

REGIONAL DEMOGRAPHIC IMPACTS ON DRIVERS OF SOCIAL VULNERABILITY:

A LOCAL VIEW OF NORWAY

A Thesis

Presented in Partial Fulfillment of the Requirements for the

Degree of Master of Science

with a

Major in Geography

in the

College of Sciences

University of Idaho

by

Patrick Fitzsimons

August 2014

Major Professor: Harley Johansen, Ph.D.

Authorization to Submit Thesis

This thesis of Patrick Fitzsimons submitted for the degree of Master in Science with a major in Geography and titled "REGIONAL DEMOGRAPHIC IMPACTS ON DRIVERS OF SOCIAL VULNERABILITY: A LOCAL VIEW OF NORWAY," has been reviewed in final form. Permission, as indicated by the signatures and dates given below, is now granted to submit final copies to the college of Graduate Studies for approval.

Major Professor: _____ Date _____
Harley Johansen, Ph.D.

Committee
Members: _____ Date _____
Tim Frazier, Ph.D.

Stephen Lee, Ph.D.

Department
Administrator: _____ Date _____
Karen Humes, Ph.D.

Discipline's
College Dean: _____ Date _____
Paul Joyce, Ph.D.

Final Approval and Acceptance

Dean of the College
of Graduate Studies: _____ Date _____
Jie Chen, Ph.D.

Abstract

The combination of climate projections for Norway, and its recent demographic history make the country a good case study for regional development and social vulnerability to climate change. The rural settlements constituting northern Norway maintain an economic and demographic history with the potential to create a scenario of regional social vulnerability. The paper's analysis will illustrate the great variation between the regions of northern and southern Norway. This paper's objective is to assess Norway's potential for social vulnerability to climate change at a more local level.

Acknowledgements

I would like to thank my entire committee for their time and effort in helping me bring this to completion. In particular I would like to thank Harley Johansen for the funding opportunity to conduct my research and giving me the opportunity to conduct my research abroad. My deepest appreciation to everyone that assisted in seeing this through to completion.

Table of Contents

Authorization to Submit Thesis	ii
Abstract	iii
Acknowledgements	iv
Table of Figures.....	vi
Table of Tables	vii
Chapter 1: Introduction	1
1.1 Regional Development Areas, migration, and social vulnerability.	1
1.3 Climate Change in Norway	3
1.4 Research Objectives.....	3
Chapter 2: Background.....	6
2.1 Study Area	6
2.2 Regional Development	7
2.3 Migration	8
2.4 Social Vulnerability	11
2.5 Norway's Demographic History	12
2.6 Norwegian Migration Preference Surveys.....	15
Chapter 3: Methods.....	17
Chapter 4: Results.....	22
Chapter 5: Discussion	33
5.1 Limitations	33
5.2 Conclusions.....	34
5.3 Future Research.....	38
Bibliography.....	40

Table of Figures

Figure 1. - Regions of Norway.....	6
Figure 2. - Barents vs. Non-Barents	7
Figure 3. - Accessibility Index map.	23
Figure 4. - Net Migration from 1990-2009 (%)	24
Figure 5. - Population change for those aged 16-29 from 1990 to 2010 (%).	25
Figure 6. - Variance of principal components.....	26
Figure 7. - Biplot of first two principal components.....	29
Figure 8. - Plot of the first two principal components.....	30
Figure 9. - 3-D Plot of first 3 principal components.....	31
Figure 10. - Cross-validated QDA output for municipalities.	32

Table of Tables

Table 1. - Net migration for each of the North Norwegian counties.....	14
Table 2. - Variables used in analysis.....	19
Table 3. - Results of component analysis.....	27

Chapter 1: Introduction

1.1 Regional Development Areas, migration, and social vulnerability.

The importance of migration effects on the development and footprint of the human landscape cannot be understated. The original urbanization of an area is predicated by the redistribution of people from rural areas, and several factors influence the migration (Morrill, 1968). Decisions to migrate are made at the individual level and include, distance willing to traveling, employment opportunity, established social connections, natural amenities, etc. (Seyfrit and Hamilton, 1992; Hamilton and Seyfrit, 1994; Power and Barrett, 2001; Reibsame, 2007). Friedmann's (1964) five categorical areas of regional development both influence migration and are influenced by migration patterns. The categorical breakdown of the five areas are as follows: core, upward-transitioning, resource frontier, downward-transitional, and special problem areas that include deserts, border areas, and could include areas affected by climate change.

As a nation undergoes industrialization, urban cores develop and act as magnets for migrants looking for employment (Friedmann, 1964). The classification of Friedmann's (1964) regional areas are malleable and can be reclassified over time, but change is not guaranteed. Population growth in the core brings with it the potential for increasing capital investment and this investment benefits not only the core areas but also affects adjacent areas that have connections to the core and based on proximity to the core become part of it or constitute the upward-transitioning area. The latter three types of regional areas are at a distance from urbanization and are respectively reliant on agriculture, extraction, or a recently antiquated means of economy.

Galvanization of investment in the core perpetuates itself while areas far outside the core are viewed as too risky for investing, and this collective of individual location decisions conducted by firms implicitly lies at the root of what makes urban centers grow (Alonso, 1975). Burgeoning core areas have potential issues and need for proper planning including, traffic, and housing. Areas geographically, and

perhaps culturally, distant from core areas have different potential development issues that include inability to attract businesses, and a loss of population due to migration towards urban centers.

Out-migration within a region can necessitate the need for government intervention, if there is a persistent outflow of the population. In theory, the migration will be curbed due to a balance occurring in wages. Urban centers' large labor pool facilitates the investments while a rural region subject to sustained out-migration loses a labor pool and becomes less attractive for investment. This investment drives the creation of jobs and the dearth of investment in rural regions, but in theory this migration will also cause a convergence for the region losing out on investment and its population. A convergence occurs because the large labor pool in urban centers will drive down the wage earned while the lack of labor in rural regions will drive up wages and thus creating a convergence where the drive to migrate out of rural areas will be dissipated with the gap in wages. If economic convergence does not take place, and out-migration continues and further suppresses a region's economic viability. In addition to potentially stunting economic development, areas continually losing their population due to migration tend to undergo changes in the demographic makeup, which affects driving variables; such as age structure, income, educational attainment, etc.; associated with social vulnerability to climate change (Haedrich and Hamilton, 2000; O'Brien et al., 2004).

A region's ability to adapt to climate change is predicated on its level of vulnerability which consists of three components: exposure, sensitivity, and adaptability (Smit et al., 2000; McCarthy et al. 2001; O'Brien et al., 2004). Climate change's heterogeneous nature makes a case for it to be included into the regional development conversation. Vulnerability is a descriptor for the collective state of marginality, helplessness, and susceptibility to harm for both physical and social frameworks, with the main purpose of assessing vulnerability to better mitigate the effects of a hazard, e.g., climate change (Adger, 2006). Social vulnerability is a combination of socio-economic variables strictly pulled from the social framework of vulnerability. Inputs into this framework consist of aspects relating to education

attainment, minority status, unemployment, labor force participation, an aging population, household income, etc. (Wood et al., 2010; Burton, 2010).

1.3 Climate Change in Norway

Norway is projected to experience both increased temperatures and precipitation over the coming decades and physical changes due to climate change have already been documented with the Intergovernmental Panel on Climate Change (IPCC) concluding changes are due to anthropogenic causes (Forbes et al., 2009; Olofson et al., 2009; Rosenzweig et al., 2008). Norway's average temperature is projected to increase by 4° C by the year 2100 with much of the increase in temperatures occurring during the winter months and increased temperatures to be highest in northern Norway (O'Brien et al., 2004). Arctic sea ice extent during summer months has been on a downward trend for decades with projections now expecting an ice free arctic ocean as soon as 2030 (Stroeve et al., 2008). Other biophysical changes resulting from decreasing sea ice will include terrestrial changes in the Arctic in way of depleting permafrost (Lawrence et al., 2008). Changes in climate for Norway and the surrounding region will result in a multitude of effects, ranging from changes in fishing stocks, reindeer herding, to changes in the tourism sector, and thawing permafrost resulting in damaged infrastructure.

1.4 Research Objectives

This thesis's objectives are to examine the level of remoteness within northern Norway and assess drivers of social vulnerability within the region. Norway has recently become a wealthy, developed country. A century ago Norway was one of the poorer countries of the world. Comparatively, Norway's industrial development has lagged behind today's Western developed countries, but like many others, Norway has moved into a post-industrial period. Continued globalization has produced many countries rife with industrialization and witnessing development of magnet, core cities. As this development continues across the globe, rural areas will have portions of their populations culled and redistributed into the growing core regions.

With many countries currently industrializing, Norway is a fitting case study for assessing the potential ramifications of industrial development by today's developing countries. This thesis will first look at the historical demographic data and the population shifts that have occurred during the last two decades within Norway. Again, the importance of looking at demography stems from its influence on future development within the region, and its potential role in affecting social vulnerability to climate change. In terms of climate change, Norway is a good selection for a case study due to its climate change projections occurring at a faster rate than the global average.

The quality of life for Norwegian citizens has greatly changed during the course of the past century; going from being a poor nation to now being a model to other countries in a vast array of developmental indicators. As a nation, Norway is one of the most advanced welfare systems on the globe; paying 35% of its national budget towards social welfare (OECD 2010). The Human Development Index (HDI), created by the United Nations, currently places Norway in the upper echelon of countries maintaining a high index value (Klugman et al., 2011). This index and high rankings in other various economic indices frame Norway as a country without a need for concern about its ability to adapt to climate change (Morrow 2008).

Even within the wealthy welfare state of Norway, marginalized areas will feel the pressures from climate change at elevated levels and have the potential to be further marginalized and climate change has the potential to stem the continuance of rural areas, cultural heritage, and social equity and hurt regional policies already threatened by the continual global neo-liberal shift (O'Brien et al., 2006). The OECD's report (2004) stressing Norway's need to lessen its subsidy payments for continued economic growth, coupled with potential disbursements for climate related damages sets a situation where proactive climate adaptation should be espoused.

Past Norwegian regional policies have demonstrated an overarching focus of leveling living conditions and maintaining population patterns (Haugen et al., 2006). To that point, it is important to

examine the rural versus urban dynamic and assess the migration pattern over the past 30 years. In 1950, the Norwegian population was split amongst those living in urban versus rural areas. Today, almost 80% of Norwegians are living in urban centers. Northern Norway has historically been a land of sparse rural settlements based on fishing and reindeer husbandry. Has northern Norway succeeded maintaining its population, or has out-migration contributed to the increasing urban living? If so, then it is important to see if in fact there is a difference between North and South on the drivers of social vulnerability and migration flows.

Economic, cultural, social and institutional factors all contribute to social vulnerability and looking at the national scale, or solely at sectoral impacts, or solely at scenario-based impacts do not fully capture the complexities and layers that construct a region and its resiliency, adaptive capacity, and vulnerability to climate change (O'Brien, 2006). To date, these are the very types of analysis of social vulnerability that have transpired within Norway, and for this reason it is necessary to assess Norway at a more local level. This thesis will first examine migration and population changes at the local level during the past 2 decades and then dovetail these results into social vulnerability to climate change and look at the role of past and current policy along with demographic changes that have potentially influenced Norway's social vulnerability to climate change.

