir Research Centre, as well as people in Akureyri and Húsavík who were potentially knowledgeable about issues such as climate change. Another key strategy for identifying suitable interviewees was by asking the people I interviewed if they knew people who may have an interest in climate or the environment; and if they did know of someone, I would ask if my interviewees were willing to provide me with contact information for the potential participant (See Figure 2). This method is referred to by Hammersley and Atkinson as 'snowball sampling' (Hammersley and Atkinson 1995:135.), a method that was quite effective for

identifying potential participants who had local knowledge of northern Iceland's environment and climate whom I had not considered as participants, such as school teachers. I soon realized that Icelanders other than fishers, farmers, and scientists had very sound local knowledge of their surrounding environment and climate.

Figure 2: An Example of Snowball Sampling and the Helpfulness of Participants to Introduce other Potential Participants (as was the case with the two participants in the above photograph).

In total I conducted thirty-two interviews with thirty-five Icelanders, one Dane, and a German in six communities in northern Iceland, and one interview with an Icelander in Reykjavik. I interviewed fifteen Icelanders, and one Dane in Akureyri including an anthropologist, an economist, a farmer, a botanist, a marine biologist, two school teachers, three life-long residences of Akureyri, a harbour worker, a tourist director, a geographer, a hostel owner, and a government worker. In the community of Hólar (population approximately 100)

(University of Hólar 2008), and Sauðakrókur (population approximately 2700) (Travelnet.is 2006a) in the Skagafjörður region, I interviewed seven Icelanders and one German, including four biologists, a tourist director, a horse-trainer, an economist, and an individual who was keenly interested in Iceland's glaciers. The interviews I conducted in Húsavík (population 2296) (Wikipedia 2006) were with two whale researchers, a tourist operator, and two fishermen. Interviews in Grímsey (population approximately 100) (Nordic Adventure Travel 2008) numbered three, two with school teachers and one with a skipper. The interview in Reykjavik was with a retired meteorologist. The one interview in Dalvík (population approximately 2000) (Travelnet.is 2006b) was a group interview with members of the nationally renowned weather club at Dalbær, a home for the elderly (See Figure 3). The participants in this interview numbered six, four men and two women, who were mostly retired fishers and farmers.

Figure 3: Myself (second on the left) and Members of the Icelandic Weather Club at Dalbær whom I Interviewed.

For a majority of the interviews language was not a barrier, as most Icelanders have an excellent command of English, except for two interviews; the group interview with the members of the weather club at Dalbær and an interview with a retired elderly fisherman in Húsavík. Both of these interviews required the services of a translator. Translation services for the group interview with the weather club were provided charitably by a nurse working at Dalbær. In Húsavík a person I previously interviewed offered to accompany me to the house of a retired fisherman and to translate for an interview that he basically arranged for me. This generosity testifies to the hospitality and helpfulness of Icelanders, traits I found quite common among the people I encountered. All participants were presented with a consent form describing my research and their rights as interviewees, which were signed by both participants and myself before interviews proceeded.

The types of interviews I conducted, with the exception of one group interview, were one-on-one, unstructured interviews. Unstructured interviews tend to set a more relaxed atmosphere, with participants encouraged to speak at length about specific topics of interest to the researcher, rather than giving definitive answers as in a structured interview. Devereux and Hoddinott describe unstructured interviews as questions that allow interviewees to be open-ended with their responses (Devereux and Hoddinott 1993b:30). The unstructured style of my questions is also guided by previous research conducted by social scientists working with indigenous peoples in the North, such as Berkes and Jolly (2001), Riedlinger (2001a), Fox (1998); and their interviewing methods for elucidating the interconnections of climate change in the contexts of indigenous peoples' cultures. By conducting ethnographic research in this manner these researchers have revealed compelling evidence that climate change is impacting terrestrial and marine ecosystems, with an emphasis on the people using and occupying these ecosystems; these findings provided me with some suitable initial areas to formulate interview topics.

The purpose of the interviews was to engage Icelanders concerning their local and/or expert knowledge regarding weather, climate, and the environment as pertaining to Iceland specifically, and to avoid political opinions about climate change globally. In this way interviews were semi-directed, but still unstructured, as I would prompt participants using a variety of probing techniques (De Leon and Cohen 2005:200), to elaborate on local observations and experiences of climate change if the interview was starting to become centered around other issues, such as global warming, issues of whaling, or the injustices of the ITQ system. The topic I chose to bring to the attention of an interviewee usually focused on recent observations of weather, which I then attempted to re-direct to questions relating to any observations by the participant of impacts being caused by these changes in weather over the short and long term, depending on their age and livelihood. I encouraged participants to first comment on changes in weather followed by whatever information they were willing to share that they thought might be associated with recent changes in weather. To keep responses within my research parameters, that is, questions pertaining to the interconnections between Iceland's climate, environment, and people, I directed other questions pertaining to links between climate change and other aspects of Iceland's environment and Icelandic culture, by referring to specific examples, or material probes (De Leon and Cohen 2005:200-201), such as glaciers and recreational activities. By conducting interviews in this manner, I was able to identify emergent themes during the analysis of the interview data, that may of have been overlooked if my interview questions were structured to answer specific and inflexible questions based on pre-structured categories of inquiry, a method that usually is unsuccessful when conducting ethnographic research (Hammersley and Atkinson 1995:152).

The interviews were held at locations convenient and comfortable to the participant, and places included restaurants, schools, gift shops, museums, and participants' residences. The

majority of interviews were recorded on cassette tapes, and notes were taken during each interview. Twelve interviews were fully transcribed, with other interviews being partially transcribed. Data from these interviews was not analyzed or categorized until after my return from the field. Interviews lasted from half an hour to two hours, taking place at times most convenient for the participant. Gratuities and compensations for interviews were not expected, once again showing the hospitality and generosity of the Icelanders I interviewed, as I did not have enough funding to compensate participants for their time with a monetary exchange.

3.3. *Analytical Research Methods*

Although the analysis of the data collected from interviews and from primary and secondary sources is discussed as the last stage of research, the actual analytical process was ongoing throughout my research. As Hammersley and Atkinson state, the analysis of ethnographic research starts when a research project is first being designed, and analysis continues as the research proceeds, informing and challenging research questions and goals (Hammersley and Atkinson 1995:205). Formal analysis of my research did not begin until after my fieldwork in Iceland was completed.

The first step to analyzing my ethnographic data was to transcribe completely twelve of my interviews, and portions of other interviews, using a transcriber and a word processor. The time to transcribe an entire interview ranged from two to eight hours, depending on the length of the interview. The approach I utilized to analyzing the data was that of a thematic analysis, a popular approach when analyzing ethnographic and unstructured interview data, as emergent and unpredictable results often arise when implementing this type of research method (Taylor-Powell and Renner 2003:3). One of the aims of my ethnographic research was to identify themes related

to climate, culture, and the environment that were not solely pre-conceived themes based on the literary sources I reviewed, as some of the themes I use are based on these literary sources. I should note that these pre-conceived themes were not selected for, as Hammersley and Atkinson warns, to, "... take the form of prejudgements, forcing interpretation of data into their mould, but are instead used as resources to make sense of the data." (Hammersley and Atkinson 1995:210).

Thus, the themes I initially pre-selected to discuss with participants were not to confine my data to these themes, but to use these themes as a basis for introducing topics associated with climate change that would stimulate responses from participants when needed, and adding new themes as they emerged, as well as dropping preset themes that became irrelevant topics during interviews. Integral in this step of my analysis was contextualizing the interconnections between pre-conceived and emergent themes to identify similarities and unexpected connections amongst these themes (Taylor-Powell and Renner 2003:3). In one particular case I dropped a pre-conceived theme I initially included in my research design. This theme was 'Sea-ice', a common indicator of climate change mentioned by social scientists working with indigenous peoples on issues of climate change, and in the historical texts of Icelanders. After the first few interviews that I conducted, contemporary observations of sea-ice in northern Iceland were not in significant quantities by my informants, as many informants remarked that sea-ice has not come to the shores of Iceland since 1979, with the exception of the odd small iceberg. Actually, the absence of sea-ice became more of a topic of conversation with informants as ice-free waters around northern Iceland and the Arctic brought up issues of Akureyri and Reykjavik becoming international depot harbours with the opening up of Arctic waters; in effect, creating a theme for 'Shipping' in replacement of a 'Sea-ice' theme. Other emergent themes and sub-themes were related to wind, fog, and aspects of tourism.

Analyzing the data from interviews and documentary sources consisted of reviewing the transcripts, interview notes, audio tapes, and documents, to elucidate common themes in the data. I decided to categorize these themes according to the three areas of interconnection that I am researching, namely culture, climate, and the environment. The themes I selected for each of these categories were either adopted from Iceland's Kyoto Protocol Report (2006), from the research of previously mentioned scholars, or they were emergent topics frequently mentioned in the responses by interviewees. The climate category is divided into four themes: 'Seasonal Weather', 'Unpredictability', 'Wind', and 'Precipitation'. 'Seasonal Weather' has a sub-theme for each of the seasons. Environmental themes include 'Flora and Fauna', 'Marine and Freshwater Environments', and 'Glaciers and Alpine Environments'. The 'Flora and Fauna' theme is further divided into six sub-themes: 'Birds', 'Insects', 'Fish', 'Whales', 'Forests' and 'Vegetation'. The themes selected for the cultural category were mainly based on human activities that may be most impacted by climate change, and include 'Agriculture', 'Fishing', 'Tourism and Recreation', 'Easier Day-To-Day Living', and 'Shipping'. These themes were selected by coding certain responses that came up frequently in the interview notes, transcripts, and audio tapes according to the themes listed above. Shagoury-Hubbard and Miller-Power recommend colour coordinating similar and contrasting responses using different coloured highlighters, and then to create tentative categories using acronyms to identify similar themes. Moreover, these researchers suggest creating an ID number and/or letter for each participant when comparing responses by informants (Shagoury-Hubbard and Miller-Power 2003:463). These were useful analytical methods I adopted when reviewing my interview data, increasing the efficiency of sifting through large amounts of qualitative data.

The analysis of the data also follows the research objectives of Smit et al's (2007) research investigating vulnerabilities to Arctic communities, and how these communities will

adapt to changes in the Arctic, and globally; changes caused by climate, the environment, and people. To present the results of my analysis in the next chapter I will employ Smit et al's approach for identifying what they term current exposure sensitivities and adaptations to climate change. For my research I have modified this approach to include current exposure opportunities to climate change as well. I include exposure opportunities here in addition, as many Icelanders see gradual climate change as more beneficial to Iceland, possibly affording Icelanders with more options to benefit both economically and environmentally; though there are mixed opinions among Icelanders regarding these issues (Cameron 2005:32-34). To identify current exposure sensitivities, Smit et al propose that documenting current conditions such as,

> "...the identification of forces, stresses, or processes which affect the livelihoods or well-being of people in a community. It also requires providing evidence of the exposure sensitivities and explaining the processes and trends that underlie them. Some conditions may be important for the whole community, while in other cases only as a certain group or sector may be sensitive to a change in condition." (Smit et al. 2007:7)

Current adaptive strategies are the responses to the exposure sensitivities and opportunities being experienced by a community or a certain group of people in a community. Exposure sensitivities and opportunities caused by climate change to people and the environment inevitably increase or decrease the vulnerabilities of some communities and their abilities to adapt. Future exposure sensitivities and adaptation strategies are informed by community insight and local/traditional knowledge as well. However, increasingly the identification of exposure sensitivities and the formulation of adaptation strategies is becoming the purview of science to predict and plan short term and long term potentialities caused by current changes in climate conditions (Smit et al 2007:7-8, Crate and Nuttall 2009:394). In Chapter Five, this approach will be further employed to identify potential future exposure sensitivities, opportunities, and

adaptation strategies to climate change by Icelanders, based on current views and ways of comprehending this phenomenon.

Smit et al (2007) recommend that the first stage in identifying current and future exposures and adaptations is to conduct preliminary and background research targeting certain communities most at risk of, or vulnerable to being impacted by major changes, such as from climate change, economic development, and pollution (Smit et al 2007:6). One difference between my research methods and the preferred research methods of Smit et al was that my research was multi-cited, both in place and people, so as not to limit myself to views of one community or to one group of people. As my research is preliminary in regards to anthropological research on contemporary climate change and culture in Iceland, it is my intention to represent a variety of Icelandic points of view from qualified participants to demonstrate the complexities of interpreting climate change from the expert and local knowledge of even one culture. This is an issue that needs to be addressed when doing preliminary ethnographic research, so as not to present one point of view as representing a single people (Fischer 1999:452). Therefore, the next chapter covering the results of my thematic analysis will closely correspond to Smit et al's current approach, but with a specific focus on identifying current exposure sensitivities, adaptation strategies, and opportunities being influenced by contemporary climate change; while the following chapter will discuss future exposure sensitivities, adaptation strategies, and opportunities to be most likely influenced by climate change in Iceland.

Chapter Four

Observing and Knowing the Weather in Northern Iceland

The organization and layout of the thematic analysis has already been outlined in the previous chapter. In this chapter the content of the analysis will be presented thematically to highlight the interconnections between climate, culture, and the environment. Needless to say, there will be areas of overlap between the categories and themes, and it is where these areas overlap that interconnections are elucidated. The more the themes overlap the more they appear to have stronger connections, as will be revealed in the following synthesis of my thematic analysis. The conceptual model represented in Figure 4, displays climate, environment, and culture as separate circles linked together trilaterally.

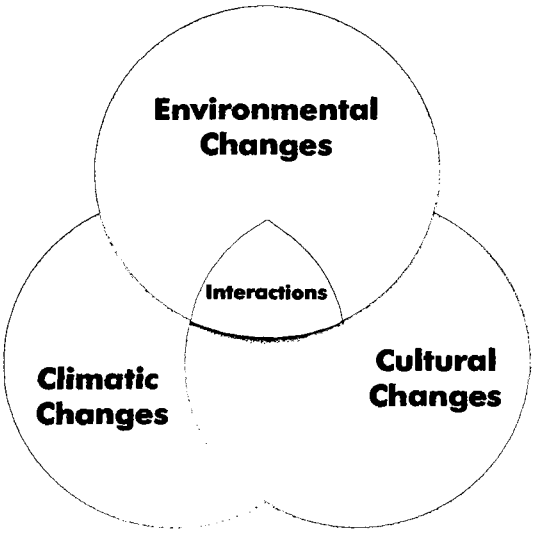

Figure 4: Conceptual Model of Interconnections Between Climate, People, and the Environment. Image courtesy of PACTeam Canada Inc.

I have analyzed the responses from these interviews and grouped these responses under three broad categories: Weather, Environment, and Culture. Each is considered in association with climate change. Within these categories I have organized Icelandic responses into themes highlighting the most common issues within each of these categories. For purposes of my thesis I have selected the themes and sub-themes that were discussed most often, or themes that stood out from other responses from my interviews, to illustrate how climatic, environmental, and cultural changes in Iceland are all interconnected.