Continued out-migration by a youthful cohort can contribute to a region's inability to be malleable enough, or maintain the proper resources to ameliorate shocks that may occur within the area. This thesis posits a continued outmigration amongst the younger population will have occurred over the past 2 decades and thus further influencing drivers of social vulnerability in the North, when compared to the rest of the country.

Chapter 2: Background

2.1 Study Area

It is important to clarify the geographical and administrative boundaries which will be used throughout this paper. Norway is a nation comprised of 430 municipalities and these municipalities are

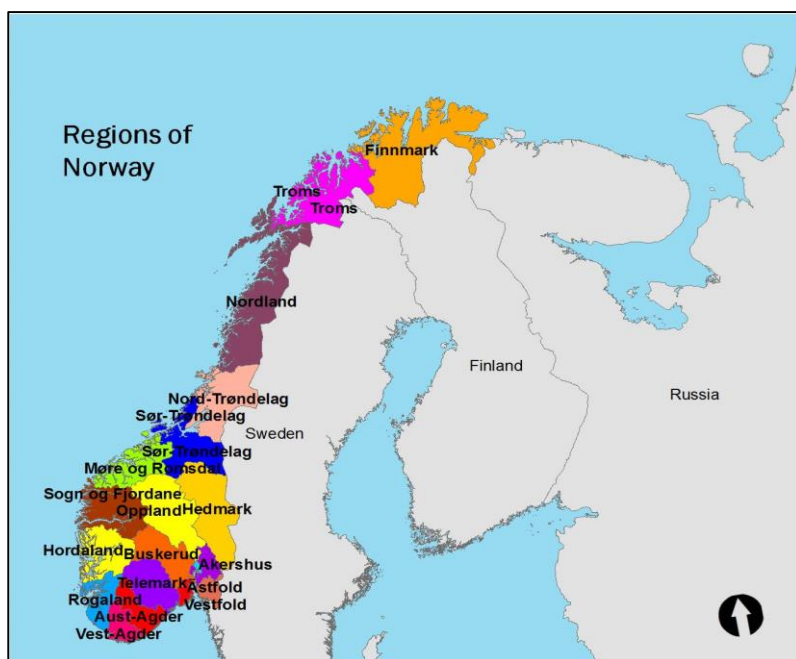


Figure 1. - Regions of Norway at the county level. There is a total of 19 counties, with the 3 most northern counties being associated with the Barents Region.

placed within 19 larger counties. The comparative analysis within this paper will be juxtaposing northern and southern Norway and will follow previous demarcations for 'North' and 'South' of Norway (O'Brien et al., 2004). Three counties; Nordland, Troms, and Finnmark; represent the land of northern

Norway while 16 counties¹ constitute southern Norway. These northern three counties are also a part of a more recent administrative body called the Barents Region.

The Barents Region came into existence following the Cold War and it encompasses the northern sections of Norway, Sweden, Finland and Russia. Throughout the rest of the paper, Barents will be in reference to the 88 municipalities constituting the 3 northernmost counties and the 'non-Barents' will be referring to the 342 municipalities in the South.

¹Other 16 municipalities: Ostfold, Akershus, Oslo, Hedmark, Oppland, Buskerud, Vestfold, Telemark, Aust-Agder, Rogaland, Hordaland, Sogn og Fjordane, More og Romsdal, Sor-Trøndelag, Nord-Trøndelag.

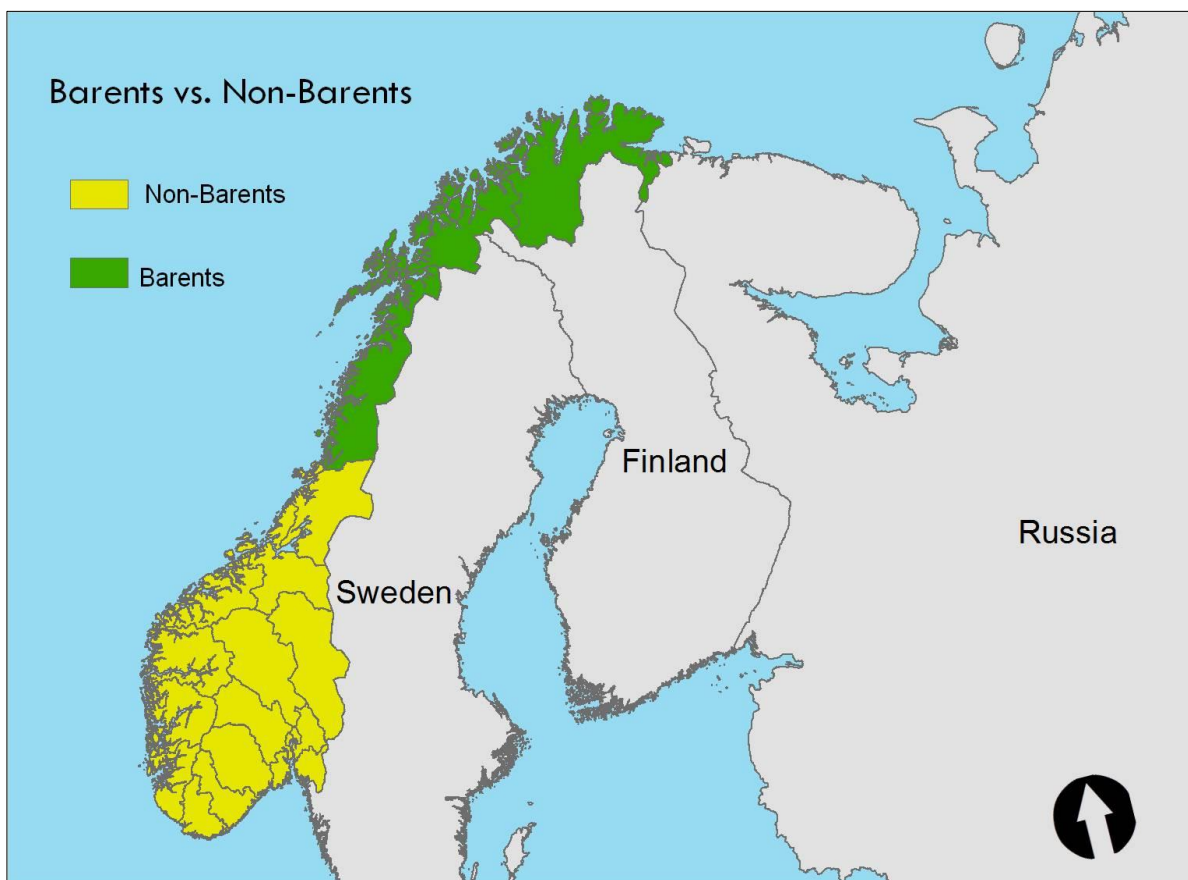


Figure 2. Barents vs. Non-Barents. The 3 most northern counties and 88 most northern municipalities constitute the Barents Region.

2.2 Regional Development

Again, Friedmann's (1964) five regions of development are as follows: core, upward-transitioning, resource frontier, downward-transitional, and special problem. The core areas consist of a large urban center or a cluster of urban centers. These areas are bustling with commerce and have a constant flow on investment coming in, and also have a constant flow of immigrants. The concern for core areas is to be able to continue to take in investments and at the same time able to handle to the burgeoning population. The upward-transitional areas are outside the tendrils of the urban core and see a boost from the persistent growing of commercialization in the core. As demand for products grow, this area will experience capitalization of agriculture. Resource frontiers are different from upward-

transitional areas because they are indeed still being discovered and populated. A contiguous resource frontier outside of the core and upward-transitional areas is possible, as too is a non-contiguous frontier area. The latter is usually an area that is built up core area for the purpose to handle resource extraction from the hinterlands.

2.3 Migration

Migration is a “process in space through which the redistribution of population occurs” Morrill (1968). Natural increase and migration are the two controlling mechanisms for a changing population of a given region. These two processes act in concert, but independently, and can expedite or curb overall population changes of a region, with migration being the ‘prime factor’ for decline in a population (Lowenthal et al., 1962). Natural increase refers to the difference between births and deaths of a region, while net migration references the difference between incoming migrants and those migrants leaving.

In a highly developed country, such as Norway, where birth rates are leveling off coupled with a high life expectancy, net migration will heavily influence the population change. The youth demographic of a region is more likely to be footloose, especially those highly educated (Power and Barrett, 2001). Even with catastrophic events, deaths over births are rarely, if at all, the main culprit for depopulation of areas and this is why depopulation cannot be separated from out-migration (Lowenthal et al., 1962).

As science and technology have progressed over the centuries, death and birth have taken a lessened role influencing a region's population change within developed countries. In today's developed countries, ease of access to the latest in medical science has extended life expectancy beyond that of the world average life expectancy. At the same time infant mortality has precipitously dropped amongst developed nations, resulting in less births due to increased likelihood of newborns successfully aging. As life expectancy has extended over the last century, rates of natural increase have lessened resulting in

migration patterns having a greater impact on the population dynamics of a region. In 2008 a watershed moment in civilization occurred when it was discovered that the majority of the earth's population lived in cities. The shift to urban living was mostly attributed to people 'voting with their feet' and migrating to urban areas. Migration patterns towards urban centers mirror the growth of industrial and postindustrial societies that are being facilitated by globalization and are a product of the economic development amongst developing and developed countries.

As a country's gross domestic product (GDP) increases, shifting within the sectors of employment occurs in two basic ways. Initially, agriculture is a large portion of the economy, but this changes to industry as the country increases its GDP per capita, and ends with the service sector as the country continues its economic growth. 'Post-industrialization' refers to the final stage into the service sector's dominance of a region's economy. To gain employment within the service sector, once a country has moved into a postindustrial society, higher education attainment is increasingly important to best match the growing employment in the service sector. And because of agglomeration effects in urban centers, rural areas usually are losing in their bidding to garner new businesses. Developed countries have a high percentage of their workforce within this service sector; the World Bank reports the service sector accounting for roughly two-thirds of all employment amongst developed nations. The deleterious effects from continued out-migration are centered on a loss of a younger highly education cohort.

The out-migration of the highly educated demographic, seeking these service jobs, can have various stressing impacts on the place they leave (Lowenthal et al., 1962). These stressors include increased cost of public services per capita, decreased potential progeny, and loss of a qualified labor pool resulting in a reduced attraction for business in their location decisions. These, explicit and implicit, impacts from continued out-migration make it necessary to take a recent historical survey of development strategies and migration patterns with Norway, to understand the relationship between demographic change, development, and the potential social vulnerability of northern Norway.

Lowenthal et al. (1962) describes, through the prism of the movement of people, the world consisting of three different places: those places where people stay, those places where people move to, and those places where people leave. The larger a population the greater probability of it being concentrated and this ebb and flow of populations is not a random event, but rather based on attractions or repulsions within an area (Taylor, 1961). The current population of a region also plays a role in which of the aforementioned three types of places a region espouses; the smaller an entity the more chance of it falling into Lowenthal's (1964) third type of place, a 'place where people leave' (Ratcliffe, 1942; Harden 1960).

Cataclysmic events ranging from famine to war can force people into an exodus from their land and traveling across vast distances, both over land and water. However, a more common occurrence is migration within one's own country, internal migration, which is greatly facilitated by the assumed closer proximity than movement outside one's country, but more importantly, due to lessened social readjustments necessary for potential migrants (Lowenthal et al., 1962). The continued narrative of out-migration imbued in an area can self-perpetuate the depopulation of a region and these effects can create a place with a lack of confidence, social cohesion, and a loss of ambition by the society left behind (Lowenthal et al., 1962).

A gulf between community and personal networks has been growing over the decades, with rural areas seeing a greater extreme of this chasm. The gulf between the two has been facilitated by technology and by the omnipresent tentacles of globalization. Rural areas experiencing a disconnect can partially attribute this to technological advances in the industries synonymous with rural life and therefore lessening labor needs (Bjarnason and Thorlindsson, 2006). The development potential of rural areas can already be steeped in stress due to high unemployment rates, low education attainment, high suicide rates, and contraction of services. These stressors are more doleful and much more palpable when this climate is apparent and an area is also losing its youthful population (Gabriel, 2002). The

youthful cohort's decision to move out of or stay in a rural setting has become one of great importance to the future of the rural region.

2.4 Social Vulnerability

Vulnerability happens, in its simplest form, when unequal exposure to risk is combined with the unequal access to resources (Bolin and Stanford, 1998). Social and economic conditions influence a region's vulnerability to environmental risks (Morrow, 2008). Social vulnerability pans both in and out from the individual out to the community level. Individual level factors such as poverty or type of employment influence an individual's level of vulnerability. While at the community level social vulnerability depends on distribution of resources and institutional changes (Adger 1998).

As Rygel et al. (2006) state, social vulnerability stems from one of two frameworks of, the more generalized, vulnerability. The first framework focuses on the region where the potential hazard will occur and assess the region's exposure to a hazard, and assess the vulnerability, for example, by the numbers of human lives and buildings at risk. The second framework of vulnerability is predicated on the idea of different areas maintaining different levels of coping to potential hazards. It is through this second framework that social vulnerability enters the equation in assessing vulnerabilities to hazards. Recognizing the economic and social structure of a region has gained credence in analyzing hazard mitigation and assessing resiliency, i.e., the ability to recover from losses in a quick manner (Mitchell et al., 1989; Rygel et al., 2006; Laska and Morrow, 2006). The Heinz Center (2002) concluded that resiliency to climate change goes beyond economic parameters and takes into account social and cultural structures.

Adger (2006) surmised that vulnerability "occurs when people have insufficient real income and wealth, and when there is a breakdown in other previously held endowments" (pg. 154). The variables constituting social vulnerability within a region are not geographically homogeneous. Norway's adaptive

capacity to climate change is suggested to be strong, but this does not take into consideration any scale other than at the national level and solely assessing at the national level can potentially cloud any regional differences. Also, Norway's high HDI is not homogeneously distributed across the country, with the northern section of the country bringing down the national average of HDI (Young & Einarsson, 2004). This regional difference illustrates deviations within the country that are hidden by nationally scaled analysis. Inputs for calculating HDI are also included in the myriad of variables assessed in gathering indices of social vulnerability. Furthermore, the wealth, education levels and technology of Norway place it in a position where it is assumed its affluence can be easily wielded to combat and adapt to climate change, yet a region's adaptive capacity cannot be solely boosted by economic development (O'Brien et al., 2006). Comparative analysis, at the municipal level, of variables driving social vulnerability can help flesh out any differences between the peripheries of Norway in the North from municipalities in the South.

2.5 Norway's Demographic History

Settlements in northern Norway have long been established, many of which were nestled against the coast between fjords or inland valleys, where Adger (1998) posits people who live in these types of coastal regions can see their sources of income as climate dependent in some sense. Up through the 19th century, migration patterns back and forth between the North and South due to bad crops or lack of fish stocks were commonplace in Norway and did not show any cause for concern by the national government. Also, outmigration during this time resulted in muted demographic impacts on northern Norway due to outmigration being counteracted by a continued high birth rate in the North (Hansen, 1999). As the 20th century progressed, two demographic changes transpired that made out-migration in the North more transparent. Lowering birth rates and an increased rise in life expectancy within northern Norway both made out-migration more obvious and made the government take notice.

Following WWII, northern Norway was in the midst of rebuilding from bombings and the scorched earth policy of the retreating Nazis (Sommers et al., 1971; Hidle et al., 2006). The conclusion of the war saw nearly 100% of the buildings and infrastructure within the most northern county, Finnmark, destroyed and Troms County, just to the South, had 50% of its buildings and infrastructure destroyed (Sommers et al., 1971). This dramatic destruction in the North enabled the national government to invest in a manner that would make northern Norway more structurally analogous to the South by focusing on centralizing and rationalizing industry of the North and thereby creating more urban landscapes (Hansen, 1999). As the 20th century progressed in Norway, fishing and agriculture continued to be a less dominant driver of employment, with the share of employment in the primary sector at the turn of the 20th century accounting for 40.7% of employment and falling to 25.9% at mid-century, with northern Norway still maintaining higher percentages than the national average (Sletmo, 1963; Sommers et al., 1971).

At the conclusion of WWII, funding for the redevelopment of northern Norway was tied to the Marshal Plan, but the majority of funding came from the inception of the North Norway Development Fund (NNDF) in 1952. The funding predominately went to further industrialization and towards areas that already had urban centers in the North (Sommers et al., 1971). The fund was not evenly distributed and, in fact, was administered on a first-come-first-served basis. Communities already exhibiting large rates of out-migration and areas heavily tied to old traditions had greater difficulty vying for funding (Sommers et al., 1971). The main focus of NNDF was to help reestablish northern Norway, but also to implicitly help the South. The country as a whole was still reeling from the destruction WWII had impressed upon the nation. Post-WWII housing in Oslo was exceptionally scarce, and traffic congestion was growing. The NNDF's allotment to the North was partially predicated on stemming relocation by northern residents seeking refuge in the South and in turn alleviating the stress put on Oslo from the influx of migrants (Sletmo 1963). Table 1 illustrates the population loss, through net-migration, for each of the three northern counties shortly following the end of WWII.

Table 1. - Net migration for each of the North Norwegian counties. It shows a continued out-migration for 3 most northern counties during the 2 decades immediate following WWII.

County	1951-1959	1960-1969
Nordland	-10,258	-19,081
Troms	-5,926	-6,359
Finnmark	-3,435	-6414

A recently empowered Labor Party, heavily influenced by the Oslo School of economics, oversaw the implementation of NNDF funds and continued its majority reign in national government beyond the next two decades. With strong political support from the Labor Party, the Oslo School of economics weighed in heavily on the prescriptions to be administered for the country and did so with the use of long-term planning (Thorsvik, 2010). The four year long-term plans developed by the Norwegian government, named 'The Long-Term Programme', put forward similar plans every four years from 1949 to 1973. From 1973 on, there was a falling apart of the planned economy and the clout the Oslo School of Economics once wielded on policy makers had fallen out of favor for a less centralized development strategy (Thorsvik, 2010).

The shift away from the Labor Party and its centralization and rationalization policies was due to the resurgence of defining 'rural' as the identity of Norway and pursue the maintenance of the dispersed settlements throughout the country and this movement was championed by Norwegian anthropologist and Labour Party critic Ottar Brox. Brox spearheaded a movement to combat centralization in northern Norway and furthered the movement to maintain decentralized settlements and he saw the national government's NNDF as an ill-conceived attempt not understanding the culture and needs of northern Norwegians. The movement for decentralization came into policy in the 1980's.

2.6 Norwegian Migration Preference Surveys

Within Norway, recent research focusing on survey data by interviewing 18 year-olds addressing their proclivity to leaving and justification for such has been investigated (Rye 2006; Rye 2011; Fosso 2003). The method of research has changed over the decades, going from structural approach to a constructionist framework. The former bases migration patterns of a population on the macro and micro economic structures of a region (Rye, 2006). A more constructionist approach has gained popularity describing migration patterns within northern Norway. This constructionist approach is popular within Europe, with the harbinger of this approach being credited to Bourdieu's (1977, 1984, and 1990) work within rural France. Bourdieu's methodology assesses the dialectics influencing the decision of potential migrants. Bourdieu's (1990) 'habitus' is the collision of the actor making decisions and the structure they are contained within when deciding on migration options.

Rural Norway, like other developed countries, is no longer an area solely consisting of employment within the primary industries as it was a half century ago, and this change has allowed the traditional ways of the rural society to be shattered releasing people of previous ties to an area and culture (Rye 2006). Social theorists argue the preordained scripts written for those within society have dissolved and no longer have the influence and today's actors within this highly individualized, developed society are 'disembedded' and are no longer fettered by traditional constraints (Giddens 1990). This theory coupled with the increased mobility present in developed societies, along with an increased knowledge based economy, create a scenario where people in rural regions of developed countries are more likely to migrate than previous generations and have more freedom to construct their own biographies (Rye, 2011; Giddens, 1996).

The younger cohort's migration from northern to southern Norway partially occurs void of any preference for living in urban centers being taken into account. The breadth of college institutions

options in the South of the country and the dearth in the North make the decision of where to live easy for those wanting to attend college (Rey, 2006). Recent studies in Norway (Rye, 2006; 2011) have gone beyond the generalizations of a young cohort being averse to rural living and rather having an affinity for an urban lifestyle. These surveys conducted within the rural North demonstrate a young cohort's desire to live in an urban setting, but this desire quickly wanes after the respondents reach their thirties. It is this out-migration by a young cohort affecting the drivers of social vulnerability.

Rye's (2006) survey approach is based within a quantitative constructivist approach assessing the biographies of youths located within rural settlements of inland northern Norway. This study adds to the discussion on residential preferences based on life phases. Of the 640 interviewed, 47% expressed a preference for city living during their twenties.² (Rye, 2006). This information is not contradictory to previous survey research, but Rye's survey went further and posed the residence preference for other future phases of life. When asked about after their 20's only 24% showed a preference for living in the city, and this percentage for preference to city residence dropped 12% when envisioned being a parent (Rye 2006). These survey results illustrate that there is not necessarily the general aversion to rural life, but more of preference for urban life during the youthful 20's with a plan for leaving the city after these years.

When Rye's survey was broken down between those planning to attend college against those planning on vocational education, 60% of those planning to attend college planned on living in the city during their twenties, but by the time they for then envisioned children as a part of their life that percentage dropped down to 12%. Of importance within these numbers and percentages is the problem when those that have left rural areas with best intentions of returning do not, either due to a change preferences as they age or are not able to return due to structural influences. As stated before, those

²'City' includes both suburbs and city center.

living in the North planning to attend college will by default be most likely locating to the Southern portion of the country. With the exception of the University of Tromsø opening its doors in 1972, the three northern counties lack any other college institutions (ADHR, 2004).

Northern Norway's historical migration patterns and remoteness give indication that, unless changes have been made that there would be a lack of a young cohort. This young cohort would also spur other issues within the region and thus making it a space that could be socially vulnerable. For this reason it is important to compare regions of Norway to see if there are differences that are hidden when a national metric is applied.

Chapter 3: Methods

First, as a way to gauge northern Norway's level of remoteness and level of urbanization, an index of urban accessibility was calculated. As previously mentioned, the NNDF main goal was to help establish centralized urban development within northern Norway. This index will illustrate if centralized development and urban centers took root in the North. The calculation for this index is below (Johansen and Fuguitt, 1979):

$$A_i = \sum_{j=1}^n p_j / d_{ij}$$

Where p_j equals cities with population of 20,000 or greater and d_{ij} equals the distance from municipal centroid to city (j). Magnet cities, p_j , must be within a 200km radius of each municipal centroid. As per the equation, each municipality's score will be a combination of distance to magnet cities and magnitude of the population of each magnet city. A mapped index of the region will best illustrate the differences, if any, between the North and South. Along with establishing urban centers in the North, the NNDF was implemented to create a more stable demographic makeup by curbing the rates of out-migration.