4.1. *Seasonal Weather*

Changes in weather patterns in the last twenty or so years have been observed by all the people I interviewed in northern Iceland. These observations support evidence of climatic warming in the Arctic and correspond to the warming trend in Iceland since the early 1980s, recorded by the Icelandic Meteorological Office (Icelandic Meteorological Office 2008). The most noticeable changes in the weather that people reported have been in the winter. All informants reported significantly warmer winters with less snow. According to many of these informants changes in winter weather have been observable since at least 2000. Elderly Icelanders say that Iceland's climate has been warming since the 1980s, but winter weather conditions have become more extreme in the last five or six years. Winters have been so mild that many informants recalled highly irregular daytime highs and the absence of snow, especially at Christmas. For example, Gunnar from Akureyri laments that "... we are lucky now if we have snow during the Christmas time". Trausti Jónsson, from Iceland's Meteorological Office stated in Iceland's 2005 climate synopsis, "Christmas day was unseasonably warm, temperatures in many parts of the country reaching 10-13°C" (Icelandic Meteorological Office 2007). With such temperatures people are also noticing that winter in northern Iceland is becoming shorter, starting in November instead of October, and ending in March and not April. In the last five or six years, March and April have been unusually warm with very little snow. In fact, at the end of April, 2007 temperature records were broken in Akureyri, with the temperature reaching 23°C. However, across northern Iceland a cooling effect followed the above seasonally warm start of spring. Many informants commented on a drastic cooling occurring at the end of spring, usually in May, in recent years. The weather at this time has been noticeably cooler, with snow and frost not an uncommon sight. For example, at the end of May 2007 it snowed enough that people went skiing at the ski hill in Akureyri. To put this in perspective, in winter the operators of this same ski hill have been using

snow making machines to stay open because there is not enough snow! Icelandic statements regarding summer were mixed, with a majority of informants feeling the summers are becoming cooler. The reality is summers are actually becoming warmer on average; however, the day time temperatures are not as high as in the past (Icelandic Meteorological Office 2008). Changes in autumn weather were rarely mentioned by people in these communities, with a few interviewees observing an increase or decrease of precipitation in the form of rain in this season, depending on the particular community in which the interviewee was living.

4.1.1. *Unpredictability*

I have mentioned the changes in weather that have been observed by Icelanders living in the northern part of the country, and to many of these informants, especially older individuals, these changes indicate that Icelandic weather is becoming more unstable and unpredictable. Before going on, I must state that unpredictable weather in Iceland is the norm; however, Icelanders are aware of what they view as normal changes and what they view as abnormal changes in seasonal weather (Lacy 1998:22-25). When weather occurs in winter that is more suited to spring, such as temperatures well above 0°C with rain, Icelanders find this weather to be very strange. Icelanders, like other peoples of the Arctic, are saying that the weather is crazy and not normal. Another example supporting this observation of volatile weather comes from the traditional and local knowledge of the elderly people in Dalvík who are members of Iceland's weather club, who make monthly predictions of the weather in Iceland. This club was formed to bring people living in this home together to talk about the weather, an impersonal and everyday topic. As I was told by the founder of the club, it is a social network for club members that keeps them connected with peers as well as keeping the mind sharp to the 'old ways' of forecasting weather, an invaluable skill farmers and fishers learned before scientific instruments provided weather

forecasts. Many of these members rely on books their fathers, grandfathers, and great-grandfathers used in attempts to forecast weather conditions in Iceland. Some of the methods used for forecasting good or bad weather by members of the club were based on physical observations of weather at certain times of year over short periods of time, or observations of the moon and its phases. For instance, frost in the spring means good weather for the summer, and two months of good weather means the fourth month will also have good weather. However, according to some of the members these traditional methods for forecasting weather are becoming less reliable, making it more difficult for the members of this club to predict weather accurately. This group says that the weather has been different in the last 25-30 years, and the climate now compared to 50 years ago, is like black and white.

Perhaps the most significant collective references to climate change voiced by older Icelanders are references to winter, summer, autumn, and spring being blurred, the absence of two of these seasons, and the lack of contrast between seasons. Based on their own observations, experiences, and knowledge Icelanders are starting to perceive their climate as changing, wherein abnormally occurring weather conditions are becoming more regular. Presently, this consists of Icelanders remarking on the lack of contrast between seasons, with winter and summer extremes being less pronounced, as if the seasons were evening out. Some Icelanders jest they are losing summer and winter, while other Icelanders say it is spring and autumn they are losing. This is exemplified by Jon's statement, "So you can't really tell what day of the year it is based on the weather sometime." After analyzing the observations of Icelanders it does appear that the more accurate perception is that winter and summer are disappearing. Warm temperatures and the sporadic presence of snow are making winters seem like an extension of autumn, or an early onset of spring in northern Iceland. Likewise, although summers are in fact warmer, Icelanders feel that summers are cooler, perhaps due to late cooling trends occurring in late spring. It is

intriguing to note that Icelanders are aware that the seasons have become warmer, but they perceive less difference between seasons to the point where four seasons start to resemble characteristics of only two seasons. At the moment winter does not have as dominate a hold on Iceland's landscape as it once did, but winter does have a hold on Icelandic perceptions of their landscape. This is effectively reflected in Stefan's statement about the weather in Akureyri, "I would have winter and summer, like when I was growing up.", that is, winter as cold and snowy and summer as hot and dry. So far these changes in Iceland's climate have been for the most part mildly confusing, alarming, humorous, and for many Icelanders (unlike Stefan) a pleasant change from long and cold winters.

4.1.2. *Wind*

Wind constitutes as its own sub-theme, as observations of changes in wind were made by some informants for most of the seasons and therefore merits separate discussion. Changes in wind directions and velocities were reported, and Icelanders remarked that recent changes in wind are as unusual as the changes in winter weather. Older Icelandic farmers and fishers are sure that there are many more days with strong winds. Moreover, some participants noticed that winds are blowing in from different directions than what is considered normal. Winds blowing in from the south are now strong winds usually bringing in warmer temperatures. One long time resident of Akureyri, Kjartan, remarked, "... we've never had snowfalls and wind coming from west or southwest. Its never happened, it almost never happen before.", and further, even the northeast winds that bring cold Arctic air to Iceland in the winter have been much milder. Strong southerly winds are also blowing with greater frequency in the summer. Helga, a woman I interviewed in Akureyri, is certain that the winds in this community were indeed stronger in the summer by the increase and intensity of dust storms she has observed in the last few years.

> "Because in the summer when the wind comes from southwest you know, it comes down the valley there, and the other valley, and there are open spaces there with no grass or anything, and so we have snow, kind of snowstorms, no sandstorms, you know over the town. Dust and stuff, not very nice. So you really notice when the wind is very strong."

Furthermore, Icelanders living on Grímsey Island are certain there are many more days of hard winds as this has impacted the small boat fishing vessels there; while residents of Húsavík reported wetter winds in the winter and dryer winds in the summer.

4.1.3. *Precipitation*

For the most part, observed changes in precipitation by people living in northern Iceland is in the winter months, with all informants reporting less snow, and more rain in the winter. Among the people I interviewed there were no reports of significant changes in the frequency or distribution of precipitation in the other seasons. However, some of these people had noticed minor changes in precipitation, and these observations varied depending on the particular area where people are living. For instance, in Akureyri residents have noticed less rain in autumn, but in a farming region 10 minutes to the south of Akureyri by car, the farmer Hjalti, was certain that there has been more rain in the autumn. Informants in Hólar reported rainier and wetter springs and summers in the normally semi-arid Skagafjörður region.

Occurrences of fog have been increasing in some regions of northern Iceland, regions where fog is a rare sight. I first heard mention of an increase in foggy days in Hólar, where a participant stated there were many more foggy days in recent years. She associated the increases of foggy days with the presence of sea-ice in Skagafjörður in these same years. When asked about fog another resident of Hólar recalled that elderly people regarded foggy days as strange

and rare in this region, unlike in Eastern Iceland where they are common. Increased numbers of foggy days have also been observed in Húsavík. Icelanders involved in whale watching and research both mentioned an increase in foggy days, but these informants did not mention the presence of sea-ice when it was foggy. Further, fishers on Grímsey reported more foggy days since winter temperatures have been warming.

4.2. *Environment*

Throughout their history, Icelanders have always had a close relationship with their environment for their subsistence needs. Conversely, Iceland's environment is very susceptible to climatic and anthropogenic impacts which have created serious social impacts for Icelanders in the past; and Iceland has been the region most impacted by human activities over time than any other place in the Arctic (Juday 2005:799). The environment here will refer to Iceland's physical surroundings, both terrestrial and marine. Furthermore, the environment is the dimension where impacts caused by climatic changes and human activities are most visible in Iceland, and consequently these environmental changes will have impacts on the cultural activities of Icelanders. The themes I will discuss here are 'Flora and Fauna', 'Marine and Freshwater Environments', and 'Glaciers and Alpine Environments'. For each of these themes and sub-themes I will also summarize any current findings and projections, if applicable, presented in the ACIA, the AHDR, the IPCC's fourth assessment report, and any other relevant primary sources that pertain to Iceland's environment for scientific validity supporting or denying the findings of my research at the local level. However, these documents also have their limitations, mainly the exclusion of cultural impacts to Icelanders caused by change in the climate and the environment, and it is my intention to demonstrate that anthropological research with people can yield many answers to scientific questions, as well as reveal unexplored areas of inquiry for both the social and environmental

scientists. My research is preliminary, but it is an attempt to show how anthropology can be applied to the issue of climate change as it is happening, rather than studying the impacts after-the-fact.

4.2.1. *Flora and Fauna*

Iceland's environment is for the most part mountainous and barren with vegetated areas located mainly around the coast, fjords, and highland valleys. Icelanders have come to inhabit many of these areas and many of them are very knowledgeable about the plants and animals on this island. I interviewed several people with a specific interest (whether it be academic, occupational, or personal) in the plants and animals of Iceland. These informants provided me with some very interesting observations of impacts they believe to be connected with climate change, including impacts on birds, insects, and vegetation.

4.2.1.1. *Birds*

In regards to birds, many Icelanders know they have seen new types of birds, but unfortunately they did not know the names of these birds. However, there was one particular bird, the golden crest, a very small bird that is a newcomer to Iceland, and has already started nesting in wooded areas on this island. A passionate bird watcher living in Akureyri, Kjartan, has noticed changes in the arrival, nesting, and breeding of whooper swans in Iceland. This man has meticulously documented the migration and breeding patterns of a number of species of birds in northern Iceland for decades. In relation to climate change, over the last 5 or 6 years he asserts that whooper swans are coming to Iceland's lakes earlier, breeding earlier, laying bigger eggs, having larger clutch sizes, and more signets are surviving to adulthood. Furthermore, some mated pairs

of whooper swans are remaining in Iceland all year as the lakes are not completely freezing in the winter.

An alarming observation made by some Icelanders is the decline of many birds that are common visitors to Iceland. Many of these birds are well adapted to cold climate, suggesting that Iceland is possibly become too warm for these birds to live. Evidence of this is the disturbing observations from many Icelanders that thousands of seabirds in Iceland have been found dead on beaches due to starvation in the last few years. The birds Icelanders are referring to are mainly northern seabirds such as puffins, black wings, and guillemots. Even the birds that do find food are not eating enough, as one informant noticed that seabird eggs are smaller, as are their offspring. All around Iceland seabird populations have been in decline with many people speculating these birds are staying north of Iceland. One possible factor could be the observed northward change in distribution of capelin stocks, a staple food for seabirds. As Loeng et al note, "Capelin can provide more than 20% of the food required by seabirds, higher predators, and the capelin fisheries collectively in a given year". (Loeng et al 2005:484). In previous instances of warming climate conditions in Iceland in the 1920s-30s capelin stocks were pushed into the High Arctic, where they remained until waters cooled in the following decades (Rose 2005:1360). These speculations may be valid, as on Grímsey Island, just north of Iceland, there has been an influx of seabirds coming to the island. When I went to Grímsey Island I asked if puffins had arrived yet, and a woman I interviewed, Sudrun, said that the puffins had already arrived and that there are, "So many puffins now" (See Figure 5).

Figure 5: A Pair of Puffins on Grimsey Island

Other birds common to Iceland that are being seen less are the ptarmigan, and the little auk. Thus, it seems apparent that Iceland's climate is becoming favourable for birds that inhabit southerly wooded regions, but very unfavourable for birds adapted to open, grassy, and wetland areas with a cold climate. The general consensus among my Icelandic informants regarding the drastic decline of seabirds is that these birds' main food source, little fish called sand eels and capelin, have sharply declined in Icelandic waters. Furthermore, the birds that are newcomers to Iceland are birds that inhabit wooded areas and have found suitable homes in Iceland's expanding forests, which are also supplying these birds with a steady food source of insects.

4.2.1.2. *Insects*

Although new bird species have been sighted in Iceland, few Icelanders commented on observing new species of insects, with some exceptions. Icelanders involved with re-vegetation and reforestation efforts in Iceland were quick to note seeing new insects living in trees. This is not so surprising as many trees in Iceland are imported, imparting the risk of importing insects commonly found with these trees. What is alarming to Icelanders is that these insects are surviving Icelandic winters. As Stefan noticed with a spruce tree in his yard, the branches are brown at the base the whole year. Stefan blamed this on insects and the warmer winters. Recent warmer winters have enabled the insects to live and feed on the tree all year round, "...you can see it on the paper, shake it out. But in a way they do very well now because of the warmer winter, and survive, but this was never a problem here." The most commonly seen insects are louse. One other insect that is increasingly being seen in northern Iceland is the wasp. Wasps are not indigenous to Iceland, but they are transported by strong winds or cargo ships, and they usually die off when winter arrives. Now wasps are not dying in the winter, and spreading to other parts of Iceland. For instance, Magnus states, "But now the difference is that they can take hold here, and you can see this with the wasp problem in Akureyri. I don't remember that in recent years, and it's a dramatic experience for those who hadn't even seen wasps...".

I found these comments to be particularly interesting after interviewing an agricultural scientist who told me that there was a fear that damage to trees and crops by these insects could become very problematic if they began surviving Iceland's warmer winters. When I told him that I had interviewed Icelanders, who were not scientists, who told me that insects were living all year round in their trees at home the scientist seemed quite surprised. Upon reflection, I found this interview to exemplify how, by interacting with people that interact with their environment, anthropologists can reveal unexpected findings outside of scientific research and experiments.

4.2.1.3. *Forests*

Trees are very sparse in Iceland and reforestation efforts have been ongoing since 1899 (Government of Iceland:16-17), and intensified throughout the 1990s with the passing of three forestry laws: The Farm Afforestation Law (1991), the Southland Afforestation Law (1997), and the Regional Afforestation Law (1999) (Juday et al 2005:800). According to Jon, a forester in Akureyri, these efforts have been more successful since the 1980s, especially the growth of imported trees. This success is primarily due to milder climate conditions in the last 25 years. For example, one resident of Akureyri was quite proud he had a maple tree growing in his yard at home. Trees are budding earlier, growing faster, and can be planted at higher elevations than was the case 25 years ago. However, Jon asserts that new challenges and problems have also developed as a result of milder climate conditions. The most serious of these challenges are the spread of fungus and insects being transported with imported trees (See Figure 6). These fungi and insects are able to survive the now mild Icelandic winters and spread to other trees in spring and summer. Moreover, cold spells in late spring can seriously damage trees budding early.