Creating an index on accessibility will also implicitly illustrate the structural foundation for which migration patterns may be induced.

Second, this thesis will assess migration patterns at the municipal level during the past two decades. In addition to analyzing migration patterns, this paper will assess population change of those within the 16-29 age group. The examination of these two measures will give a current representation of migration patterns and see if Brox's (1966) prescription for curbing out-migration by forwarding the subsistence of decentralized settlements was in fact correct.

Third, multivariate analysis will be implemented comparing municipalities in the North and South across 16 variables, which have been seen as indicating variables for social vulnerability (Morrow, 2008; Wood et al., 2010). Multivariate analysis will allow several variables to be assessed at once, and the first step in this analysis is to run an analysis of variance (AVOVA) across all 16 variables. In lieu of running an AVOVA 16 times for each variable, a MANOVA will be run, which assess the variance across all variables in one test. A statistically significant result on the MANOVA test can be extrapolated into each individual AVOVA across each variable. Just as an ANOVA, the null hypothesis for a MANOVA test would maintain no significant difference between the 2 factors being tested. The two factors for this MANOVA will be the collection of the northern municipalities (N=88) compared the southern municipalities (N=342). If the null hypothesis on the MANOVA is rejected, a principal components analysis (PCA) with the same 16 variables will be run. The cost of using PCA is the loss of capturing 100% of the variance within the data, but this compression reduces the dimensionality of the data allowing easier assessment of data. The compression of the data by the PCA will help illustrate which variables are most greatly different between northern and southern Norway. And the last bit of analysis will be discriminant analysis.

The selection of 16 variables used for comparison is based on previous modeling of social vulnerability (Cutter et al., 2003; Wood et al., 2010). The SoVI model (Cutter et al., 2003) has become widely used, through the prism of human ecology, for modeling social vulnerability. The SoVI model was

originally implemented in the United States and has been implemented at the household, tract and county levels. Norway's municipal boundary is a similar enough administrative units to county boundaries of the United States, allowing for this model to be transferred to Norway. The sixteen variables selected for multivariate analysis are listed in Table 2. These 16 variables are not an exhaustive list of inputs used in other models, but were selected on the basis of current availability. The decision of selecting input variables in terms of percentages was based on previous research by Rygel et al. (2006) concluding selection of either percentages or absolute numbers did not influence the indicating variables in the principal component analysis. In addition, using percentages allowed less populated municipalities to be equally counted as larger municipalities (Clark et al., 1998).

Table 2. - Variables used in multivariate analysis to compare northern and southern Norway.

Variables used in Multivariate Analysis

1. *% Net Migration* -- *Percent net migration from 1990 to 2009*
 2. *% Household Income < 150,000 NOK* -- *~ equivalent to 25,000 USD*
 3. *% Household Income > 500,000 NOK* -- *~ equivalent to 85,000 USD*
 4. *% Elderly* -- *percent aged 66 and older*
 5. *% Labor Force Participation* -- *percent averaged over 2007-2010*
 6. *% Over age 25 with primary Ed.* -- *percent with only primary education*
 7. *% Over age 25 with secondary Ed.* -- *percent with only secondary education*
 8. *% Over age 25 with Tertiary Ed. Started* -- *percent with some Tertiary credits*
 9. *% Over age 25 with Tertiary Ed. Completed* -- *percent completed Tertiary*
 10. *% Employed in Primary Industries* -- *percent in fishing, agriculture, and mining*
 11. *% Unemployed* -- *percent unemployed averaged 2005-2008*
 12. *% Long Term Debt of Municipality* -- *percent from 2010*
 13. *% Voter Turnout* -- *percent voter turnout averaged over 3 previous elections*
 14. *% Paid for Social Assistance* -- *percent spent for social assistance avg. 2010-2012*
 15. *% Net Loan to Gross Revenue* -- *percent net loan debt to gross revenue 2010*
 16. *% Net Loan Debt Per Capita* -- *percent municipal net loan debt per capita 2010*
-

Poverty rates are commonly used as an input for assessing social vulnerability. The rate of poverty in Norway is mostly nonexistent, but inequality is present and growing in the nation (O'Brien et al., 2006). As previously stated, Norway has consistently been rated very highly in the United Nations Human Development Index (HDI). The GINI coefficient is used to index the disbursement of wealth throughout a country and results in an index score ranging between 0 and 1, with a score of '0' indicating wealth being perfectly spread out across its population and a '1' indicating all wealth owned by 1 person. This index is used, not only to compare countries, but also to compare the same country at a temporal

scale. Norway's GINI index is one of the lowest in the world; however, there has been a recent trend over the past 2 decades of its GINI index increasing. As an analog to poverty as an input variable, the percentage of household incomes with less than 150,000 NOK, roughly equivalent to 25,000 USD is used as an input variable. In addition to the lower end of the spectrum for income, a second variable accounting for the wealthier end of the spectrum is also included and has a threshold of households with incomes greater than 500,000 NOK (85,000 USD).

The fishing industry has shown an inability at adapting to quick changes or shocks in fishing stocks (O'Brien, 2004). With the inception of the Northern Norway Development Fund, attention has been placed on specialization, consolidation, and capitalization in the North. While there has been a garnering of clout by fisheries in the North, a mismatch exists between benefits for fisheries and those regions heavily dependent on the fishing (Lindkvist, 2001). Fishing dependency in northern Norway was an indicator for depressed areas when Norway began promoting development after WWII (Sommers, 1964). Today, this same reliance on fishing and other primary industries, in lieu of a diversified economy, can have the same potential demographic pushing effect. This lack of alternative economic options for a region reliant on primary industries exacerbates the social vulnerability of a region.

Fifty years ago, half of the 16 year-old cohort of Norway were already participating in the workforce, while today hardly any of that same cohort has completed school (Hansen, 1999). Compared to southern Norway, the three northern counties lack higher educational institutions and this situation lends itself to students from the North, who attend university in southern Norway, surrounded by others of different backgrounds and are shaped during their 'intermediate social phase' by peers and not by the familiarities of their childhoods (Roalso et al., 1998). Higher education attainment better fills the employment demands of the growing service economy and as diversified sectors of employment lessen a regions social vulnerability so too does having a population maintaining a high level of educational attainment.

Labor force participation and unemployment rates are both included as barometers for gauging the amount of a tax base that is present within a municipality and degree of stress the unemployed are having in the municipality. The inclusion of the elderly, those aged 66 and above, as a driver for social vulnerability relates to the elderly's being less ambulatory and lessening the progeny rate as the percentage of elderly increases within a region. The final grouping of variables are relate to the municipal debt and its ability to shoulder disasters, before and after. These relate to the solvency of the municipality which would show its ability to proactively approach hazards, such as climate change.

Chapter 4: Results

The index of accessibility, figure 3, illustrates the lack of urbanization the Northern Norway Development Fund architects envisioned decades ago. The mapped indices exhibit the disparity in proximity to urban centers, in comparing the northern and southern sections of Norway. The Russian city of Murmansk, which is the largest city in the Arctic Circle, is the one major urban center in this region.

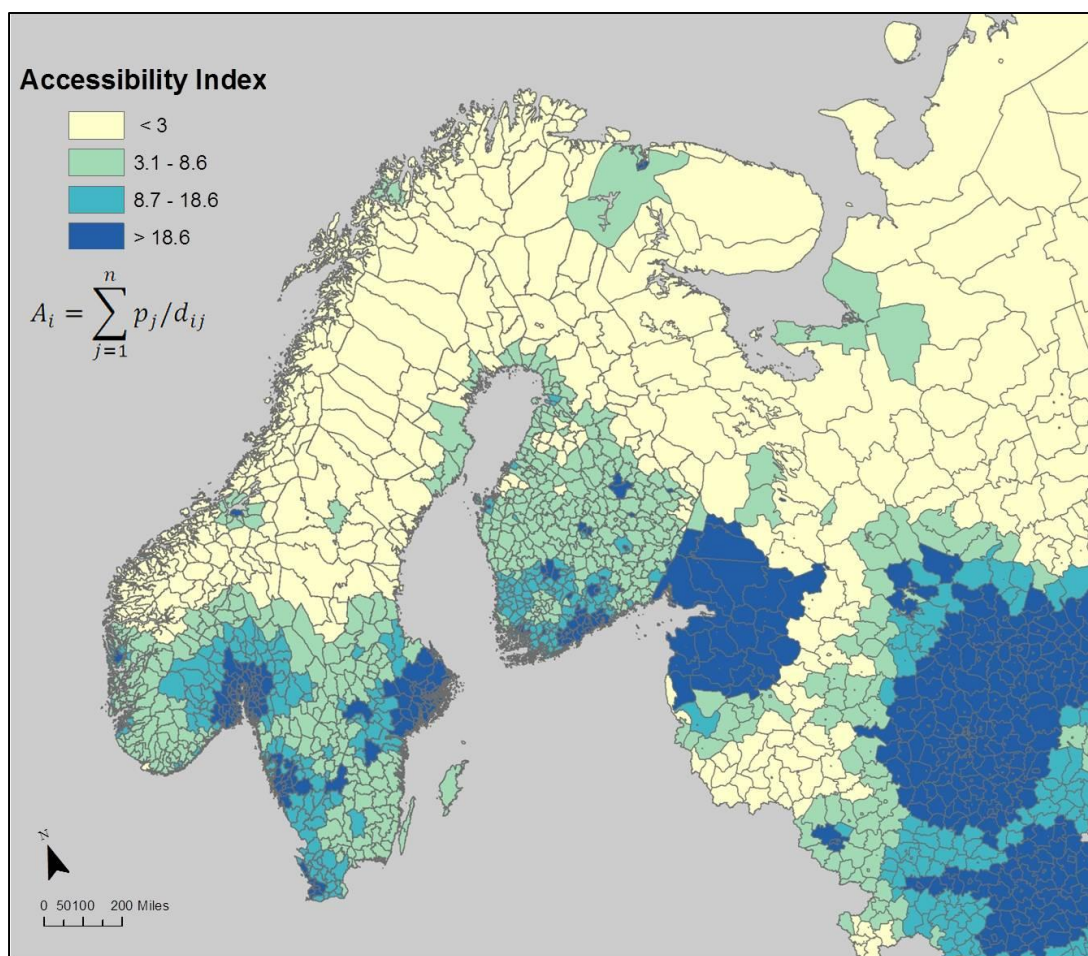


Figure 3. Accessibility Index map illustrating the lack of accessibility to urban centers for the northern portions of Norway, Sweden, Finland, and Russia.

Murmansk's economy is based on primary sectors of industry and its port has the advantage ocean currents allowing the port ice-free waters during the freezing fall and winter months. The low accessibility index scores of the North represent an area unable to enjoy the agglomeration effects that take place in regions with closer proximity to large metropolitan areas. The lack of urban proximity within the North equates to an area that has more disadvantages to recruiting businesses, with reasons varying from small market areas to great distances traveled by supply linkages.

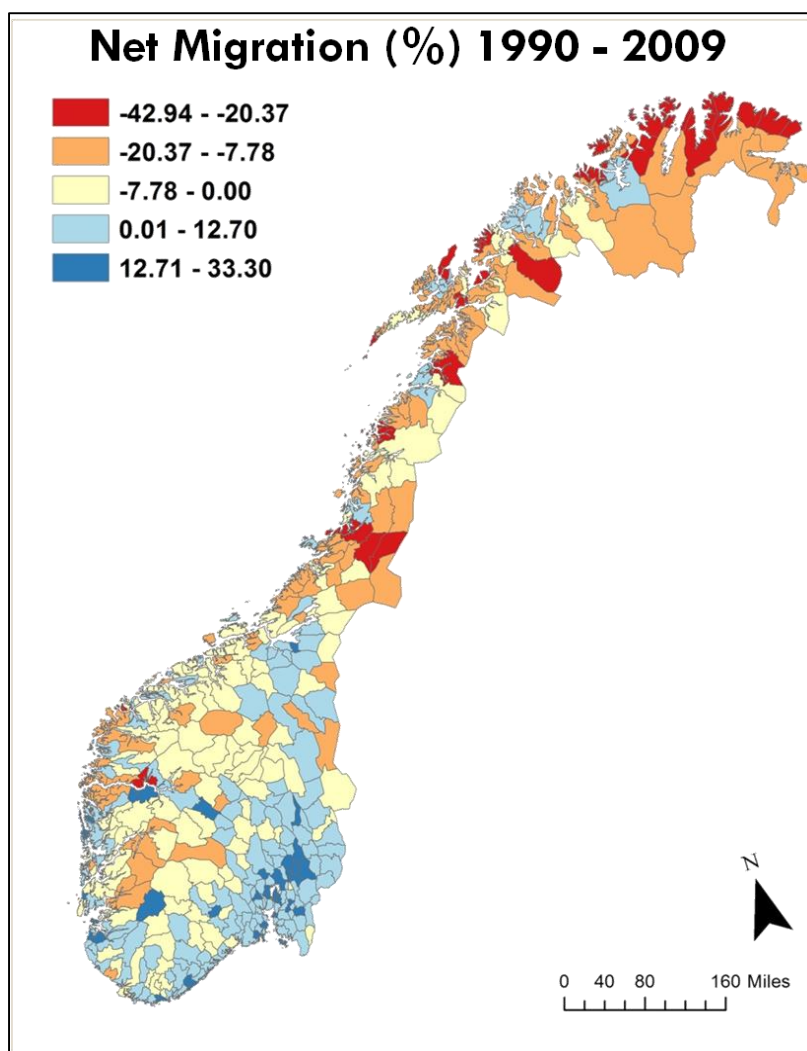


Figure 4. Net Migration from 1990-2009 (%) map illustrates northern Norway mostly consisting of outmigration and the South, in particular Southeast coast, having positive net-migration.

Migration patterns, illustrated in Figure 4, show a trend of migrants moving to the southern portion of the country over the course of the past two decades. Norway's capital, Oslo, is located in the center of the cluster of positive net migration in the southeastern corner of the country. Only a handful of municipalities in the north maintain a positive net-migration over the last couple decades. The municipality of Royrvik, located in northern Nord-

Trondelag, witnessed the most extreme loss of population due to migration with a negative net-migration of roughly 42 percent. This municipality along with a few others had rather extreme negative rates. These percentages are a product of each of these municipalities having a small population and therefore their percentages being more greatly impacted by the raw number of people leaving each respective municipality. In the last few years there has been a slight curbing of the negative net-migration patterns in the northern Norway, but the recent trend may be attributable to the current global recession. This same pattern occurred in Norway during the Great Depression and was attributable to the primary

sectors in northern Norway not being as greatly affected as other sectors of industry more common in the South, and therefore potential migrants from the North having less of an incentive to migrate south.

Figure 5 represents the population change over the, at the county level, 1990-2010 period of those aged between 16 and 29. As stated earlier, this loss of population of a young cohort has the potential to negatively impact many aspects of an area. Figure 5 also shows a large youthful influx into Oslo, with a positive population change of almost 29 percent. Again, Oslo is in the southeastern region of the country and is the smaller dark blue region in the southeastern corner. Two of the three northern counties experienced the most negative rates of population change, while Troms was ranked 5th in terms of declining population. The potential pressures from continued loss of population due to migration,

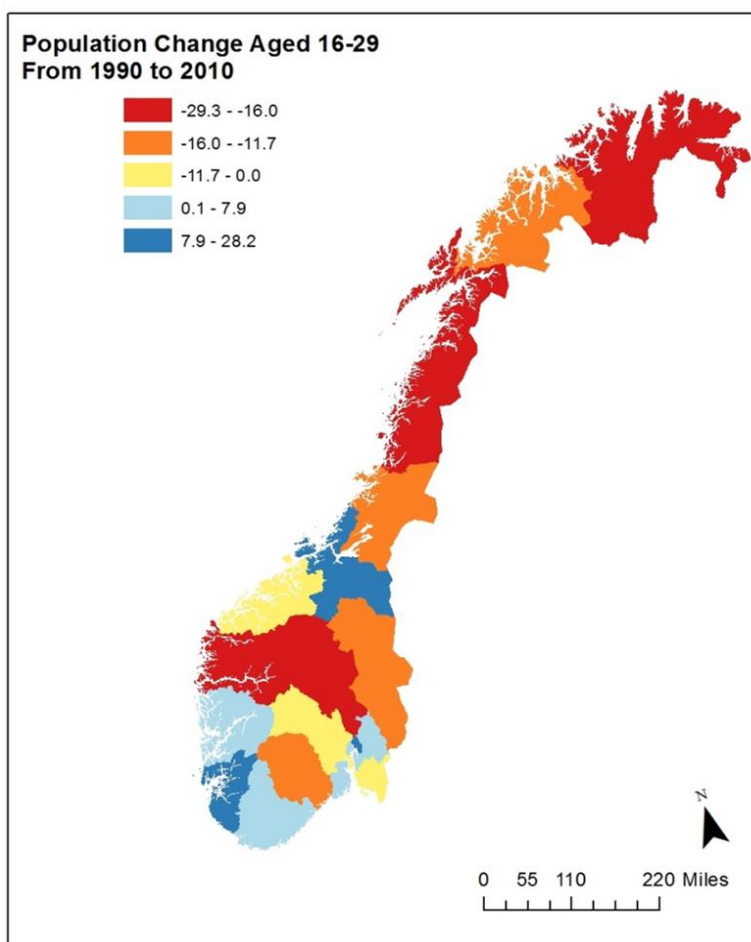


Figure 5. Population change for those aged 16-29 from 1990 to 2010 (%) at the county level.

and in particular, a youthful cohort can greatly impact social vulnerability.

With the MANOVA producing a significant difference between the matrices of the North to that of the South, running principal component analysis will bring to surface which of the 16 variables are more greatly dissimilar between the two regions of Norway and greatly compress the 16 dimensions of the data. The results across the 16 variables produced 4 principal components

that were above the threshold of 1 under the Kaiser Criterion. These 4 principal components represent 70% of the total variance for all the data.

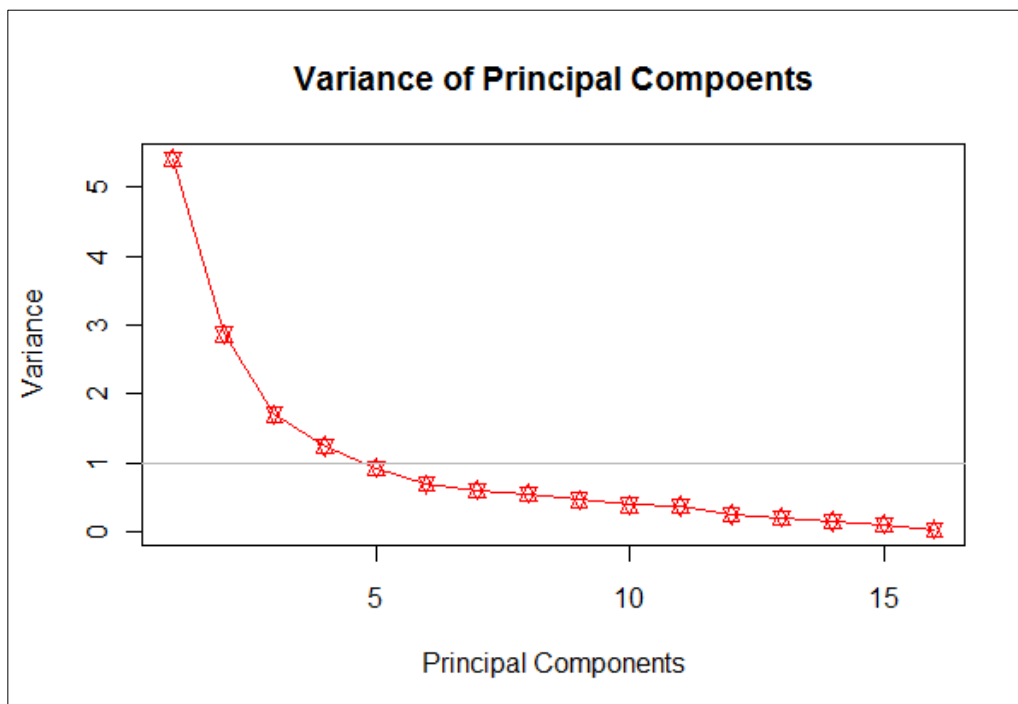


Figure 6. - Variance of principal components with the first 4 components being above one.

Below on the following page, Table 3 contains each of the four principal components and the percentage of the total variance explained by each component along with certain variables contributions to each respective component. For each principal component, each of the 16 variables has a loading value associated with the correlation each variable has to the component. Loadings of less than 0.5 or greater than -0.5 were not included as a variable contributing to the component. The loading threshold of 0.5 and -0.5 mirror the loading ranges selected by Wood et al. (2010) for PCA examining social vulnerability in coastal Oregon.

Table 3. Results of component analysis for each of the first 4 components and percent of the total variance. Variables shown in last column are those being equal to or above 0.05 or equal to or below -0.05 for their respective loading value.

Component	Eigenvalue	% of total Variance	Variables and (component loadings)
1. Age, Income, School, Migration and Labor Force	2.324	33.75%	Percent Elderly (0.730) Income < 150,000 (0.762) Percent Primary Sector (0.651) Percent Tertiary Finish (-0.738) Percent Tertiary Begin (-0.641) Net Migration (-0.695) Labor Force Part. (-0.612) Income > 500,000 (-0.814)
2. Social Welfare	1.692	17.90%	Percent Unemployed (0.599) Percent Secondary Ed. (-0.576) Social Assistance (0.543) Labor Force Part. (-0.527)
3. Debt	1.305	10.65%	Net Loan to Gross Rev. (0.617) Long Term debt (0.637) Net Loan Debt/capita (0.709)
4. Education	1.115	7.77%	Tertiary Finish (-0.543)

The last column in Table 3 only shows those variables within the explained threshold for each principal component. The first principal component explains approximately 33% of the total variance within all of the data and there are 8 variables with loadings within the stated threshold having influence on explaining the component. The components' names on the left of table 2 are arbitrary names given to each component taken from the loadings that are within the threshold to be included. As Table 3 illustrates, the highest loaded variables on the first component were high income levels, percent elderly, and tertiary education. The second principal component explains an additional 17.9% of the variance within the data and comprising variables with significant loadings revolving around the labor force (unemployment and participation) along with social assistance paid out and secondary education. Together these two components account for 51.65% of the total variance within all 16 variables across the 430 municipalities of Norway.