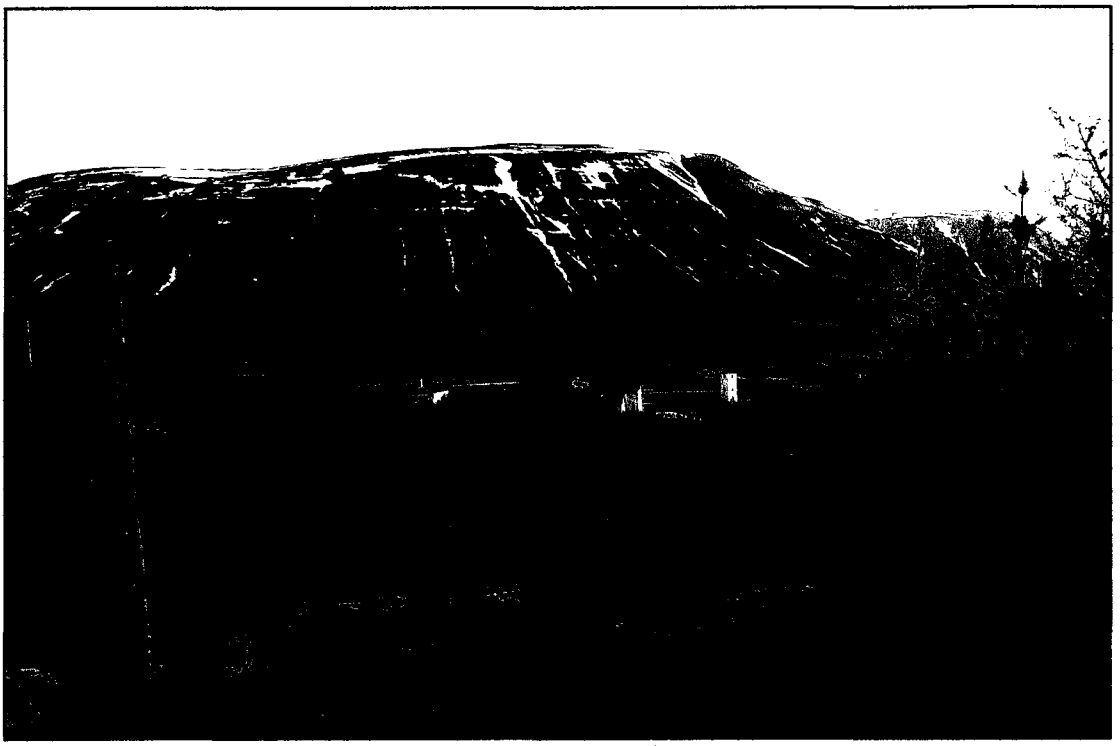

Figure 6: Woodland Comprising of Mainly Imported Trees Surrounding Hólar

4.2.1.4. *Vegetation*

Changes in the growth of other plants in northern Iceland had not been observed by the people I interviewed, with two exceptions. First, many Icelanders who knew farmers reported that these farmers have been growing barley since the 1980s, and barley production is continuing to increase. This crop has not been grown in Iceland since the 13th century due to cold climate conditions persisting in this country for the better part of seven centuries. Moreover, farmers are seeing greater yields in grass over the last few years, cutting their hay two or three times a year, instead of just once or twice. Second, flowers are blooming earlier. An Icelandic woman living in Akureyri told me that people are starting to buy their spring flowers in March or April, rather than in May or June. However, a botanist living in Akureyri, Guðleifsson, has noticed that indigenous alpine flowering plants are struggling to survive in their alpine habitats. According to Guðleifsson, although there has been less snow in the winter, there has been more frost in the

highlands. This increase of frost is damaging these flowers because the presence of snow insulates them from the frosts in spring, allowing these flowers to sprout as well as provide them with water when the snow melts (Guðleifsson, Personal Communication: May 2007).

There has been some research supporting Icelandic observations of flowers blooming earlier with early onsets of spring. Thórhallsdóttir (1998) demonstrated through experiments that Arctic flowers could bloom earlier, produce more, and increase their distribution in environments with higher temperatures. From these experiments it was found that the flowers that bloomed earliest become the dominant flower species in that area. Unfortunately, these experiments only tested the impacts of temperature increases, as did Jónsdóttir et al with their experiments with moss and dwarf heaths, and left out such factors as precipitation. Jónsdóttir et al's results indicated increased growth of dwarf heaths, while no significant changes occurring with the moss heaths when temperatures were increased (Jónsdóttir et al 2005:561).

4.2.2. *Marine and Freshwater Environments*

The marine environment surrounding Iceland is very important to Iceland, providing Icelanders with an abundance of fish, which is the mainstay of Iceland's economy. The marine environment is very complex and it is difficult to verify observed impacts caused by climatic conditions. However, marine biologists and fishers in Iceland have reported that the ocean temperatures in northern Iceland have increased by approximately 2°C since 1989 (Björnsson and Pàlsson 2004:6). This observation is supported by the increased catches of fish rarely seen in the waters of northern Iceland. People informed about the status of Iceland's fisheries all made reference to the increased catches of monkfish, a fish rarely caught this far north in Iceland. Other fish species being caught more frequently and in bigger quantities are Greenland halibut, haddock,

herring, and blue whiting. Fishers and marine biologists have also noticed a decrease of cold water species such as capelin and shrimp, but this may be due more to over-fishing, compounded by the impacts of a warming ocean (Rose 2005: 1361, Björnsson and Pàlsson 2004:1). Changes in distribution of cod have not been observed by Icelanders that I interviewed, but one fisher reported that cod have been bigger, fatter, and firmer in the last few years. Moreover, scallops in Icelandic waters are becoming infested with parasites that are commonly found in warmer waters, according to one of my informants.

In the community of Húsavík more whales, especially humpback and blue whales, are being spotted by whale watching boats and whale researchers. *Minkhe* whales are the exception, as these whales were previously the most commonly seen whales by the crews on these boats, but sightings of *minkhe* whales have been declining recently.

Temperatures in freshwater lakes and rivers have also been increasing according to the biologists of the University of Hólar's aquaculture department. The fish in these freshwater environs that prefer colder water are declining, such as Arctic char and salmon while brown trout numbers are rising due to the warming of Iceland's lakes and rivers (Thorarensen Personal Communication: May 2007, Stefansson Personal Communication: May 2007, and Kristiansson Personal Communication: May 2007). According to Wrona et al the likelihood of Arctic freshwater ecosystems being impacted by climate change is very likely, as the few species that live in these ecosystems are at their southern range of their habitat distribution. Moreover, species, in particular arctic char, are identified as being amongst the most susceptible to warming trends (Wrona et al 2005: 385, 437).

4.2.3. *Glaciers and Alpine Environments*

Glaciers are a major feature of Iceland's geography and environment, hence the island's name, and they have receded and advanced under warmer and colder climate conditions. Not surprisingly, Icelanders I interviewed who visited smaller glaciers below 1500 meters often in the last ten years have observed significant reduction in the sizes of these glaciers. So far these informants have seen no observable impacts to northern Iceland's environment, with the exception of making some hiking trails more treacherous to traverse, or completely unusable. A few informants also noted that there has been an increase in avalanches. These informants thought that the increases in avalanches are being caused by the more frequent freezing and thawing temperatures during winter. These temperatures do not allow snow to accumulate and freeze to mountain slopes, resulting in snow being unstable on mountainsides. For me this was exemplified during my stay in Iceland, when people skiing after a snowstorm at the end of May, were caught in an avalanche and needed to be rescued. Most of the informants to whom I directed questions regarding increases in avalanches and landslides as a result of a warmer climate change were unsure, and most did not recall an increase in avalanches over the last twenty or so years. However, according to Instanes et al avalanches are influenced by wind velocity and snow accumulation, in combination with temperatures. When temperatures are warm and winds are stronger, and they are blowing in from different directions, this increases the likelihood of the snow pack on mountain slopes to loosen, causing an avalanche (Instanes et al 2005:917).

Glaciers cover 11% of Iceland's geographic area, and according to Iceland's Kyoto Protocol report one of the greatest impacts that could be caused by climate change are impacts these changes may have on increased glacial runoff in the rivers that power Iceland's hydroelectric power plants, as well as increased fluvial erosion. Additionally, there is the

realization that river courses may also be altered with increased glacial runoff, which may threaten to damage roads, bridges, communication lines, and tourist attractions. Iceland's Kyoto Protocol report supports the ACIA's findings and Icelandic reports that all glaciers are receding in this country (Government of Iceland 2006:36-37, Cameron 2005:32).

4.3. *Culture*

This theme encompasses the observable impacts that climate change is having on the perceptions and activities of Icelanders. These impacts are interconnected with environmental changes being caused or compounded by climate change. The cultural activities that people living in northern Iceland have noticed as being most impacted by climate change are winter recreational activities and tourist operations. Easier day-to-day living in the winter is also mentioned as an impact by many of the informants I interviewed. Agriculture is also being impacted by climatic changes of late, best reflected in Icelandic statements referring to the increase of barley production in Iceland. Iceland's Kyoto Protocol report also states that Icelandic farmers have had a considerable increase in their production of barely and oat crops (Government of Iceland 2006:15) Thus far, fishers have not been significantly impacted by climate change, with the exception of comments made by fishers on Grímsey Island. The cultural activities mentioned above are also the themes for this category.

4.3.1. *Recreation and Tourism*

Typical winters in northern Iceland are usually long and snowy, providing Icelanders with opportunities to enjoy such winter recreational activities as skiing and snowboarding, outdoor skating, sledging, and snowmobiling. However, in the past 5 or 6 years there has not been

enough snow or frozen ice for people to do these winter activities for most of the winter, if at all. Of greatest importance to the people I talked to was the closure of ski hills all over Iceland. As a tourist director in Akureyri, Edward Huejbens explained, ski hills in Hólar and Húsavík were closed last winter because there was not enough snow. The communities of Akureyri and Dalvík purchased snow making machines so that they were able to keep their ski hills operating throughout the winter, an approximately three to four million U.S. dollar investment for each community. However, this has caused many people to come to Akureyri and Dalvík from across the country to ski as these are two of just a few ski hills still operating in Iceland. In Hólar the ski hill did not open until 1998 and only then because the people of this community felt assured that there would be enough snow in the winter based on past winters (Huejbens Personal Communication: June 2007). One informant from Húsavík was quite disappointed that his children had not learned how to ski yet, when he remembers skiing to school when he was a child.

Winter warming has also had negative impacts on Iceland's winter tourism. As I was informed by Huejbens, tourism is a relatively new industry in Iceland, being only ten to twelve years old, but it is now this country's third largest industry (Huejbens Personal Communication: June 2007). Much of the tourism in Iceland is in the summer, and summer tourism has been benefitting from warmer seasonal temperatures, as these temperatures have been extending the summer tourism season, or the shoulder season, earlier into spring and later into the fall. Guðrún Gunnarsdóttir, head of the University of Hólar's tourism department even suggested that if temperatures continue to warm, people from southern countries may come to Iceland to 'cool off' in the summer (Personal Communication: May 2007). Winter tourism initiatives have been largely unsuccessful in Iceland over the last ten years. An example used by academics researching tourism in Iceland is the Myvatn region. In this region Icelandic entrepreneurs have

attempted to start tourist initiatives involving ice-fishing and dog-sledging. Currently, there is a winter tourist project called Snow Magic being carried out in the Myvatn region. All of these tourist initiatives have failed, or are failing, because the conditions in winter have been too warm with not enough snow and ice (Gunnarsdóttir Personal Communication: May 2007; Huejbens Personal Communication: June 2007). In other parts of Iceland glacial tours are being adversely impacted by climate change. Glaciers are receding and thus are becoming harder to access, less safe to travel on, and hence more expensive for both tour operators and their clients. If Icelandic winters continue to be warm, or warmer than of late, Icelanders will have to find new activities to occupy their time in the winter, and winter tourism may become unviable if this sector of tourism is planning around snowy and cold winters.

4.3.2. *Easier Day-to-Day Living*

Not all Icelanders are involved in outdoor winter activities, but almost all adults drive in the winter, as is evident by the fact there may be more cars than people in Iceland. Thus, many people remarked on how much easier driving has now become in the winter. There is less snow on the roads; as well as fewer whiteouts, making driving much safer. Moreover, less snow also means roads are accessible, as roads need to be cleared less in the winter. Older people admitted that day-to-day life is easier on their bodies. Their bodies were not as stiff and sore, they exerted less energy clearing snow, and they were not afflicted with as many health problems when winters are warmer. Sudrun, the woman living on Grímsey observed that people living on this island, "... are more relaxed in the winter".

4.3.3. *Agriculture*

While I was in northern Iceland I was only able to interview one farmer, Hjalti, who lived in the Eyjafjörður region just south of Akureyri, but this participant was very informative. As mentioned previously, farmers have been growing barley since the 1980s, and their hay yields have increased, with Hjalti stating that he can cut his hay three or four times in a year, providing close to double the amount of hay that he had typically harvested in a year. These impacts seem to indicate that climate change is positive for Icelandic agriculture, but Hjalti pointed out that a warmer climate brings with it a number of problems Icelandic farmers have to contend with. First, while warmer weather has meant farming in general has become easier and more productive, Icelandic farmers in northern Iceland cannot plant crops too early or these crops may be damaged or destroyed during cold spells in late spring. Moreover, barley crops are becoming more and more infested with fungi in the autumn due to increased rain, causing farmers to harvest their barley earlier. Additionally, harvesting crops when they are wet is more labour, cost, and time intensive. Therefore, climate change has extended the growing season and thus production of grass, but not for barley. Second, because summer temperatures have not been as extreme recently hay yields have increased, while barley yields have not increased in this region. As I was informed by this farmer, barley needs higher day time temperatures in the summer than have been occurring since 2000. Third, ten years ago this farmer had never fallowed one of his barley fields before; however, in the last ten years he has had to fallow barley fields to rejuvenate the nutrients in the soils. Finally, more insects and invasive plants are being found in farmers' crops, but this has not yet led to farmers using herbicides, pesticides, or insecticides; which are not used by Icelandic farmers (Government of Iceland 2006:37).

4.3.4. *Fishing*

The impacts of climate change on Iceland's most important industry thus far have been relatively mild. Species not usually caught by Icelandic fishers in northern Iceland have been welcome consequences of a warmer ocean, especially catches of monkfish as these fish have a high market value. According to one skipper in Húsavík, catches of monkfish have become abundant enough in the last three years for the government to include this species in Iceland's ITQ system.

Fishers and marine biologists have reported little change in cod catches, with the exception of fishers on Grímsey Island. The fishers living here have noticed some changes in cod, such as catching cod further away from this island in the summer. Moreover, these fishers are catching cod at deeper depths. According to one skipper, cod around Grímsey are usually caught at 50-100 meters, but now cod are being caught 300-400 meters deep. More importantly, fishers in Grímsey have been adversely impacted by the significant increase in windy days. While these fishers admit the weather is warmer on Grímsey, they are adamant that the weather is worse because of strong winds. These winds make it extremely dangerous for fishers to go out in their small boats (See Figure 7). This means there are fewer days for these fishers to be out at sea to fill their quotas. One fisher recalls February as being a calm month when you could fish twenty-eight days straight. In February 2006 this fisher could only fish twelve days of twenty-eight because strong winds kept his boat at port. McGoodwin reported similar statements made by Icelandic fishers living on Heimaey Island, in southern Iceland:

> "Our informants also understood that the fishing activities of Heimaey small boat sector are greatly constrained by severe weather and ocean conditions, whereas the large-scale vessels can fish in practically any conditions. This becomes especially problematic for the small boat sector in the winter months, when the weather and corresponding sea conditions around Heimaey can be quite treacherous. During these rough periods, not only may small boats be unable to go out for many days, they may

have to wait another 2-3 days after the bad weather passes to give the sea time to calm down. As the skipper of an intermediate sized vessel described the problem, 'The big trawler doesn't even check the weather these days he just goes out. But for the smaller boats bad weather from November through February may have only 10 days a month to fish – or less." (McGoodwin 2007:49)

Figure 7: Small Fishing Boats in Grímsey

Chapter Five

Prospective Experiences and Adaptation Strategies to Climate Change in Iceland

This chapter explores the concerns, vulnerabilities, challenges, opportunities, and hopes and fears that climate change might create for Icelanders, as voiced by the people I interviewed, and from the discourse of current Icelandic documentary sources related to climate change. Future exposure sensitivities and opportunities will be framed in relation to predicted weather changes and environmental and cultural impacts caused by climate change, along with any possible future adaptation strategies, loosely following Smit et al's (2007) approach mentioned earlier. This chapter will also include Iceland's approach to adaptation measures to climate change, an approach based on developing climate friendly technologies, to reduce GHG emissions, and other climate change mitigation policies (Mahr 2007, Fialka 2007, Steinsdottir 2007, Government of Iceland 2006, and Cameron 2005).

5.1. *Weather*

For most Icelanders there is little concern over warmer winters, with less snow, as this reduces winter dangers and stresses. Even farmers agree that the weather now is more conducive for agriculture than twenty-five years ago. The one genuine concern, or vulnerability, of changes in seasonal weather are the increases in wind strength, and the number of days of hard wind. Stronger winds could hamper flight conditions, damage infrastructure, and cause problems for farmers when it comes to harvesting their crops (Steinsdottir 2007:2). As mentioned above, strong winds in the last year or two have kept the small fishing vessels of Grímsey and Heimaey off the ocean for more days in a year than what is considered normal by the fishers living on these islands. If stronger winds become the norm in northern Iceland this could lead to even less days

on the sea for fishers at Grímsey, and possibly for small fishing vessels in other communities in Iceland, reducing the capacity of these fishers to pursue their livelihood, catch their quota, and financially provide for themselves and their families.

The Government of Iceland's Kyoto Protocol report identified two possible health concerns associated with societal impacts caused by future climate change. First, increases in extreme weather events and natural disasters may occur, putting Icelanders at risk. One prediction is that the frequency and intensity of storms will increase in the North Atlantic (IPCC 2007:30). Second, climate change could cause an increase in infectious diseases for people, animals, and plants. This point is not very clear in the document, but it does acknowledge the need for more research and monitoring (Government of Iceland 2006: 38-39).

For the most part warm weather is indicative of hope and good times ahead throughout Icelandic history, and appears so again today. However, Icelanders are aware of their history, and they are certain that Iceland will have a colder climate in the future at some point, either in the short or long term. Moreover, warmer weather historically has been beneficial for Iceland's economy, but this has also increased the risk of Icelanders overexploiting their resources, leaving future generations of Icelanders with limited resources, and a further circumscribed environment, when harsher climate conditions inevitably return (Amorsi et al 1997). Thus, the Icelanders I interviewed are concerned about the negative impacts to Iceland's natural environments caused by climate change directly or indirectly by humans, leading to the overexploitation of natural resources and damage to the environment, enticed by the economic boons opened up by climate change. However, many Icelandic decision-makers are viewing climate change for Iceland optimistically, promoting the positive impacts a warmer Arctic may afford. According to Icelandic Ambassador Gunnar Pàlsson, "You could say that where you stand on global warming depends on where you sit." (quoted in Cameron 2005:31). The Icelandic president, Ólafur

Grímsson, views Iceland as a testing ground for developing climate and environmentally friendly technologies that would render Iceland a carbon free society in the near future (Mahr 2007:63).

5.2. *Ecosystems and the Environment*

5.2.1. *Terrestrial Ecosystems*

Impacts to Iceland's terrestrial environment caused directly by climate change are cautiously being viewed with optimism by Icelanders. Foresters in Akureyri report that trees and vegetation are flourishing as they are healthier and more abundant as Iceland's climate has been warming since the 1980s. Farmers' crops are already producing larger yields, and livestock can be put outside for longer periods in the spring and autumn, cutting down on the costs to house them. The most important impact to Iceland's terrestrial ecosystem according to Iceland's Kyoto Protocol report, is the extension of the growing season, starting earlier in spring (Government of Iceland 2006:38). Furthermore, with a warmer climate Icelandic farmers may be able to grow other crops besides grass, barley, and potatoes. There are some concerns raised by farmers and foresters about increased potential for new diseases and insects with warmer temperatures that could potentially harm animals and damage crops. As well, with the recent cold spells in late spring, there is some concern about the damage to imported trees budding too early in the spring.

The botanist in Akureyri, Guðleifsson, has conducted extensive research on the impacts of climate change on wild flowers and crops in Iceland. His research takes into account temperature, precipitation, snow, frost, ice coverage, and elevation. The results of Guðleifsson's research shows that less snow in the winter, as has been the norm in recent years, leads to ice encasement of winter crops, destroying large sections of some fields. According to Guðleifsson, snow cover acts as insulation against ice for dormant plants, as well as a source of water for the

plants when the snow melts. When there is no snow the ice encases a vegetated area, in effect suffocating the plant life. This is already having very serious impacts on some Icelandic farmers' capacity to have a productive crop in spite of warmer weather and a longer growing season (Guðleifsson Personal Communication: May 2007). Coupled with the late cold spells in spring reported by Icelanders in the north of late, agriculture may not expand as much as anticipated by the more optimistic views expressed in the ACIA and Iceland's Kyoto Protocol Report.

In the 1950s Iceland was in the late stages of its last warming trend that lasted from the 1920s to the 1960s, and similar observations of climate have been made by people throughout North Iceland since 2000. Malmstrom's research in the 1950s on potato crops in Iceland concluded that the key factor for a successful crop was to have a relatively warm spring. Malmstrom studied the potato yields and climate conditions in Iceland from 1952-57, and noticed some puzzling results. To summarize: potato yields in 1952 and 1955 were low compared to 1953, the year with the highest yield in the study, despite the fact that the summer temperatures and precipitation levels were very similar for all three years. After going back over his data Malmstrom found that in 1952 and 1955 there were considerable cold spells in May into June, which severely retarded the growth of the potato crops during these years, no matter how warm summer temperatures reached (Malmstrom 1960:121-122). The main point to be taken here is that regardless of how high temperatures climb in the summer, if the growing season is not extended at the start of spring due to late cold spells, crop yield and productivity will not increase, and this may also limit opportunities to grow new types of crops such as wheat and onions.

The future of Iceland's indigenous fauna in a warmer climate is of some concern to Icelanders who are fond of observing, or studying, such animals as birds, insects, and marine life. As previously mentioned, Arctic seabirds that migrate to Iceland to nest have been dying of starvation by the thousands, an observation that is absent in climate change research pertaining to

Iceland. Other birds common to Iceland, such as the ptarmigan, are also being seen less by people that I interviewed. One negative impact to the terrestrial ecosystems associated with birds mentioned is the thawing of permafrost areas, which would disrupt the birds that nest on the tundra in these areas (Government of Iceland 2006:38). This may signify changes in other levels of Iceland's ecosystems, as birds have been identified as early indicators of climatic and environmental changes in a region by scientists and indigenous peoples (MacDonald et al 1997:9-10). Some birds, such as the whooper swan, have been thriving with the recent trend of very mild winters in northern Iceland. Interestingly, whooper swans feed on freshwater fish, of which biologists at Hólar noted trout are increasing while salmon and arctic char are decreasing. Moreover, new birds from the south are migrating to Iceland, attracted by warmer temperatures, trees to nest in, and more insects to eat. In regards to insects, Icelanders are already seeing new insects in Iceland, which can survive the recently mild Icelandic winters. With increased warming the abundance and types of insects should also be expected by Icelanders.

Presently, little seems to be known or understood and more research is needed to investigate if the decrease of seabirds and the increase of tree birds, insects, and forests is an actual indication of significant changes in Iceland's terrestrial and marine ecosystems heavily affected by climate change; and if climate change is not the cause, what are the causes of these changes? Of particular interest to future researchers would be an investigation into the connections among the primary food sources of seabirds, small fish such as capelin and sand eels. If these small fish are not coming into Icelandic waters in great enough numbers to feed the seabirds that migrate to Iceland, what does this indicate for other fish species, especially the ever valuable cod that also feed on these fish? Another question to investigate would be if over-fishing of capelin is adversely impacting seabird populations. One retired fisherman and bird-watcher in Húsavík was quite passionate that it is the over-fishing of capelin, and not so much

climate change, that has been causing the guillemot population in this area to plummet. Furthermore, the harvesting of seabirds has long been a cultural activity in Iceland, particularly in the past to supplement the subsistence diets of Icelanders. Seabirds are still harvested by Icelanders, but in a manner more akin to recreational hunting than subsistence harvesting; although there has been an increase in the demand for seabirds as a food delicacy popular among tourists. The added pressure of human harvesting activities on seabirds may also be tied to the decline of seabirds, or the decline of seabirds may lead to harvesting restrictions of certain traditional species of seabirds, as they become vulnerable species in Iceland (Klein et al 2005:629).

Unfortunately, there is very little published research available concerning changes in the habitats of bird species due to climate change and other factors in Iceland to support the observations made by Icelanders I interviewed. However, in one study by Gunnarsson et al (2006), they conclude that anthropogenic activities stimulated by climate change are having negative impacts on wetland habitats of bird species known as waders in southern Iceland. Waders include snipe, redshank, arctic skua, oystercatcher, dunlin, and golden plover; and these birds are accustomed to marshy, grassy, wetland, and otherwise open vegetated areas (Gunnarsson et al 2006:265-266). However, wetland areas in Iceland are being encroached upon by forested and agricultural lands. Furthermore, wetlands are being drained for hydro-projects, irrigation, and to expand agricultural lands. To date, since the 1980s, afforestation efforts and the expansion of agricultural areas have been highly successful mainly due to favourable climate conditions. The shrinking of the wetland habitat due to these activities has had a negative impact on wader bird species that, with the exception of the snipe, tend to avoid wooded habitats (Gunnarsson et al 2006:272-273). As with the seabirds of Iceland, wetland birds of Iceland may also be declining due to impacts caused by anthropogenic factors and climate change. Thus, as

noted above new birds adapted to woodland habitats are coming to Iceland in greater numbers as Iceland's terrains and ecosystems gradually change. Unlike the plight of the seabirds, the remaining wetland areas are still viable ecosystems, but with reduced carrying capacities for species in these shrinking areas. Therefore, impacts of climate change that are viewed positively by Icelanders may also have negative impacts on the current thriving ecosystems of Iceland, especially if land-use planning is involved. According to the Mimura et al, an increase of agriculture and afforestation in Iceland will initially lead to a decrease of biodiversity in areas where these processes are occurring, "The imbalance of species loss and replacement leads to an initial loss in diversity. Northward expansion of dwarf-shrub and tree-dominated vegetation into areas rich in rare endemic species results in their loss." (Mimura et al 2007:696). This prediction is also stated by Callaghan et al when referring to circumpolar islands, "The imbalance of species loss and replacement by species migrating more slowly to islands is projected to lead to an initial loss in diversity." (Callaghan et al 2005:327).

5.2.2. *Marine Ecosystems*

It is not surprising to scientists or Icelanders that the waters around Iceland have been warming. Monitoring by scientists has shown significant increases in ocean temperatures since the 1980s. For example, in northern Iceland in 1989 the ocean temperature was 0.2°C and has risen to 2.0°C in 2000 and 1.9°C in 2004 (Björnsson and Pàlsson 2004:6). This warming of the oceans is similar to the warming of oceans experienced in the 1930s to 1960s when Icelandic fishermen observed changes in numbers, types, and distributions of fish species. Most notable of these observations was the northward distribution of cod and capelin. Cod spawning grounds also extended to the northern coasts of Iceland, while capelin spawned as far north as Thule (Drinkwater 2005:1329, Rose 2005:1360, Björnsson and Pàlsson 2004:2). Herring were caught in great abundance during

this time, exemplified by the boomtown of the 'Herring Capital of the World', Siglufjörður (Hamilton et al 2004). During the 1960s and into the 1970s Icelandic waters cooled and overexploited fish stocks collapsed, or came near to collapse, as fish stocks became less abundant and retreated to the warmer waters of southern Iceland (Drinkwater 2005:1330). Currently ocean temperatures are again rising, and once again Icelandic fishers and scientists are observing a northward shift of both cold water and warm water species in Icelandic waters (Drinkwater 2005, Rose 2005, Björnsson and Pàlsson 2004). This generally translates to a decrease of cold water species and an increase in warm water species in Icelandic waters. Many of the fish species inhabiting Iceland's waters are either on their southernmost or northernmost limits of their distribution (Rose 2005:1371, Björnsson and Pàlsson 2004:7), and changes in ocean temperatures can alter these distribution limits, eventually transforming marine ecosystems, like as has happened off the coast of Newfoundland (Drinkwater 2005:1335). Cold water species such as capelin, an important prey species for cod and seabirds, are declining in Icelandic waters (Murisma et al 2007:696). Additionally, capelin have not been spawning in their usual spawning grounds off the south and west coasts of Iceland; although, in 2004 capelin were found in high abundance off the north coast of Iceland, suggesting a northward shift in distribution of this species (Björnsson and Pàlsson 2004:9). Other cold water species such as Atlantic hookear sculpin, polar cod, Greenland halibut, mailed sculpin, and leopardfish have also been declining; however, many of these other species are not commercially fished and the impacts of climate change may not be as severe for these fish species (Björnsson and Pàlsson 2004:21). Other cold water species that have been overexploited, such as halibut stocks may be too depleted to take advantage of potentially improved environmental conditions brought about by climate change, as these species did in the 1930s (Björnsson and Pàlsson 2004:7).

Warm water species are increasing in Icelandic waters, including the north coast. Species such as herring, haddock, whiting, blue whiting, and monkfish are all being caught in greater numbers, confirming the reports from Icelandic interviewees (Rose 2005, Björnsson and Pàlsson 2004). These observations follow scientists' well proven theory that warmer ocean temperatures in northern waters will cause a northward shift of cold water and warm water fish species. The differences and complexities of the factors impacting the fish stocks around Iceland now as compared to the 1930s – 1960s are the overexploitation of many commercial fishing stocks, larger whale stocks, damage from bottom trawling, and extensive fishing of pelagic fisheries, reducing chances for these stocks to grow even under favourable environmental conditions stimulated by climate change (Björnsson and Pàlsson 2004:10-11). The question remaining is how are cod impacted by the warming of Iceland's waters?

Unlike many other fish species in Icelandic waters, cod are not near their temperature threshold limit, even with the present increases in ocean temperatures (Fogarty et al 2001:958). Thus, reportedly direct impacts have been minimal, with the exception of cod spawning off the north coast of Iceland as they did in the 1930s – 1960s. However, during this same time period cod stocks shifted their distribution northwards like the capelin (Drinkwater 2005:1329-1330). If it is not temperature pushing cod northwards it may be the dependency of cod on cold water species like capelin for food, and thus the cod migrate along with the capelin. Another theory is that the introduction of warm water species into the traditional feeding and spawning grounds of cod causes increased competition; driving the cod to colder waters there they can easily adapt and have less food competitors to contend with. There is one study by Myers et al (2001) that suggests the carrying capacity of cod is reduced when the ocean warms, and more competitor species arrive. Drinkwater supports this theory and demonstrates through his research that cod become less productive and competitive at temperatures above 12°C, causing these fish to migrate

to colder and deeper waters (Drinkwater 2005:1331-1332). This also raises the question of whether sand eels, a warm water species and main food source of seabirds, are being overly preyed upon by the increased appearance of warm water predatory species, reducing the amount of food available to seabirds, compounded by a northerly shift of capelin distribution areas.