The biplot of the first 2 principal components, in Figure 7, explains a multitude of information across the 16 variables along with regional differences across all 430 municipalities. There are a total of 16 arcs within the biplot, an arc for each variable and each variable's arc is unique in both direction and length. Arc length is the magnitude to which the variable is influencing the component. As an example the 3 debt variables' arc lengths are among the shortest within the biplot. Again using these same 3 variables, they maintain a small angle between each one. This acuteness of angle in comparing two variables illustrates the degree of correlation; more acute the angle the greater the correlation. The exception to this would be once the angle went beyond 90 degrees. Angles between 90° and 270° would indicate a negative correlation between variables. The strong negative correlation between 'primary industries' and 'tertiary education' is illustrated within the biplot by the almost 180° angle between their two arcs. And unlike the variables relating to municipal debt, 'primary industries' and 'tertiary education

completed' are both variables with loading values within the threshold be include each as an explanation of the first principal component. The high loading values for each (0.651,-0.738) and the strong negative correlation indicate that through the first principal component that municipalities exhibiting higher percentages of a variable would have lower percentages of the other variable. The numbers in the

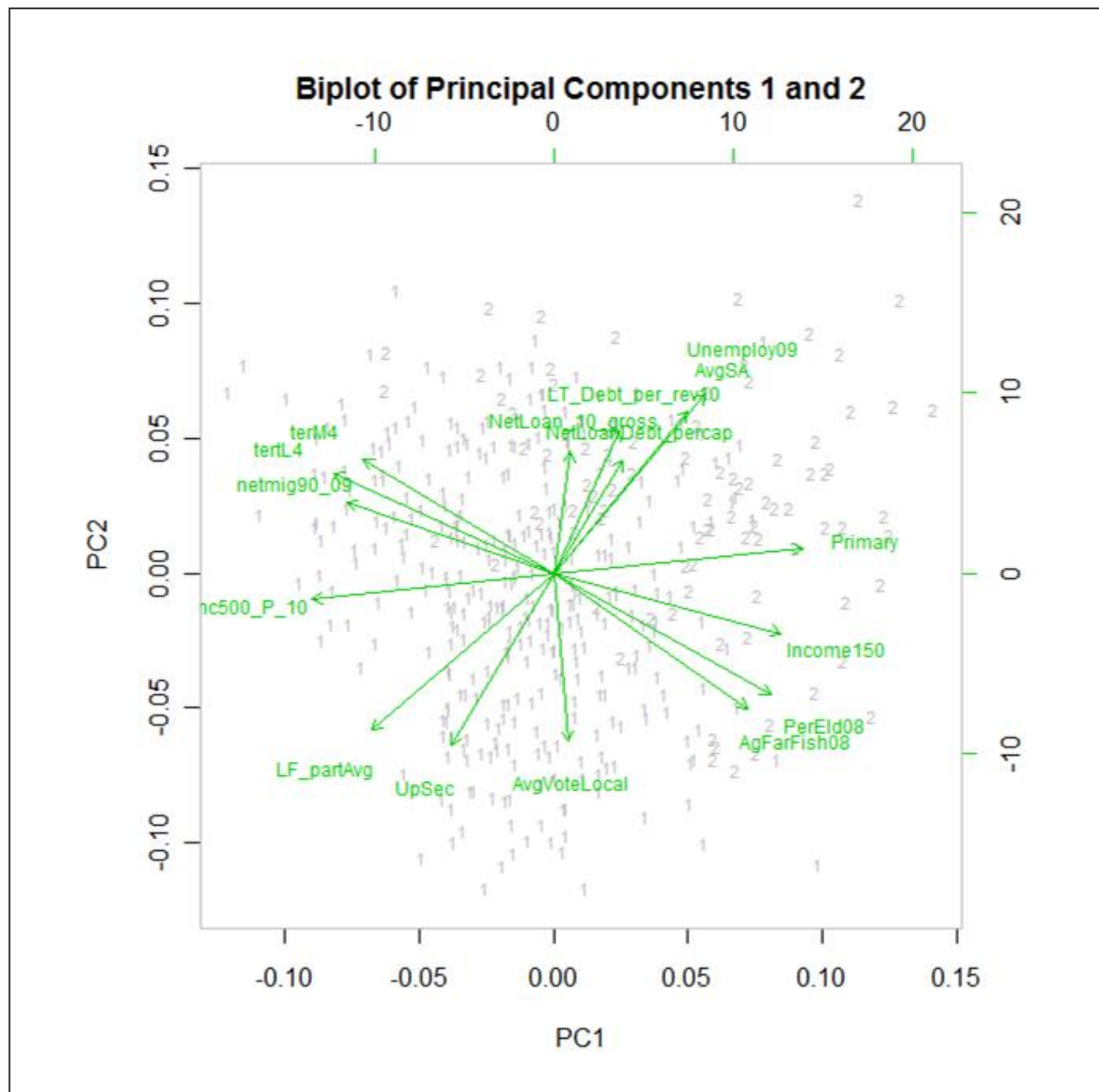


Figure 7. Biplot of first two principal components illustrating the all 16 variables. '1's' represent where non-Barents municipalities lie on the first two principal components and '2's' are the Barents municipalities.

background of the biplot refer to the 430 municipalities of Norway, with '1' referring to the 342 municipalities in the South and the 88 '2's' referring to the municipalities in the Barents North.

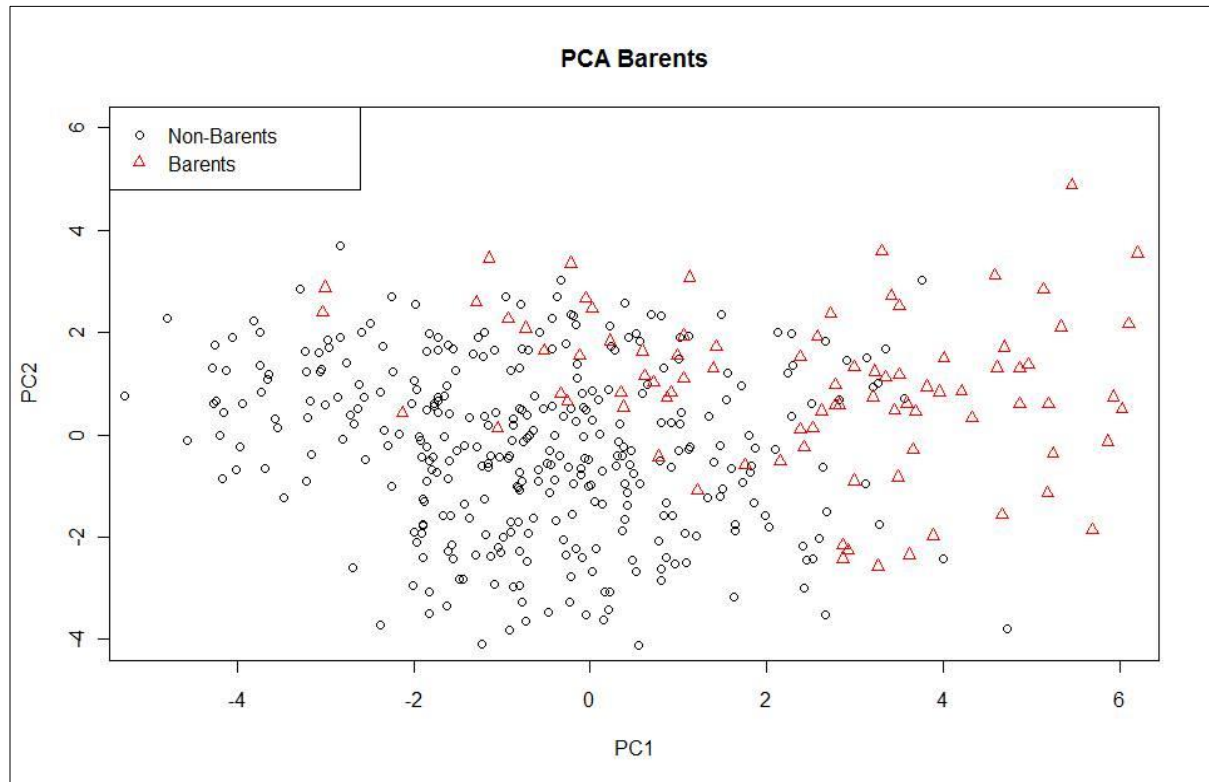


Figure 8. Plot of the first two principal components. The Barents municipalities tend to fall to the right, drawing a discernable difference from the municipalities in the South.

The 88 municipalities constituting the North are predominantly on the right side of the biplot while the southern municipalities are positioned towards the left. This separation between the municipalities is primarily based on the first principal component which is along the x axis. Above in figure 8, again, the first two principal components are used to plot the actual PCA value for each municipality for each respective principal component. While the break is not clean, Figure 10's layout is similar to the layout as the biplot in Figure 7, with most of the municipalities of the northern Norway being located along the right side of the plot.

Coupling the significant loadings of the first two principal components and with the two plots in figures 7 and 8 allows for greater understanding which variables are best informing each municipalities principal component value. Many of the municipalities in the Barents region have higher percentages of elderly, lower income earning, lower education attainment, higher unemployment, and greater social

assistance. And an overarching theme for the 342 southern municipalities is a higher level of education attainment, higher labor force participation, and higher income levels. While not all of the 88 municipalities in the North nor all of the 342 municipalities in the South are hermetically sealed within the above narrative, the two previous plots demonstrate a distinction between North and South being present.