Moreover, an overall annual temperature increase of more than 2°C from present conditions in the water around Iceland are anticipated to cause cod stocks to decline in much of the North Atlantic, including Iceland; as cod are expected to migrate to Arctic waters, and potentially to the high Arctic waters if these waters become ice free (Drinkwater 2005:1332).

With the exception of the uncertain future of Icelandic fisheries, the other primary issue concerning Iceland's marine environment is the increase in shipping traffic. The economic and cultural significance of increased shipping will be discussed later. The environmental implications of increased shipping with an opening up of Arctic waters are viewed by Icelanders with mixed opinions. Although many Icelanders agree that the economic benefits would be substantial, they also agree that Iceland does not have the policies, resources, or capital to manage the risks of environmental damage to Iceland's marine ecosystems due to increased pollution caused by a dramatic increase in shipping traffic. Such an incident as an oil spill could easily devastate Iceland's fisheries, and hence the current primary industry supporting Iceland's economy (Arctic Council 2004:4-5). Therefore, if fishing becomes a dwindling industry in Iceland, will the reason be because of environmental or anthropogenic changes caused directly by climate change, or indirectly by climate change? However, the shortening of global shipping routes would reduce CO_2 emissions significantly due to less fuel used over shorter voyages (Ministry of Foreign Affairs 2006:42). Examples were provided by a few informants relating to an incident when a cargo ship was damaged and drifted close to the southern Icelandic coast. The Icelandic Coast Guard was just able to divert any damage to Iceland's environment, but these

informants made it clear that if the ship was a large cargo ship or oil tanker, Iceland does not have, at this time, the capabilities to respond and control shipping disasters on a large scale.

In accordance with the Protection of the Arctic Marine Environment (PAME), a working group under the auspices of the Arctic Council:

> "Activities such as development of hydrocarbon and mineral resources, cruise ship tourism, and commercial fishing are expected to expand with increased accessibility and marine transportation in the Arctic (due to climate change). This may require greater infrastructure support and may pose increased environmental risks to the Arctic marine environment and its ecological processes, including the introduction of alien species and potential for pollution." (PAME 2006a:1; parentheses added).

The most pressing concern to Icelanders is not the pollution that would increase as a result of increased shipping traffic, as presently marine pollution from such traffic is around 20% in comparison to marine pollution from land-based resources comprising the other 80%. The most pressing issue for Icelanders concerning increased shipping in waters near Iceland is the risk of more serious environmental accidents caused by such events as oil spills or other organic substances. These concerns are warranted as a major environmental accident in Icelandic waters could cause irreparable damage to the marine ecosystems that currently sustain Icelandic fisheries (Ministry of Foreign Affairs 2006:44-45). However, the Icelandic government does not want to take passive stance on this issue, as PAME's progress report on Arctic marine shipping states, "That being said, an increase in Arctic shipping will be inevitable." (PAME 2006b:9). Therefore, the Icelandic government is promoting a more proactive role in the future of trans-Arctic shipping routes, where Iceland along with other Scandinavian countries set and enforce environmental regulations for foreign ships (especially Russian oil tankers) to adhere to when crossing these nations' sovereign waters. Plans for the implementation, monitoring, and enforcement of such regulations are still on the drawing board with no concrete plan yet developed by the concerned

Icelandic agencies: Environmental Agency, Maritime Administration, and the Coast Guard; but agreements have been made between Scandinavian countries to cooperate and combine efforts if a major environmental accident were to occur in northern waters (Ministry of Foreign Affairs 2006:45-47).

There are also the environmental considerations of constructing and expanding Icelandic ports to facilitate the needs and amenities of international transhipment ports. The construction or expansion of such harbour facilities requires large areas of land for loading and storage purposes, as well as the services to attend to the influx of people working on cargo vessels. The Icelandic government, in its proactive stance to capitalize on what seems to be the inevitable opening of Arctic shipping routes, has introduced legislation to implement environmental regulations concerning quality control standards of ships wishing to use Icelandic ports, in addition to emergency response initiatives to deal with environmental incidences at port or offshore (Ministry of Foreign Affairs 2006:51-53)

5.2.3. *Glaciers*

Lastly in regards to environmental issues, is a discussion of future exposure sensitivities regarding Iceland's glaciers. Glaciers are a prominent feature of Iceland's landscape, most of which are keenly observed by some Icelanders. The Icelanders I interviewed reported similar observations pertaining to the smaller glaciers that they would visit in the summer. They reported that small glaciers below 1500 meters have been receding rather significantly in the last two or three decades, some shrinking as much as 50% in the last 25-30 years. Some Icelanders believe these glaciers will be completely gone in the next twenty-five years. The melting of Iceland's glaciers obviously will have environmental and cultural impacts; exactly what these will be are

not entirely clear, but such impacts as flooding and rivers drying up are realistic possibilities. Additionally, roads, trails, bridges, and communication lines could be damaged by surging glacial rivers. Melting glaciers would detract from Iceland's natural beauty and its tourism industry, as Iceland's glaciers, including ski resorts located near glaciers, are a popular tourist attraction. Glaciers are also a part of Iceland, both environmentally and culturally, and Icelanders genuinely feel that the loss of glaciers in as a big loss for Icelandic culture.

What was not reported by participants, or by the Government of Iceland's Kyoto Protocol document, are the potential environmental and cultural impacts associated with deglaciation. Scientists studying glaciers in Iceland have identified how deglaciation in the past has transformed Icelandic landscapes and caused direct impacts on the environment that resulted in direct impacts on Icelanders. Furthermore, these scientists are also researching the potential impacts to Iceland caused by the deglaciation occurring in Iceland today, as the authors cited here agree that all of Iceland's glaciers are reducing in overall size and volume (Van Vliet-Lanoë et al 2007, Aðalgeirsdóttir et al 2005, Gisladottir et al 2005, Sjöberg et al 2004, Broecker 2001, and Oerlemans 1998).

Iceland's glaciers are in a temperate or maritime climate and therefore they are always near a state of rapid growth or collapse, making them very sensitive to climatic changes. When the climate warms, these glaciers shrink and cause such environmental hazards as floods and avalanches. The less obvious but perhaps more significant impacts caused by the reduction of glaciers are the changes to Iceland's environment. For instance, Sjöberg et al came to the tentative conclusions that the lithosphere at the margins of *Vatnajökull*, Iceland's largest glacier, is being uplifted, and the rate of this lithospheric upheaval has increased considerably since the 1980s (Sjöberg et al 2004:947-948), corresponding with the beginning of the current warming trend in the North Atlantic.

A more concrete impact with more observable and alarming consequences than lithospheric uplift is the deposition of large amounts of Aeolian sediments ranging from silt to sand. These sediments are spread further over the landscape by glacial rivers. As glaciers shrink these rivers may flood and alter course, spreading glacial sediments in an even wider range, possibly forming glacial lagoons in the process. This primary and secondary deposition of glacial sediments is currently expanding the size of sandy areas in Iceland, and these sandy areas are encroaching on vegetated areas; compounding Iceland's ongoing issues of land degradation and erosion. This encroachment on vegetated areas by the expansion of sandy areas is further exacerbated by strong winds transporting Aeolian materials to certain locations where they accumulate and spread in coverage. Gisladottir et al have already been observing and researching deglaciation and wind erosion south of *Langjökull*, in southern Iceland; and these researchers are convinced that this Aeolian process is causing the most severe changes to the surrounding environment, namely deglaciation and land degradation (Gisladottir et al 2005:186). The fact that all glaciers in Iceland are receding, albeit some faster than others, coupled with increased observations of changes in wind velocities and directions by Icelanders, indicate that these Aeolian processes may cause dramatic changes to the landscapes in other regions of Iceland (Walsh et al 2005:206). As noted earlier, one woman in Akureyri has observed an increase in winds from the southwest, based on her observations of increased occurrences of sandstorms in this area.

Other serious impacts may possibly be alterations to the flow and course of glacial rivers, such as the *Glerá* River that runs through Akureyri (See Figure 8), as these rivers are important energy sources for existing and considered hydropower plants, sources of water for irrigation, and for tourist activities; as well as the resulting impacts to roads, buildings, and infrastructure. (Government of Iceland: 2006:37).

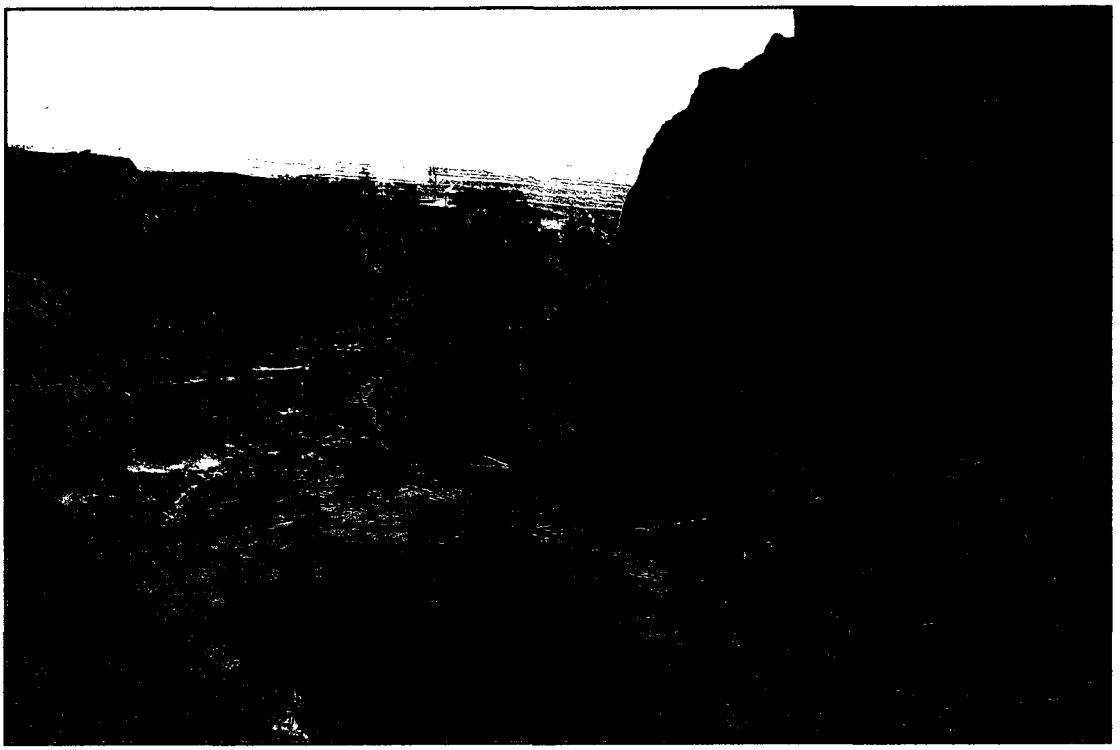

Figure 8: Glerá River in Akureyri, a glacial-fed river.

Perhaps the most voiced concern and fear among Icelanders, based upon theoretical scientific reports regarding the melting of Iceland's glaciers, is the potential for changes to ocean currents caused by the influx of freshwater from melting glaciers (Cameron 2005, Callaghan et al 2005, Kattsov et al 2005, Loeng et al 2005, Rose 2005, Walsh et al 2005, Broecker 2001). Supposedly these changes will occur as more and more freshwater from melting glaciers flow into the ocean, decreasing the density and salinity of the ocean waters. Besides the drastic and largely uncertain changes to marine ecosystems, scientists predict that the Gulf Stream could reverse its current cycle. At this stage in climate change research these predictions are hypothetical, but they are based on evidence from changes in direction of the Gulf Stream in the past. Broecker's analysis of this type of research supports the theory that the Gulf Stream has shifted from being dominant in the Northern Hemisphere, as it is now, to being dominant in the Southern Hemisphere in the past. Broecker's evidence is primarily based on Bond's research

documenting the deposition of large sediments on the ocean floor in southerly waters. It was concluded by Bond, that these deposits are too large to have been deposited in open water. Thus, these deposits were transported south by icebergs when the ocean in the Northern Hemisphere was colder as a result of the Gulf Stream pushing warm water to the Southern Hemisphere. Presently, the Gulf Stream (the main current circulating warm and cold water around the globe) pulls most of the warm water northwards where it mixes around Iceland with the cold salty waters of the Arctic and North Atlantic, which then pushes cold water south around East Iceland back down into the Atlantic (Broecker 2001: 61-64).

Iceland is located more or less where the warm Atlantic water is being brought in from the south and circulates around Iceland, from west to east, becoming cooler and more salty before being drawn south again (Cameron 2005:33). An important factor in the Gulf Stream's cycle, or more correctly, the thermohaline cycle, of which the Gulf Stream is a part, that cools warm water being pushed north, is the saltiness of the North Atlantic. The highly salty waters of the North Atlantic make the water denser, pushing down incoming warm water where it becomes cooler. Excess salt is then pumped out when this now cooler water is transported south where it eventually rises again as it warms (See Figure 9). In other words, the high salinity levels in the North Atlantic helps keep these waters cool, even as the Gulf Stream pushes warm water in, acting, in Loeng et al's terms, like a 'Great Conveyor Belt' (Loeng et al 2005:461). According to Broecker, just one additional gram of salt per litre of water throughout the North Atlantic is the equivalent of an 8° Fahrenheit cooling in ocean temperatures. Thus, a reduction of a gram of salt per litre in the North Atlantic would allow for more warm water to penetrate farther north before cooling, in turn warming ocean temperatures in the North Atlantic. This also weakens the push of cool saltwater southward, slowing the Gulf Steam to an eventual stop; followed by a reversal in its direction. At this stage the North Atlantic would cool dramatically as warm water would be

pushed south, surrounding Iceland in cold water and sea-ice, making the island virtually uninhabitable for humans. This reversal of the Gulf Stream has happened in the past, but no conclusive evidence has been given that suggests a timeline for when this cycle tends to reverse (Broecker 2001:63-64).

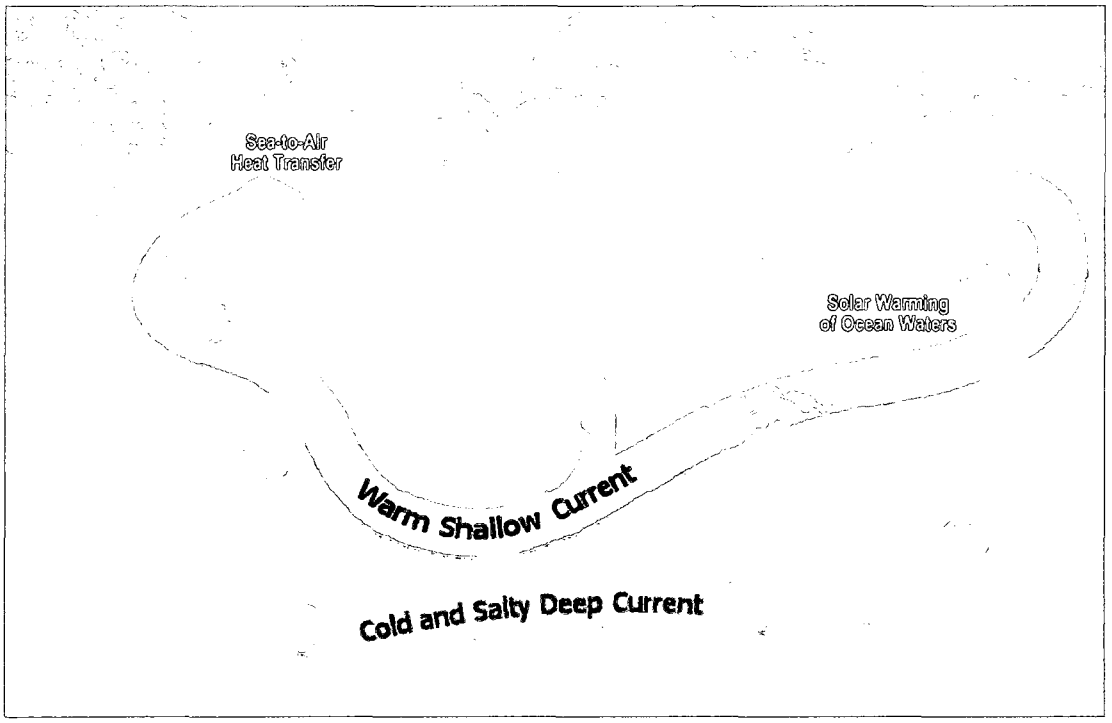

Figure 9: Image of Thermohaline Cycle posted on *Water Wired* website by Michael E. Campana. Available at http://aquadoc.typepad.com/photos/uncategorized/2008/04/18/ocean_circulation_conveyor_belt.jpg.

To bring this back to glaciers and climate change, the melting of large glaciers, like the Greenland inland, could introduce enough freshwater to the North Atlantic, effectively reducing salinity levels, and therefore potentially initiating the slowing down of the Gulf Stream. To come full circle, with recent climate change being caused, or at least, accelerated by anthropogenic factors, Icelanders are truly concerned if increased global warming will lead to the Gulf Stream stopping and become reorganized at an accelerated rate as well. Even though the scientific theories regarding the workings of the Gulf Stream and its interconnections with other global systems, such as the Jet Stream, are poorly understood and mostly unknown to the scientists

themselves (Kattsov et al 2005:125, Walsh et al 2005:196); this is by far among the most worrisome long term potential impact of climate change voiced by Icelanders. Whether through interviews or from documentary sources, the reversal of the Gulf Stream and the drastic consequences this would have on Iceland is often mentioned, and is not so easily dismissed by Icelanders as just scientific theory.

However, contrary to the Gulf Stream theory is the data from GCM's indicating that the complete disappearance of glaciers just in Iceland would have relatively minor impacts to the overall climate in the North Atlantic. Moreover, Van Vliet-Lanöe et al provide evidence of a completely glacier free Iceland during the Eemian Optimum 127,000 years ago and 116,000 years ago (Van Vliet-Lanöe et al 2007:9-10). The point to be taken here is that the melting of Iceland glaciers and the potential for the Gulf Stream to reverse direction are viable theories as they have happened in the past; however, planning and preparing for such an occurrence at this time is much like planning and preparing for a meteor strike, a giant earthquake, or some other such unpredictable but equally catastrophic event.

5.3. *Culture*

From a cultural viewpoint Icelanders are already preparing adaptation strategies to adjust to and mitigate the impacts of climate change, while attempting to maintain a strong economy and a healthy environment. The government of Iceland has taken a seemingly strong stance to mitigate climate change, exemplified in its signing of the Kyoto Protocol in 2003; its involvement in the Arctic Council's ACIA, Iceland's mandate to investigate the interconnections between people and the environment in the Arctic as chair of the Arctic Council from 2002-2004; and the Stefansson Arctic Institute's lead role in compiling the *Arctic Human Development Report*. However, there

is some controversy among Icelanders regarding their government's approach and commitments to the Kyoto Protocol, or how Iceland will proceed if the Arctic becomes as warm as scientists are predicting for the long term. An Icelandic woman I interviewed had worked for the Government of Iceland on the Kyoto Protocol report in 2004, and she stated that Iceland's signing of the Kyoto Protocol put little to no pressure on the Government of Iceland to implement policies to reduce its CO_2 emissions, as most of Iceland's permanent infrastructure has been powered by local renewable energy sources since the 1970s, when oil became economically unviable for Iceland to import to provide heat and power for their homes and buildings. Thus, Iceland produces less than its quota, and therefore the government can environmentally justify more economic development in Iceland, such as the building or expansion of aluminium smelters; a highly controversial topic among Icelanders.

On the positive side, Icelanders say aluminium smelters provide much needed employment in rural areas. Moreover, Icelandic politicians and public and private supporters claim that aluminium smelters built in developing countries would not follow as stringent environmental policies as Iceland imposes on the aluminium smelters built and operated in Iceland. There is validity to this statement as aluminium smelters in Iceland use up-to-date technologies that reduce the CO_2 emissions of these smelters by some 40%, while increasing productivity by 70% (Government of Iceland 2006:29). This reinforces my observation that some Icelanders view climate change as an environmental concern globally; however, nationally Iceland does not feel its own environment to be overly threatened by climate change, as they are willing to take on industrial projects as an international effort to mitigate climate change. In other words, Iceland is claiming that since it does not exceed its emissions quota under the Kyoto Protocol, it is environmentally responsible, on a global scale, to expand its own aluminium smelting industry, as opposed to that of a country that has already exceeded its quota or would

exceed its quota. This is exemplified in Ambassador Gunnar Pàlsson's positive outlook on climate change expressed in such statements as,

> "One should not necessarily take a bleak view of climate change... It's clear that many communities in the Arctic region will be negatively affected. This is true of the indigenous peoples in North America and Russia. Some of these peoples may see the basis of their livelihoods disappear, more or less. There could be very serious repercussions traditional hunting, for instance." (Pàlsson; as quoted in Cameron 2005:32).

This is countered by the more environmentally concerned Icelanders such as Finnsson, who counters Icelandic political views of climate change as having largely positive impacts for Icelanders with such statements as, "The idea that Iceland will do well; that is extremely parochial thinking. Surely Iceland will be affected by global developments. I mean how stupid can you get?" (Finnsson; as quoted in Cameron 2005:34).

On the negative side is the pollution of the environment caused by the construction and operation of aluminium smelters, increased CO_2 emissions, and the high amount of energy to run the smelters and the general loss of the natural aesthetics of the landscape where these smelters are built. One Icelander who was incensed with the environmental damage caused by aluminium smelters, was also disgusted by the fact that Iceland competes with developing countries to produce aluminium, while claiming to be an environmentally responsible nation.

The Icelandic government has also introduced a clever twist into the Kyoto Protocol, based on the reforestation and re-vegetation policies instituted by Icelandic governments in the 1960s. Iceland is in a peculiar position of increasing its forested and agricultural areas through these policies and with assistance from a changing climate; while in most other countries in the world the circumscription of forested and vegetated areas is decreasing due mainly to anthropogenic factors, and now more so by climate change. Iceland has used its reforestation and

re-vegetation policies to reduce its CO_2 emissions and has used the Kyoto Protocol to justify increased economic growth, as long as the Icelandic government makes efforts to reduce CO_2 emissions with carbon sequestration (Government of Iceland 2006:30,38; Juday et al 2005:800). In other words, Iceland's commitment to the Kyoto Protocol seems more political and economical showmanship than environmental stewardship. Another example is Icelandic President Grimmsson announcements of Iceland's intention to pump excess CO_2 into the ground instead of into the atmosphere, as a mitigation measure to carbon sequestration (Mahr 2007:63). My criticism does not extend to the participants that I interviewed, and most Icelanders in general, who do not want to see Iceland's environment irreparably damaged for the sake of unsustainable development, and like Finnsson's sentiments, agree that Icelanders should not: "...do any irreparable damage to the thing that feeds you..." (Cameron 2005:34).

5.3.1. *Shipping*

While I was in Iceland during my preliminary visit in Akureyri in March, 2007, I attended a conference titled, *Breaking the Ice*, that gave me a very informative insight into Iceland's future in international shipping in the Arctic. The topic of the conference (Ministry of Foreign Affairs 2006) pertained to the opening up of Arctic sea routes, especially in the Russian North, and what this would mean for shipping around the world. Speakers spoke of the upcoming reality of open Arctic sea routes with hundreds of voyages a year; reduction in the shipping time of goods, substantially larger ships than the current cargo ships travelling via the Suez or Panama Canals, the volume of goods shipped; and places of strategic importance as transhipment port centers. Iceland was identified as an ideal candidate as a depot harbour for the shipment of goods in the North Atlantic between Eastern North America and Europe, Russia, and China. In this scenario Iceland would need to expand harbour facilities to accommodate this increased shipping traffic.

Already, in Akureyri, a harbour worker I interviewed said that five years ago he would get five or six ships coming into port a day, while this year he was expecting fifty to sixty ships per day.

Becoming a depot harbour for international shipping coming through the Arctic and North Atlantic may well prove to be an effective adaptive strategy for Icelanders. If fisheries are impacted negatively by climate change or by increased shipping traffic, Iceland's economy may have to shift from being primarily a resource based economy to being primarily a tertiary based economy catering to the shipping and tourism industries. It is not so much that Icelanders are against being a depot harbour for international shipping, but is Iceland prepared and equipped to respond to environmental violations and disasters that inevitably will happen in Icelandic waters if Iceland becomes a centre for international shipments in the North Atlantic? Presently, from what I have been told by people regarding this topic the answer is a resounding 'NO!'. In *How the World will Change with Global Warming*, Valsson (2006), among other Icelanders, envisions Iceland as an international depot harbour, as the importance of the Arctic as a significant global region that will become more utilized and settled in the future due to climate change (Valsson 2006, Ministry of Foreign Affairs 2006, PAME 2006b). As Valsson righteously exclaims: "What will happen within the system of today's ribbon of habitation will be quite different, that is, once the Arctic has gained its RIGHTFUL position as a very central place on the globe." (Valsson 2006:66; emphasis added). Less controversial views among other Icelandic academics and policy-makers are that Iceland is best to be involved in international relations over shipping, rather than being excluded from geopolitical and geoeconomcial decisions and actions that will inevitably occur, such as the recent meeting in Ilulissat, Greenland on May 27, 2008; between Canada, Denmark, Norway, Russia, and the United States over the sovereignty of the Arctic Ocean (McLaughlin 2008:1). The future of increased shipping in the Arctic as an opportunity

afforded by climate change is just another example of how climatic changes and anthropogenic factors compound the stresses on the environment, and invariably of climate and culture.

The excitement at this conference on the opening of the Arctic was mainly based on climate change and the economic opportunities to be gained. Very little attention was paid to the environmental impacts that increased shipping will have on the Arctic and Iceland, especially with the transport of oil. In fact, the question of whether an oil refinery for Russian oil was going to be ratified in the Westfjords was a contentious issue while I was staying in Iceland, which would result in Russian oil tankers coming into Icelandic waters to deposit there unrefined oil for refining, increasing the already known risks of what environmental accidents associated with oil spills can inflict on natural and social environments (Ministry of Foreign Affairs 2006).

5.3.2. *Tourism*

Tourism is one industry that may feel impacts of climate change first before other economic sectors of Iceland are impacted. With the need for relocation of current ski and glacier tour facilities closer to receding glaciers, and the increasing dangers of melting glaciers and avalanches does not bode well for winter tourist operators in Iceland (Steinsdottir 2007:4). As already mentioned, winter tourism is on the decline and may well become an unviable tourist initiative. On the upside, summer tourism may expand as more people start choosing Iceland as a place to go to cool down if southern nations are experiencing extreme heat waves in the future.

Two unforeseen potential impacts to the whale watching industry caused by climate change were mentioned by first a tourist planner in Akureyri, and second, by a whale watching tour operator in Húsavík. The tourist planner mentioned that if whales start moving in search of food farther away from known whale watching locations around Húsavík, then whale watching

tours will take longer. Fewer tours being able to be go out in a day equates to less revenue for the whale watching tour operators. This could lead to charging higher prices by whale watching tour operators, or to the end of whale watching as a viable enterprise in Húsavík. From current observations by the whale researchers at the Whale Museum in Húsavík, there are increased numbers and types of whales being seen in the bay at Húsavík, and so travelling farther to watch whales does not seem to be an immediate challenge for whale watching tour operators to be concerned with in the short term. Though the building of an aluminium smelter in Húsavík, as was being proposed when I visited this community in May 2007, may alter the nutrients reaching the bay from the glacial river, *Laxa*, that the whales feed on, which could cause whales to seek food in more distant waters. The building of an aluminium smelter may also impact the flow of this river, and it would definitely be polluted due to smelting activities.

The second insight by the skipper in Húsavík, was that in the last few years there has been an increase in fog in the area. With too many days of fog in a whale watching season this could reduce the numbers of tours that can go out to view whales, again reducing the revenue of these companies. This second insight seems much more likely in the short term, as other residents of Húsavík have mentioned an increase in the amount of foggy days in the last four or five years. However, one whale watching tour operator in Húsavík believes that he will be able to extend his whale watching season if the whales keep coming as early, and in as great a numbers and variety, as they have in recent years. Another challenge that may impact whale watching companies is increased winds. Although, the informants I interviewed in Húsavík did not mention any significant changes in wind velocities, if winds were to increase around Húsavík, whale watching boats, which are small, may not be able to go out due to dangerous conditions caused by the hard winds; as has happened to small fishing boats on the islands of Grímsey and Heimaey (See Figure 10).

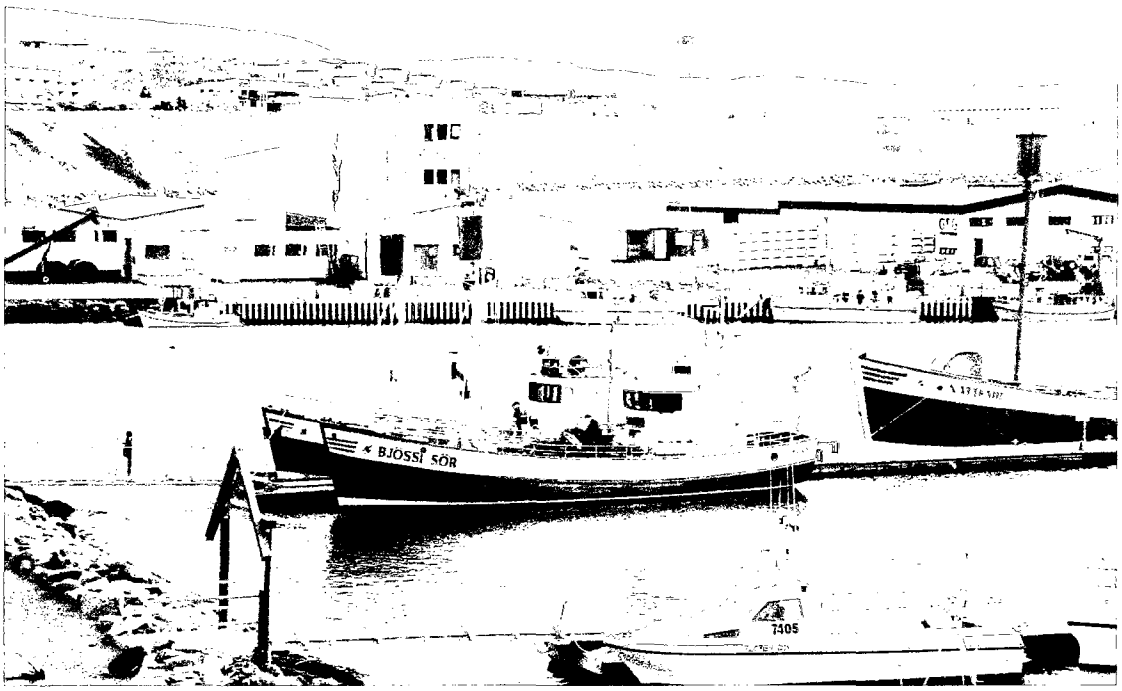

Figure 10: Whale Watching Boats in Húsavík Harbour

5.3.3. *Agriculture*

Future climate change impacts upon agriculture are primarily viewed in a positive light in Iceland's Kyoto Protocol report. This report presents promising statistics regarding the potential for agriculture to expand in Iceland. For example, every 1° C increase in temperature in the summer equates to an overall 11% increase in grassland production and even higher production for barley. Further projections are that more areas will become vegetated and consequently more land will be suitable for agriculture, expanding this rather limited and heavily subsidized industry. This could lead to a 64% increase, or 1.7 tons per hectare, in hay production by 2050 in Iceland. Other future exposure opportunities for agriculture in Iceland include the growing of other cereal crops such as oats, wheat, rye; and increasing the production of root crops such as potatoes, onions, turnips, carrots and possibly other new species. In regard to animal husbandry, warming

is again viewed as beneficial, as farmers would be able to allow their animals to have more grazing time outdoors with less time being sheltered (Government of Iceland 2006:37-38). As Hjalti said, having animals outdoors in suitable weather conditions makes animals healthier by just being in the fresh air and having the freedom to roam. Farmers would also save on labour, energy, and extra food processing costs with having their animals outdoors most of the time. There are references to the negative impacts to agriculture, including the increase in insects and diseases mentioned before, as well as the use of pesticides, which are not used in Icelandic agriculture presently. One side effect of increased grazing, especially in the winter, is land erosion, prompting some Icelanders to push their government to enforce fenced grazing areas to avoid issues of overgrazing and land degradation that have emerged in the past.