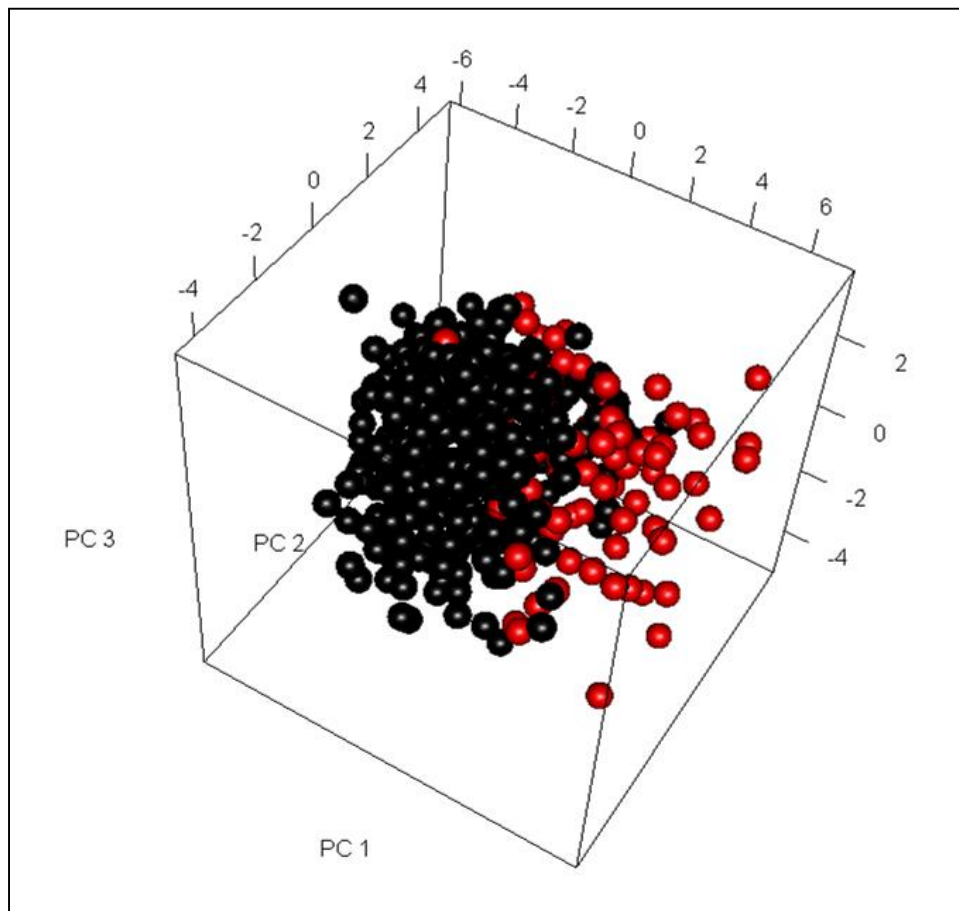


Figure 9. 3-D Plot of first 3 principal components. With 62.3% of the variance explained, the red spheres, representing the 88 municipalities in the North, overall remain distinct from the southern municipalities.

Adding the third component of the PCA will increase the description of the total variance by an additional 10.65 percent and explaining 63% of the variance across all the data. Figure 9 displays the municipalities with the additional third component and does not deviate from what the previous plots

illustrated. With 63% of the total variance explained, the 3D plot in Figure 9 still maintains the separation between North and South.

The final piece of analysis used on the data was Quadratic Discriminant Analysis (QDA) to predict if a municipality would fall within the North or South, based on the indicators used here. Figure 10 shows a very high rate of correct classification for municipalities. Since the covariance of the matrices for each of the variables between Barents and non-Barents was different, a cross-validated quadratic discriminate analysis (QDA) was applied rather than linear discriminate analysis. This resulted in a cross-validated correct classification rate of 94.5 percent. Figure 10 below shows the actual real numbers for the actual versus the classified. Of the 342 municipalities in the South, only 8 were misclassified and sorted as belonging to the Barents municipalities. Likewise for the northern municipalities, there were 15 of the 88 that were sorted within the southern municipalities. The QDA output in figure 10 further demonstrates the division between northern and southern Norway across these 16 variables.

Classified		
Actual	1	2
1	334	8
2	15	73

Figure 10. Cross-validated QDA output for municipalities resulted with 94.5% correct classification.

Chapter 5: Discussion

5.1 Limitations

One main caveat to this analysis is the lack of any race/ethnicity data. Minority status is seen as one of the main variable inputs for social vulnerability modeling (Cutter et al., 2003). The indigenous group within Norway, Sami, have historically relied on reindeer husbandry, agriculture, and fishing for sustenance. Archeological data documents reindeer husbandry by the Sami back to 600 AD (Fedororava, 1998). While Sami are captured in Norway's census data, there has been no gathering of data on race or ethnicity. The current lack of data on the minority, indigenous group has been documented (Pettersen et al. 2005), and this current time, the Nordic Sami Institute is gathering statistical data to help fill this void in information. The quantitative data is lacking in regard to Sami, but various amount of qualitative research has illustrated potential threats to the livelihood of the pastoral people. While minority ratios are not included in the analysis, Sami account for roughly 25% of the population in the North. And there is much variance between coast and inland, with Sami representing roughly 10% on the coast and up to 90% in some of the inland settlements (Pettersen, 2006).

Another limitation is within the multivariate analysis of the data. There is a possibility of a redundancy in the variables that were used in the multivariate analysis. Factor analysis prior to conducting the other analysis would verify that there was no redundancy in the variables. Also, since the municipalities throughout Norway are not independent observations, a Moran's I should have been ran to assess the potential for spatial autocorrelation. With a lack of independence within the observations, other rotations should have been examined when conducting the principal component analysis. A gamma rotation may have been more appropriate instead of a varimax rotation.

5.2 Conclusions

As the mapped accessibility index illustrates, northern Norway has remained rural and remote, even with best efforts from the government. The demographic trends also point towards the three northern counties losing a younger cohort of the population through migration. Governmental attempts to stem the flow of out-migrants from the North and create cityscapes analogous to those in the South have not come to fruition. The results of this analysis have shown a generalized difference among those in the North compared to Southern Norway. The migratory patterns of Norway illustrate a need for concern. Two past diverse development strategies have not created a change of course in migration patterns within Norway. The results from this analysis indicate migratory patterns in Norway may influence driving variables of socially vulnerable.

Again, Norway has been had the continuance of their subsidy programs questioned by the OECD (2004). Today, the same shouldering of municipal expenses by the national government continues. Climate change also continues to impress its influence on northern lands. Nations without any political boundaries abutting the arctic seas around Scandinavia have begun taking stock for future potential of the area. China, Japan, and the United States and others have looked to this a new passage for goods and future natural resource opportunities. This potential for an economic boon for Northern Norway is palpable, but so too is the potential for acquiescing to foreign demands while turning a blind eye to the local population.

The microcosm of survey responses from Rye's (2006, 2011) aforementioned surveys seems to have manifested itself in the North through the presented migration patterns, (figure 4), and population changes amongst those aged 16-29, (figure 5). The survey results cannot be extrapolated too far into the future and most credence should be given to the closest future life phase. These residential preferences are continually changing throughout life or even day to day, and so teenagers questioned about residential preference at a future retirement age should be taken with caution. It is not known if

preferences are indeed changing or if it is the structural aspect, e.g., lack of jobs, or weakening of one's rural roots that does not allow them to return, or if it is a combination of structural and constructionist theories. However, what is known is that as an individual ages and more social connections are created the complexity of a living preference increases greatly and rarely does an individual reside exactly where they desire to live (Rye, 2006).

The increasing necessity for further education to best fit into the growing service sector could further out-migration by the youth from the North to the South. First this movement will be due to the lack of universities in the North compared to the South. Second, this movement will occur for lack of job matching in the North for new college graduates coupled with the fact that previous migrants have a higher propensity to move again. Miller's (1973) justification for this movement is based on, first, a self-selective group of individuals (young people and students) and, second, the severing of a portion of human capital that is lost after the initial move. As a person lives at a residence she is gathering human capital through increased bonds with friends and increased network of friends along with gaining knowledge of surrounding area and so the initial dismantling of these connections from migration makes a second move less costly (Miller, 1973). This out-migration will further social vulnerabilities in the North and maintain the same type of employment structure in the North that was seen before the development of the NNDF. Structurally, areas not maintaining constant employment growth will have out-migration and areas experiencing higher comparative wages, having a pulling effect on in-migrants, will also be experiencing growth in employment (Miller, 1973).

Within Norway, generational research looking at the 1965 rural birth cohort displayed social status and affluence affecting migration patterns to urban centers (Rye, 2006; Rye and Blekesaune, 2007). Those leaving the rural areas for urban centers coming from an upper rural social class, coming from a family of high income and education, have an increased wage of 24% compared to those that stay. While lower classes only experience a wage increase of 12% and thus experiencing less of a pulling effect to

urban centers (Rye, 2006). Also, coming from an upper rural social class with intentions of attaining a college degree boosted percentage of moving to an urban center from 33.3% up to 77.9 percent. While lower rural class residents planning on a college education experienced an increase in the propensity to move from only 5% to up to 32.1 percent (Rye, 2006).

As a way to see the structural change that has taken place over the years and the growing norm of a college education in Norway, 40 years ago half of the 16-year-old cohort were already in the workforce, but today almost the entirety of that cohort is still in school. Over that same time span 25% of 19-year-olds were in school and today 50% are still in school. And finally, 40 years ago less than 10 percent of 24-year-olds were in school and today at least one third are in the education system.

The deleterious effects of the continuance of out-migration by the younger cohort within a region have been explored and its connection to social vulnerability illustrated within this thesis. The NNDF first attempted to curb general out-migration from the North a half a century ago. Those attempts have not perhaps had much impact, and today migration patterns are mirroring those of the past and of most importance is the loss of the younger cohort. The important question to ask for each of these northern municipalities is "how does a region maintain this group of their communities?". History has shown recommendations for creating government incentives to help influence businesses location and behavior have lacked the teeth to influence migration patterns in the long term. At the local level, it would be disingenuous to assume communities losing at economic growth would not be already wielding tools at their disposal to help their respective localities subsist and grow.

Northern Norway has a history of being a place of remote settlements maintaining a wealth of natural resources. The one thing that is showing a sign of changing is the climate of the region and great effort is being made to best gauge the future change that might result from climate change and how it will be reflected in demographic and economic developments in the north of Norway.

This thesis illustrates the difference between northern and southern Norway when juxtaposing on demographics, accessibility to urban centers, and sensitivity of social vulnerability. This division between North and South is not a new phenomenon, but rather a continuation of many decades ago. The North has been steeped in natural resources, as an economic means, over a century ago. The nation's regional policy needs to address the decreasing youth population in the North, and there are measures to help combat and instill a positive image of the North. Climate change has the possibility to have negative impacts for Norway and maybe in the North even more, with its levels of social vulnerabilities being higher than the rest of the country coupled with its already large sums of welfare money propping up economies in the North.

However, it has yet to be set how changes in the climate will affect northern Norway. Already there are shipping routes being tested in waters that were previously unnavigable icy waters. Also, new finds in natural resources in the North could also be a boon for the North. Northern Norway has already experienced economic booms from spikes in natural resources and then experienced the trailing bust. What is necessary for both the national governments and local governments to be cognizant of is the need to keep a young cohort.

It is impossible to predict how the changing climate will shape northern Norway economy or demographics, but this thesis illustrates an already dividing line across the middle of the country. Whether it is risk seeking behavior, a desire for urban life, or a better match of education attainment and employment potential, a younger cohort is moving out of northern Norway. There will be winners and there will be losers across the northern municipalities. Fishing stocks along one coast may spike, while coast of the municipality to the South may see stocks move too far offshore to fish. A mineral find of the coast of one municipality may establish a 20 year mining operation that has residual effects of other service industries, while the adjoining landlocked municipality witnesses reindeer migration patterns impeded by climate change.

The purpose of the thesis was to go beyond the national survey and dive further into the regional nuances of Norway's demography and sensitivity to social vulnerability to climate change. While many municipalities in the north share economic and demographic makeup, there is still variance across the municipalities. Municipalities need to take stock of where they are with the changing climate and how economies will be affected and what means they have to better their preparedness for the changes.

In conclusion, northern Norway continues to maintain a remote, resource frontier with a population that is continually moving away to other places. Outmigration of a younger cohort can impact many variables that increase a region's social vulnerability sensitivity. Further research into migration patterns, and further analysis on vulnerability to climate change within the region needs to be conducted.

5.3 Future Research

This paper's analysis has posited that a scope at the national level can hide apparent differences within a country. This same logic is thought to be a weakness of looking at the municipal level when compared to the community level or household level. For this reason, selecting a handful of municipalities most anomalous in their high degree of social vulnerability from this analysis and then conducting a survey at the community level as a comparative analysis would be worthwhile future research for this area.