Many of the future sensitivities to agriculture in northern Icelandic communities have already been mentioned, with the exception of one. With a longer growing season and use of better agricultural techniques, Iceland may be able to become agriculturally self sufficient, with surplus products to export. As one interviewee pointed out, the United States has been increasing its imports of Icelandic agricultural products due to the surplus and high quality of Icelandic farmers' products. This interviewee is also intensely interested in Icelandic agriculture, and he perceives Iceland as a leader among circumpolar nations in realizing the potential of agriculture in the Arctic as an opportunity to gain from climate change. There is already evidence of other Arctic nations following Iceland's lead of capitalizing on agricultural opportunities afforded by a warming climate. For instance, Greenland's sheep farms are beginning to become more and more productive as the climate warms, in addition to the expansion of Greenlandic agriculture to include cattle farming (Nuttall 2008:49). Overall, a gradually warming climate will provide more options for Icelandic farmers to grow other crops, increase the yields of their existing crops, and allow farmers to be less dependent on government subsidies. The one caution to farmers are

lessons from the past that should reinforce the responsible management of agricultural lands in Iceland to avoid past land erosion and degradation problems caused by a combination of climate change and unsustainable agricultural practices; and not to overproduce for economic gain at the expense of depleting ecosystems for future Icelanders.

In reality, the position of Icelandic agriculture in the political-economic arenas that it is involved nationally and internationally may influence the direction of Icelandic agriculture more than impacts caused by climate change. As Juday et al summarize:

> "There are complex multiple goals in Icelandic agriculture, including food production, employment, rural stability, maintaining an attractive landscape, and environmental protection. Because the agricultural system exists in a highly interventionist public policy environment, a traditional economic analysis is likely to show that national and CAP (European Community Common Agricultural Programme) policies will be more influential than temperature increases in the future of Icelandic agriculture." (Juday et al 2005:809; parentheses added).

Unaccounted for in the literature is the knowledge and insights of farmers, such as Hjalti, that assert that if harsh cold spells in spring effectively reduce the growing season, regardless of how warm summer and autumn are, and this local knowledge is even supported with scientific evidence collected in the past (see Malmstrom 1960).

5.3.4. *Fishing*

Clearly the most important resource and industry in Iceland are still fish, and still cod in particular. Fishing has been the most important industry in Iceland well before this nation gained its independence from Denmark in 1944; and this industry has become the primary indicator of a strong or weak Icelandic economy, and associated socioeconomic status changes among its citizens. As noted in ACIA, Iceland's five economic depressions corresponded with low catches

in the Icelandic fisheries (Vilhjálmsson and Hoel 2005:721). According to Iceland's Kyoto Protocol report the future of Iceland's fisheries under warmer climate conditions is uncertain (Government of Iceland 2006: 39). It would seem, without conclusive predictions pertaining to Iceland's fisheries, that there is a good chance they will benefit, as warmer ocean temperatures suggest an enhancement in Iceland's marine ecosystems.

Moreover, impacts to fisheries will vary from region to region, with periods of instability, but more than likely Icelandic fisheries will adjust to any long term and short term changes. However, it will mainly be small fishing and farming communities in Iceland that will experience the greatest of these impacts, a small proportion of Iceland's population. Therefore, the Government of Iceland considers impacts caused to a few rural communities to have a negligible impact on Iceland's GDP, and thus any social, political, and economical impacts will have very little consequences for Iceland on the whole; even if climate changes are sudden and not gradual. Once again, at the national level Iceland admits to an initial' instability' for Icelandic society due to climate change, followed by an 'adjustment period'. However, there is the belief at the national level that, at its worst, climate change will have minor impacts on both the environment and people of Iceland, no matter how sudden or gradual climate change may occur. Therefore, climate change is portrayed as a global change that Iceland will more than likely benefit from locally, especially if Icelanders are quick to capitalize on any beneficial impacts and reduce the negative impacts (Mahr 2007:63, Valsson 2006:66-69, Cameron 2005:32-33, Vilhjálmsson et al 2005:730-731). These are very general statements made by Icelandic academics and politicians, and they seem to maintain the current status quo of the country – continued economic prosperity.

Unfortunately, from the interviews I conducted with Icelanders, including scientists at the MRI and fishermen in Húsavík and Grímsey; and the research I conducted into climate change impacts on Iceland's fisheries, not one of these sources could provide a conclusive answer or a

concrete observation regarding the impacts that warmer Icelandic waters will have on Iceland's fisheries. There have been reports by the fishermen at Grímsey about cod being caught at deeper depths, and these cod are healthier, fatter, and larger. According to biologists at the Aquaculture Department at the University of Hólar, cod are a very adaptable fish and may be able to adjust to extremes in climate conditions in just a few generations, as other scientists have noted (Myers et al 2001, Drinkwater 2005, and Fogarty et al 2001). A research initiative investigating why cod around Grímsey are being caught at deeper depths may cast some illumination for biologists and fishers, if capelin and other food sources for adult cod are also being found in greater numbers at deeper depths.

Fortunately, McGoodwin's research with the fishers living on Heimaey has elaborated on some of the vulnerabilities and potential short term adaptation strategies. Heimaey is a community of 4600 people, almost all of which are employed in the fishing industry. The responses these fishers had to McGoodwin's questions regarding climate change were mixed, but considerably more negative than the Icelanders I interviewed. First, if there is a replacement of fish species in the marine environment around Iceland the impact to fishers will depend on the numbers and market values of the new species. Second, weather conditions on the waters are becoming worse, limiting the days that fishers of small boats have to fill their quota. Third, the ITQ system is inflexible to changes caused by climate change, and in practice is proving to be more restrictive in response to changes in fish stocks caused by climate change. These last two points were expressed mainly by owners of small boats who thought that large boat owners had an unfair advantage over small boat operators because trawlers did not have to account for weather conditions on the water, therefore not limiting their days at sea, as is happening to small boat owners. Small boat owners also added that the ITQ system does not allow for fishers in these boats to seize opportunities when certain fish become periodically abundant, for whatever

reason, to make up for lost days at sea due to weather and sea conditions (McGoodwin 2007:43-44).

Fishers on Heimaey blamed the ITQ system for being inflexible to the owners of small boats because this system does not account for changes caused by climate change, and has degraded the livelihood of fishing in the community greatly. McGoodwin suggests the management systems such as the ITQ system should become more flexible, such as allowing small boats to fish during prohibited times to make up for lost days of fishing due to weather, and/or sea conditions. Another suggestion to be considered, based on my own research and observations of fishermen's conversations, is the relaxation of quotas on new fish species for small boat owners for a limited time; to make up for losses caused by a decrease in indigenous fishing stocks and an increase in unsuitable weather and sea conditions. Presently, small boat owners become at risk to selling their quota to large boat owners if changes to climate or ocean ecology do not allow small boat owners to catch their quota. Perhaps the greatest vulnerability faced by the fishers of Heimaey, who currently enjoy a high standard of living, is that the community is not diversified enough, with fishing being virtually the only form of income available in Heimaey. This community has become over-specialized, restricting its ability to adapt to environmental and cultural changes caused by climate change, among other changes. If fishing is adversely impacted by climate change in Heimaey, the possibility of a large migration of people away from this island is highly likely (McGoodwin 2007:53-54). Other small Icelandic fishing communities have recognized the need to diversify their economy if they are to survive as thriving communities in a post-modern world experiencing global climate change. Examples include the communities of Höfn and Ísafjörður, as these fishing villages have transformed from being chiefly fishery dependent to incorporating economic strategies that focus on developing

tourism initiatives and high-tech enterprises catering to Iceland's fishing fleet or management of Iceland's marine resources (Aarsæther et al 2004:148-149).

5.3.5. *Whales and Whaling*

Whaling is a very sensitive issue in Iceland, with some Icelanders for, and some against, whaling. However, for many of the people I spoke with whaling was a sensitive subject because other countries accuse Iceland, thereby all Icelanders, of supporting whaling. Icelanders are offended by this stereotype, and this issue brings forth feelings of nationalism, particularly in those Icelanders who do not share other cultures' views of abolishing whaling, and defend Icelandic views of whaling as a livelihood for a handful of Icelanders who are not overexploiting this resource (Einarsson 1996). During fieldwork I avoided bringing up the issue of whaling, as this inevitably led to my participant becoming defensive. However, at times whales and whaling came up, and after looking over the data I collected on this issue, I am compelled to speculate if whaling will become an adaptation strategy for Icelanders in the future. That is, if the whales move too far away from the coast to create viable whale watching tourism enterprises, and especially if key fisheries collapse in northern Iceland, will whaling be an option? Take, for example, whale watching boats in Húsavík. If boats currently used for whale watching become unviable because the whales are too far away, or there are too many foggy days, will they be re-outfitted as fishing vessels, or as the whaling ships they were originally commissioned as (see Brydon 1996)? The value for harvesting a resource such as whales, rather than observing them, outweighs the cost to travel the extra distance to harvest them. This is not a statement for or against whaling activities, but a statement to raise the point that if more whales are coming to Icelandic waters, but they are too far away to profitably operate a whale watching enterprise, and fishers are struggling, is the potential for new whaling enterprises an unrealistic possibility?

Currently, quotas for harvesting whales are being allocated as of May 2008, according to an article published by *Reuters*. "The BBC said that a government official had confirmed that quotas would probably be issued again soon with whaling starting in May." (Reuters 2008).

Another possible speculation related to whales, climate change, and fishers that does not involve whaling is based on Einarsson's findings regarding the behaviour of whales around Iceland in the 1920s. At this time whales actually played a beneficial role for fishers by herding schools of commercial fish, keeping them in the fjords of Iceland (Einarsson 1996:52). Therefore, the presence of more whales in northern Iceland could correlate with an increase of fish in these waters. Moreover, whales may be keeping more fish in Húsavík's bay, *Skalfundi*, herding these schools as they did in the past. In turn, this might lead to an increase of employment in the fisheries in this area, or conversely reduce the fish stocks in this area, coupled with intensive fishing efforts. The future of small boat fishing may be linked with whales, as whales keep fish in the fjords where weather and sea conditions are not so turbulent as the open ocean waters beyond the fjords.

5.4. *Reflections on Anthropological Contributions to Climate Change Research*

The above discussion, as with this entire thesis is based on the premise that climate change is happening, and that the current overall global warming trend being experienced will continue well into the 21st century, if not beyond (IPCC 2007, ACIA 2005). This discussion doubles as a gap analysis, highlighting events and observations indicative of climate change that provide a valuable contribution to the human dimension of Arctic climate change research, especially for Iceland. For instance, in the course of the research that I conducted in northern Iceland, several areas of inquiry related to how aspects of Icelandic culture and Iceland's environment are

connected to, and will be influenced by, climate change are elucidated; which may be of some interest to Icelandic scientists, professionals, decision-makers, and to community stakeholders. One of the most surprising observations that I made, reinforcing Crate and Nuttall's (in 2009:395) call for more anthropological research to the study of climate change, is the disconnect between scientifically and academically educated Icelanders, with Icelanders who are very knowledgeable about their local environments, but are not scientists or professionally recognized experts. As noted earlier, Pálsson (1991) points out the mistrust that developed between Icelandic fishers and marine biologists with the establishment of Iceland's MRI in the 1960s, with both these groups suspicious of each others' knowledge of the sea. The disconnect between scientists and Icelanders who are not fishers are not as strained, but there seems to be a noticeable lack of communication between scientists and people who base their livelihood on the land, or on the sea.

Another example of how anthropology may possibly be capable of positively contributing to climate change research in Iceland, are further studies with small fishing or farming communities. Based upon my own research in Grímsey Island, and McGoodwin's (2007) research in Heimaey Island, the potential for small boat fishers to be adversely impacted by climate change is quite plausible. Therefore, these communities become more vulnerable to climate change, especially under the ITQ system. This system was not devised to respond to ecological changes brought on by climate change in Icelandic waters; and in fact, this system was devised to concentrate fishing rights in the hands of a small group of Icelanders, which has been accomplished very effectively since the 1980s (Pálsson and Helgason 1995). Climate change might yet increase the concentration of ITQ fishing rights in the hands of even fewer Icelanders. Thus, by identifying issues of increasing importance to these communities, anthropologists may be able to inform scientists and politicians of these community level concerns. What is more, by actively working with communities to build their capacity to voice their concerns, respond to

climate change effectively, and participate in climate change policy-making initiatives; anthropologists have the opportunity to interpret, facilitate, and mediate the communication channels, which remain so murky, between scientists, politicians, and communities.

One of the more important anthropological contributions to climate change research is elucidating what people are doing, and what people will have the capacity to do, in response to climate change and its associated impacts currently and in the future, at both the national and community level. Communities in Iceland vulnerable to climate change will have to develop adaptation measures and strategies to keep their communities culturally and economically intact. If changes to Iceland's environment and culture are significant enough to cause a reorientation of Iceland's economy to shipping, tourism, technologies and other tertiary and quaternary industries as a way of adapting to climate change; small fishing communities may become places that once existed, rather than exist.

Iceland provides an excellent example of how past decisions and policies made at the national level have undermined the social and cultural integrity of small rural communities; as decision-makers are basing their decisions on scientific information about climate and the environment, with the voices of people living at risk to these changes being overlooked or regarded as secondary sources of information rarely called upon to support, complement, or refute the authority of scientific findings (McGoodwin 2007:51-54). Moreover, many communities find it difficult to present their concerns, questions, and knowledge in a way recognized by scientists and politicians as complementary, and not secondary to science and political ideologies. The social sciences have the theories, methods, people, and resources geared specifically to frame community issues and knowledge in a manner that makes sense scientifically, technically, and practically; as well as being representative of the people sharing their knowledge, concerns, issues, and questions at the community level within wider academic

and political circles. Anthropologists committed to an applied approach to this discipline have the opportunity to step in and foster cooperative relations between scientists, politicians, communities, and other stakeholders by being knowledgeable of how climate change is culturally shaped and understood differently by both scientists and non-scientists. As Crate and Nuttall stress:

> "The reality is that climate change challenges researchers in both the natural and social sciences to forge strong working partnerships across disciplines, as well as with various stakeholders. The development of innovative multidisciplinary forms of collaboration between the natural and social sciences seems the only real way forward if we are to identify and understand the processes driving climate changes, for instance, or if we are to assess, analyze, and evaluate the impacts of climate change within the broader context of social and cultural change for indigenous peoples and local communities." (Crate and Nuttall 2009:397)."

Chapter Six

Conclusions and Moving Forward

Scientists overwhelmingly agree that the Arctic is experiencing, and will continue to experience, significant warming trends. However, from my analysis of Iceland's historical linkages between climate and culture, it is evident that variable, and at times extreme, climate perturbations accompany longer warming and cooling trends. Moreover, when climate change occurs, it impacts the existing cultural and environmental conditions of people and their homelands (Strauss and Orlove 2003:6). In regards to contemporary climate change in Iceland, this includes marine pollution, glacial movements, land erosion, and the sustainable development of Iceland's marine and terrestrial resources. Finally, it is important that Icelanders and other Arctic peoples learn from the mistakes of past responses to climate change. When Icelanders first settled this island they drastically over-exploited the natural bank account of Iceland's natural resources, writing a blank cheque for themselves. This left future generations of Icelanders with limited natural resources and land, reducing their options for coping with, and buffering the impacts caused by future climate change (Ogilvie and McGovern 2001:392-393). Icelanders repeated this mistake a thousand years later when a warming trend started in the early 20th century. Again Icelanders were granted a new natural bank account of marine resources, and in less than a century Icelanders have almost bankrupted their natural capital of fish on several occasions. Therefore, it is imperative that these mistakes are not repeated for the benefit of future Icelanders and other Arctic peoples. Likewise, Icelandic policy-makers should be more conscious of the policies they implement so as not to concentrate the access of scarce resources of market, or of subsistence, value in times of need in the hands of the few. Policies regarding the conservation and/or management of natural resources should be flexible enough to anticipate and mitigate the impacts

of sudden climatic changes, which have occurred with high frequency and variability throughout Iceland's history.

The preliminary results of the ethnographic research I conducted in Iceland in 2007 indicate that weather and climate are still very important in Icelandic discourse, and a changing climate in Iceland is highly supported within this discourse. For instance, in regard to Icelandic observations of climate change, every Icelander I interviewed stated that winters are now warmer, and with noticeably less snow. Moreover, many Icelanders remarked that seasonal contrasts are becoming less pronounced, as if the seasons are 'blurring' together. New species of birds, fish, and insects common in southerly regions are also being observed more frequently in Iceland, indicating a warming climate, as some of these species are surviving Icelandic winters, or are returning to Iceland as part of their altered migratory routes. Although Icelanders are not presently being severely impacted by a warming climate in Iceland, many voiced concerns relating to potential future impacts that climate change may have on aspects of Icelandic culture, particularly in regards to fishing, agriculture, shipping, and tourism. Icelandic perceptions of a warming climate seem to be mixed, but most of the people I interviewed agreed that a warmer climate in Iceland would overall be beneficial in the day-to-day lives of Icelanders, that is if the warming trend is gradual. However, there is the concern that a warming climate will afford new economic opportunities in Iceland, such as increased shipping of oil and gas through Icelandic waters from other Arctic regions, which could also jeopardize the fisheries, Iceland's leading industry. Thus, from the preliminary results of my research a warming climate in Iceland is not necessarily viewed negatively by Icelanders; it is how they will respond and adapt to the impacts of a changing climate that will determine if this phenomenon is more beneficial or detrimental for Icelanders.

Furthermore, Icelanders may find that certain aspects of their culture are transformed by climate change induced alterations to Iceland's, and the Arctic's, terrestrial and marine ecosystems. A few of these scenarios, which are mentioned in the previous chapter may seem highly speculative to some. However, these speculative scenarios emphasize the need for more research to clarify holistic and interdisciplinary interpretations of the interconnections between climate, culture, and the environment in Iceland; so the consequences of observed impacts by local Icelanders of climate change are not speculated, but are realized and anticipated. A key point to this discussion is how Iceland will balance economic growth while maintaining viable and thriving rural communities and ecosystems with climate change causing environmental changes, in turn causing cultural changes, and vice versa, while Iceland continues to participate in an increasingly globalized world.

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Appendix

A. Copy of the Approval Letter from Tri-Council Ethics Board

UNIVERSITY OF ALBERTA

Arts, Science & Law Research Ethics Board (ASL REB)
Certificate of REB Approval for Fully-Detailed Research Proposal

Applicant: Ryan Brown

Supervisor (if applicable): Dr Mark Nuttall

Department / Faculty: Anthropology/Arts

Project Title: Cultural Impacts of Climate Change in Iceland

Grant / Contract Agency (and number):

ASL REB Member (and file number if applicable): Andie Palmer

Application number: 1331

Approval Expiry Date: January 10, 2008

CERTIFICATION of ASL REB APPROVAL

I have reviewed your application for research ethics review and conclude that your proposed research meets the University of Alberta standards for research involving human participants (GFC Policy Section 66). On behalf of the *Arts, Science & Law Research Ethics Board* (ASL REB), I am providing expedited research ethics approval for your proposed project.

Expedited research ethics approval allows you to begin your research with human participants, but is conditional on the full ASL REB approving my decision at its next meeting (January 15, *2007*). If the full ASL REB reaches a different decision, requests additional information, or imposes additional research ethics requirements on your study, I will contact you immediately.

If the full ASL REB reverses my decision, and if your research is grant- or contract-funded, the Research Services Office (RSO) will also be informed immediately. The RSO will then withhold further funding for that portion of your research involving human participants until it has been informed by the ASL REB that research ethics approval for your project has been granted.
This research ethics approval is valid for one year. To request a renewal after (January 10, *2008*), please contact me and explain the circumstances, making reference to the research ethics review number assigned to this project (see above). Also, if there are significant changes to the project that need to be reviewed, or if any adverse effects to human participants are encountered in your research, please contact me immediately.

ASL REB member (name & signature: _____

Date: January 10, 2007

B. Predetermined Research Questions

1. What is your occupation?
2. How long have you lived in *Community Name*?
3. Have you noticed any long-term or short-term changes in weather or climate, especially in the last decade?
4. Is climate change affecting, or has climate change ever affected, your livelihood in any way? If it has, how so?
5. Are you interested in, or concerned with, climate change at this time? If so, why?
6. How are you responding to climate change, or how do you plan to respond to climate change?
7. What do you consider to be the most pressing issue(s) in relation to climate change in Iceland specifically, and in relation to the Arctic generally?
8. From what sources do you rely on for your information concerning the weather and climate change?

C. Invitation to Participate Letter

Dear Potential Participant,

My name is Ryan Brown, and I am a Master's student in the Humanities Computing program at the University of Alberta, Canada. I am also an anthropology student, as the program I am attending is interdisciplinary. I invite you to be a research participant in my Master's thesis research that I will be conducting in Iceland from the end of April, to the middle of June, 2007. The aim of my research will be an anthropological study of Icelandic perspectives of contemporary climate change, and the cultural impacts climate change is having, or may have, on Icelandic society. The results of my research will be informed by the perceptions of Icelanders who have a direct interest in climate; such as farmers, fishers, politicians, and environmental scientists. These perspectives will be analyzed to reveal if climate change is a major concern to Icelanders, and if it is, which Icelanders will be affected the most by these changes. Moreover, this study will contribute to a greater overall understanding of the human dimensions of Arctic climate change.

Your opinions and perspectives are important for this study. I am inviting you to participate in this study on an entirely voluntary basis. Participation involves being interviewed about climate change in Iceland, specifically the local area where you work or live. Interviews will last approximately one hour. In addition, participation can involve showing me a location where there is evidence of impacts caused by, or compounded by climate change that you may have observed.

Interviews will be recorded on audiotape or they will be written down on paper. The data from these sources will be transcribed later onto a computer, from which I will be able to compare with observations I have documented. The data collected from these interviews will only be used for the purposes of this project. Up until the completion of my thesis, my supervisor will be the only other person to have access to my raw data concerning this project. Research participants will be identified using pseudonyms to protect their anonymity, and all responses will be kept confidential. Furthermore, participants will have opportunities to review any written transcripts compiled from the raw data that they have contributed, to verify its accuracy and interpretation of the contents.

Participation is totally voluntary. You may decide not to participate, and at any time before June 30, 2007, you have the option of withdrawing your participation from this study. In this case, the data you have provided will be deleted from the database. Moreover, you may refrain from answering any questions at any time.

Participants' rights to privacy, confidentiality, and anonymity will be respected throughout this study. Participants will not be identified by name in the written report unless the participant gives free and informed consent to be identified by name. All participants are welcome and encouraged to read a copy of my completed thesis. Copies will be available at the University of Alberta, the Canadian Circumpolar Institute, and the Stefansson Arctic Institute.

The data used in this study will comply with the University of Alberta's Standards for the Protection of Human Research Participants policy.

The nature of this study entails no risk, nor harm for participants. The benefits of this research for participants includes learning more about climate change in Iceland, and a way to voice their concerns and opinions regarding climate change, which will contribute to a better understanding of the human aspects of climate change in Iceland, and the Arctic.

If you would like to participate please sign the attached consent form and return the form to me.

If you have any questions feel free to contact me. You may also contact my thesis supervisor, Dr. Mark Nuttall, at (780) 492-0129, or by email at mnuttall@ualberta.ca.

Thank you for your time, and thank you in advance if you decide to participate.

Sincerely,

Ryan Brown
(780) 492-5890 – in Canada after June 15, 2007
(354) 460-8393
rgb1@ualberta.ca

D. Þátttökubeiðni (Invitation to Participate Letter in Icelandic)

Kæri hugsanlegi þátttakandi!

Ég heiti Ryan Brown og er í meistaranámi í því sem kallað er "Humanities Computing Program" í Háskólanum í Alberta í Kanada. Jafnframt stunda ég mannfræðinám. Mig langar að biðja þig að taka þátt í rannsókn minni til meistaragráðu sem ég mun vinna að á Íslandi frá apríllokum fram í miðjan júní 2007. Markmið rannsóknarinnar er að gera mannfræðilega athugun á íslenskum viðhorfum til veðurfarsbreytinga samtímans og þeim menningarlegu áhrifum sem veðurfarsbreytingarnar hafa, eða munu hafa, á íslenskt samfélag. Árangur rannsóknar minnar mun felast í skynjun þeirra Íslendinga sem hafa mikinn áhuga á veðurfari; svo sem bænda, sjómanna, stjórnmálamanna og umhverfisvísindamanna. Skynjun þeirra verður greind til að komast að hvort veðurfarsbreytingarnar eru mikið mál í hugum Íslendinga og ef svo er, hvaða hópur Íslendinga mun verða fyrir mestum áhrifum af þeim.

Skoðanir þínar og skynjun eru mikilvægar fyrir þessa athugun. Þátttaka þín yrði sjálfboðavinna sem fælist í viðtali um veðurfarsbreytingar á Íslandi, sérstaklega á þínum heimaslóðum. Viðtalið mun taka u.þ.b. klukkustund. Þar að auki gæti þátttaka þín falist í að sýna mér staði þar sem þú hefur séð sannanir um áhrif af veðurfarsbreytingum.

Viðtalið verður tekið upp eða skrifað niður. Upplýsingarnar verða síðan fluttar á tölvutækt form, sem ég nýti til samanburðar á þeim athugunum sem ég hef gert. Þessar upplýsingar verða aðeins notaðar í þessu tiltekna verkefni. Leiðbeinandi minn er sá eini sem hefur aðgang að upplýsingunum á meðan ég vinn að meistararitgerðinni. Nafnleynd ríkir í verkefninu og þátttakendur fá dulnefni. Öll viðbrögð verða trúnaðarmál. Þátttakendur munu einnig hafa möguleika á að skoða allt skriflegt efni sem byggir á upplýsingum þeirra, til að sannreyna nákvæmni og túlkun á þeim.

Þátttaka er algjörlega frjáls. Þú getur hætt við þátttöku hvenær sem er fyrir 30. júní 2007. Ef þú hefur lagt fram einhverjar upplýsingar þegar/ef þú hættir þátttöku, mun þeim gögnum verða eytt. Þú þarft heldur ekki að svara öllum spurningum sem fyrir þig eru lagðar.

Réttur þátttakenda á trúnaði og nafnleynd verður að fullu virtur. Þátttakendur koma ekki fram með nafni í meistararitgerðinni nema þeir gefi til þess frjálst og upplýst samþykki. Allir þátttakendur eru hvattir til að lesa ritgerðina mína þegar henni er lokið. Eintök verða aðgengileg í Háskólanum í Alberta, hjá Canadian Circumpolar Institute og Stofnun Vilhjálms Stefánssonar.

Upplýsingar í þessari athugun fylgja stöðlum Háskólans í Alberta um vernd þátttakenda í rannsóknum á vegum skólans.

Þessi rannsókn hefur ekki í för með sér neina áhættu eða skaða fyrir þátttakendur. Þeir hafa gagn af henni með því að fá að vita meira um veðurfarsbreytingar á Íslandi og hafa möguleika á að viðra skoðanir sínar og áhyggjur varðandi málefnið, sem mun stuðla að auknum skilningi á mannlega þættinum í veðurfarsbreytingum á Íslandi og norðurslóðum.

Ef þú samþykkir að taka þátt í rannsókninni bið ég þig að skrifa undir meðfylgjandi eyðublað og afhenda mér.

Hikaðu ekki við að spyrja mig ef eitthvað er óljóst. Þú getur líka haft samband við leiðbeinanda minn, Dr. Mark Nuttall í síma +1 780 492 0129 eða netfang mnuttall@ualberta.ca.

Ég þakka þér fyrir að lesa þetta og sömuleiðis ef þú ákveður að taka þátt.

Kveðja,

Ryan Brown
rgb1@ualberta.ca
Apríl 2007

E. Consent Form

Interviewer: Ryan Brown

Department of Anthropology
University of Alberta
Edmonton, Alberta, Canada
T6G 2H4

I, _____, agree to participate in Ryan Brown's Master's thesis research project as stated in the information letter attached with this form.

Date: _____

As the interviewee, I have been fully informed of the following points before proceeding with the interview:

1. My participation in this research is completely voluntary, and I understand the intent and purpose of this research.

2. I understand that my identity will be kept confidential, and that I have the right to withdraw from this research at any time, before June 30, 2007.

3. I know that I may refuse to answer any questions and that I may withdraw from this study at a later date. Any information provided by me can be deleted at any time upon my request, before June 30, 2007.

4. I am aware that others will be reading the results of this research and that this research will eventually be published. In any publications, I will not be identified by name, unless I give permission to be identified by name.

I agree to (please initial):

_____ to participate in interviews which will be recorded by hand or on audiotape.

_____ to be photographed.

_____
Signature of Consent

_____
(Print Name)

_____
Signature of Interviewer