Migration studies that include a longitudinal study of the young cohort in the North would give further insight to the motivations of the young cohort to move or stay. This research would enlighten local governments as to what contributing factors are influencing migration out of northern Norway and to what has transpired further in time for those out-migrants and has contributed to their decision to move again or stay years later.

This thesis succeeds at assessing Norway at the sub-county level data to indicate a difference in sensitivities to social vulnerability and illustrating the migration patterns that may be contributing to

drivers of social vulnerability. This is the beginning of assessing social vulnerability to climate change within Norway at the sub-county level. A more robust view of vulnerability to climate change with actionable steps for stakeholders is the next step. Further research and study is needed to best assess and recommend strategies to alleviate drivers of social vulnerability. A more holistic approach of analysis, such as the SERV model (Frazier et al., 2014), is the next needed phase of analysis for assessing northern Norway's overall vulnerability and adaptive capacity to climate change. This next step would continue to look at the sub-county level data and produce results that would be fruitful and actionable for stakeholders.

Bibliography

- Adger, W. N. (1998). *Indicators of social and economic vulnerability to climate change in Vietnam*. The Centre for Social and Economic Research on the Global Environment (CSERGE).
- Adger, W. N. (2006). Vulnerability. *Global Environmental Change*, 268-281.
- Alonso, W. (1975). Industrial Location and Regional Policy in Economic Development. In J. Friedman, & W. Alonso, *Regional Policy: Readings in Theory and Application* (pp. 64-96). Cambridge, MA: MIT Press.
- (2004). *Arctic Human Development Report*. Copenhagen.
- Bjarnason, T., & Thorlindsson, T. (2006). Should I stay or should I go? Migration expectation among youth in Icelandic fishing and farming communities. *Journal of Rural Studies*, 290-300.
- Bolin, R., & Stanford, L. (1998). *The Northridge Earthquake: Vulnerability and Disaster*. London: Routledge.
- Bourdieu, P. (1977). *Outline of a Theory of Practice*. Cambridge: Cambridge University Press.
- Bourdieu, P. (1984). *Distinction. A Social Critique of the Judgement of Taste*. London: Routledge.
- Bourdieu, P. (1990). *In Other Words. Essays Towards a Reflexive Sociology*. Cambridge: Cambridge University Press.
- Briggs, C. (2006). Science, local knowledge and exclusionary practices from the Alta Dam case. *Journal of Norwegian Geography*, 149-160.
- Burton, C. (2010). Social Vulnerability and Hurricane Impact Modeling. *Natural Hazards Review*, 58-68.
- Center, The Heinz. (2002). *Human Links to Coastal Disasters*. Retrieved from The Heinz Center: www.heinzctr.org
- Clark, G., Moser, S., Ratick, S. J., Dow, K., Meyer, W., Emani, S., . . . Schwarz, H. E. (1998). Assessing the vulnerability of coastal communities to extreme storms: The case of Revere MA., USA. *Mitigation and Adaptation Strategies for Global Change*, 59-82.
- Cruickshank, J. (2001). Regional diversification in the Norwegian fish processing industry. *Journal of Norwegian Geography*, 17-25.
- Cruickshank, J. (2006). Protest against centralization in Norway: The evolution of the goal for maintaining a dispersed settlement pattern. *Norwegian Journal of Geography*, 179-188.

- Cutter, S., Boruff, B., & Shirley, W. L. (2003). Social Vulnerability to Environmental Hazards. *Social Science Quarterly*, 242-261.
- Forbes, B., Macias, M., & Zetterberg, P. (2009). Russian Arctic warming and 'greening' are closely tracked by tundra shrub willows. *Global Change Biology*, 1542-1554.
- Fosso, E. J. (2003). *Understanding Young Peoples Migration Practices - The Significance of Social Spatialisation and Identity Production*. Bergen: University of Bergen.
- Fraizer, T., Thompson, C., & Dezzani, R. (2014). A framework for the development of the SERV model: A spatially Explicit Resilience-Vulnerability model. *Applied Geography*, 158-172.
- Gabriel, M. (2002). Australia's regional youth exodus. *Journal of Rural Studies*, 2009-212.
- Giddens, A. (1990). *The Consequences of Modernity*. Cambridge: Polity Press.
- Giddens, A. (1996). *In Defense of Sociology*. Cambridge: Polity Press.
- Haedrich, R. L., & Hamilton, L. C. (2000). 2000 R. L. Haedrich and L. C. Hamilton. The fall and future of Newfoundland's cod fishery. *Society and Natural Resources*, 359-372.
- Hamilton, L., & Seyfrit, C. (1994). Coming out of the country: Community size and gender balance among Alaskan natives. *Arctic Anthropology*, 16-25.
- Hansen, J. (1999). Coastal Finnmark, Norway: The transformation of a European resource periphery. *European Urban and Regional Studies*, 347-359.
- Hansen, J. C. (1999). Coastal Finnmark, Norway: the transformation of a European resource periphery. *European Urban and Regional Studies*, 347-359.
- Harden, W. (1960). Social and Economic Effects of Community Size. *Rural Sociology*, 204-211.
- Haugen, M. S., & Villa, M. (2006). Big Brother in rural societies: Youths; discourses on gossip. *Norwegian Journal of Geography*, 209-216.
- Haugen, M., & Lysgard, H. (2006). Discourses of rurality in a Norwegian context. *Norwegian Journal of Geography*, 174-178.
- Hidle, K., Cruickshank, J., & Nesje, L. (2006). Marke, commodity, resource, and strength: Logics of Norwegian rurality. *Journal of Norwegian Geography*, 189-198.
- Hidle, K., Cruickshank, J., & Nesje, L. M. (2006). Market, commodity, resource, and strength: Logics of Norwegian rurality. *Norwegian Journal of Geography*, 189-198.
- Johansen, H., & Fuguitt, G. (1979). Population grown and retail decline: conflicting effects of urban accessibility in American villiages. *Rural Sociology*, 24-38.

- Klugman, J., Rodríguez, F., & Choi, H.-J. (2011). *The HDI 2010: New Controversies, Old Critiques*. United Nations.
- Laska, S., & Morrow, B. H. (2006). Social Vulnerabilities and Hurricane Katrina: An Unnatural Disaster in New Orleans. *Marine Technology Society Journal*, 16-26.
- Lawrence, D., Slater, A., Tomas, R., Holland, M., & Deser, C. (2008). Accelerated Arctic land warming and permafrost degradation during rapid sea ice loss. *Geophysical Research Letters*, 1-6.
- Lindkvist, K. B. (2001). Governance and territoriality in Norwegian fisheries. *Norwegian Journal of Geography*, 9-16.
- Lowenthal, D., & Comitas, L. (1962). Emigration and depopulation: Some neglected aspects of population geography. *Geographical Review*, 195-210.
- McCarthy, J., Canziani, O., Leary, N., Dokken, D., & White, K. (2001). *CLIMATE CHANGE 2001: Impacts, Adaptation, and Vulnerability*. Cambridge: Cambridge Press University.
- Miller, E. (1973). Is out-migration affected by economic conditions? *Southern Economic Journal*, 396-405.
- Mitchell, J. K., Devine, N., & Jagger, K. (1989). A contextual Model of Natural Hazard. *American Geographical Society*, 391-409.
- Morrill, R. (1968). Waves of spatial diffusion. *Journal of Regional Science*, 1-18.
- Morrow, B. H. (2008). *Community Resilience: A Social Justice Perspective*. Community and Regional Resilience Initiative (CARRI).
- Mustafa, D. (1998). Structural causes of vulnerability to flood hazard in Pakistan. *Economic Geography*, 289-305.
- O'Brien, K., Eriksen, S., Sygna, L., & Naess, L. (2006). Questioning complacency; climate change impacts, vulnerability, and adaptation in Norway. *AMBIO*, 50-56.
- O'Brien, K., Sygna, L., & Haugen, J. (2004). Vulnerability or resilient? A multi-scale assessment of climate impacts and vulnerability in Norway. *Climatic Change*, 193-225.
- OECD. (2004). *Economic Survey - Norway 2004: Economic trends and policy challenges*. Paris: OECD Publishing.
- OECD. (2010). *OECD Economic Surveys: Norway 2010*. Paris: OECD Publishing.
- Olofsson, J., Oksanen, L., Callaghan, T., Hulme, P., Oksanen, T., & Suominen, O. (2009). Herbivores inhibit climate-driven shrub expansion on the tundra. *Global Change Biology*, 2681-2693.

- Pettersen, T. (2006). Contemporary Sami demography - a 'black hole' in research and policy making. *Nordic Sami Institute*, (pp. 1-7).
- Power, T. M., & Barrett, R. (2001). *Post-Cowboy Economics: Pay And Prosperity In The New American West*. Island Press.
- Ratcliffe, S. (1942). Size as a Factor in Population Changes of Incorporated Hamlets and Villages. *Rural Sociology*, 318-328.
- Reibsame, W. (2007). *New Geographies of the American West: Land Use and the Changing Patterns of Place*. Island Press.
- Rosenweig, C., Karoly, D., Vicarelli, M., neofotis, P., Wu, Q., Casassa, G., . . . Imeson, A. (2008). Attributing physical and biological impacts to anthropogenic climate change. *Nature*, 353-358.
- Rye, J. F. (2006). Heading for the cities? Gender and lifestyle patterns in rural youths' residential preferences. *Norwegian Journal of Geography*, 199-208.
- Rye, J. F. (2011). Youth migration, rurality and class: a Bourdieusian approach. *European Urban and Regional Studies*, 170-183.
- Rye, J. F., & Blekesaune, A. (2007). The class structure of rural-to-urban migration. The Case of Norway. *Young*, 169-191.
- Rygel, L., O'Sullivan, D., & Yarnal, B. (2006). A method for constructing a social vulnerability index: an application to hurricane storm surges in a developed country. *Mitigation and Adaptation Strategies for Global Change*, 741-764.
- Seyfrit, C., & Hamilton, L. (1992). Who will leave? Oil, migration, and Scottish island youth. *Society and Natural Resources*, 263-276.
- Sletmo, G. (1963). *Regional development in post-war Norway*. Bergen.
- Sommers, L., & Gade, O. (1971). The spatial impact of government decision on postwar economic change in north Norway. *Annals of the association of American geographers*, 522-536.
- Stroeve, J., Serreze, M., Drobot, S., Gearheard, S., Holland, M., Maslanik, J., . . . Scambos, T. (2008). Arctic Sea Ice Extent Plumets in 2007. *EOS*, 13-14.
- Taylor, L. (1961). Aggregation, Variance, and the Mean. *Nature*, 732-735.
- Teal, J. (1953). The rebirth of north Norway. *Foreign Affairs*, 123-134.
- Thorsvik, J. (2010). How simultaneity in time, contextual influences and constraints affect planning situation, and shape the capacity of participants to plan. *Futures*, 1200-1211.

Wood, N., Burton, C., & Cutter, S. (2010). Community variations in social vulnerability to Cascadia-related tsunamis in the U.S. Pacific Northwest. *Nat Hazards* , 369-389.

Young, O. R., & Einarsson, N. (2004). *Arctic Human Development Report*. Stefansson Arctic Institute.