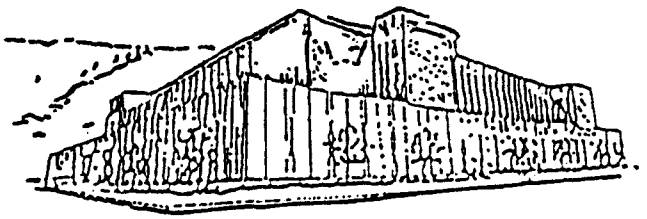
2002

The Viking expansion| Climate, population, plunder

John C. Sharpe
The University of Montana



Maureen and Mike
MANSFIELD LIBRARY

The University of **MONTANA**

** *Please check "Yes" or "No" and provide signature* **

Yes, I grant permission X
No, I do not grant permission ____

Author's Signature [signature]

Date 6/26/03

THE VIKING EXPANSION:

CLIMATE, POPULATION, PLUNDER

by

John C. Sharpe

B.A. Eastern Washington University, Cheney, 1991

presented in partial fulfillment of the requirements

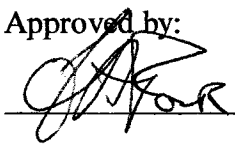
for the degree of

Master of Arts

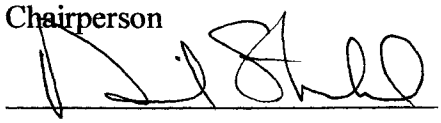
The University of Montana

June 2002

Approved by:



Chairperson



Dean, Graduate School

6-28-02

Date

ProQuest LLC.
789 East Eisenhower Parkway
P.O. Box 1346
Ann Arbor, MI 48106 - 1346

Sharpe, John C. M.A., June 2002 Anthropology

The Viking Expansion: Climate, Population, Plunder (48)

Director: Thomas A. Foor TAF

During the Viking Age (AD 800-1200) there was a significant increase in the population of Scandinavia. A period of favorable climatic conditions, agricultural intensification, and prevailing reproductive strategies contributed to this development. The subsequent Viking Expansion was one way of compensating for the inability to internally meet the needs of this rapidly growing population. It was motivated by a combination of factors, including: mild climatic conditions, population pressure, internal conflict, and external strife.

Evidence for population growth exists in both the archaeological and historical record. An interior colonization is indicated by an expanded occupation of the landscape, an increase in the number of farms, and the establishment urban centers. Pollen analysis reveals an intensification in agricultural pursuits during the Late Iron Age (AD 400-1200). More land under cultivation and greater yields per acre resulted in increased food production. This increase was in part made possible by improving summer conditions. It is also an indication of adaptations being made in response to the demands of population growth.

As the population increased people were forced to seek alternative methods of supporting their families. Changes in social organization affected the carrying capacity of the landscape and restricted access to the private ownership of land. This caused an imbalance to occur between the availability of resources and the size of the population. Emigration to new territories provided access to land and wealth for many, thereby successfully addressing this imbalance. This was accomplished through the occupation of newly discovered territories, the conquest of settled lands, and the extraction of tribute. With this option available there was little reason for Norse people to adopt reproductive strategies that would limit population size.

This thesis presents information that demonstrates climatic improvements, population growth, changes in social organization, economic growth, political opportunity, and technological innovation contributed to the Viking Expansion. Data are compiled from archaeological, historical, geographical, meteorological, geological, and botanical sources.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

CHAPTER 1

INTRODUCTION

This thesis examines the complex relationship between population growth, fluctuations in climatic conditions, and the Viking Expansion. Evidence for population growth during the Viking Age (AD 800-1200) exists in both the archaeological and historical record. A period of favorable climatic conditions, agricultural intensification, and prevailing reproductive strategies contributed to this increase. The subsequent Viking expansion was motivated by population pressure, economic growth, conflict within Norse society, and aggression towards those in other societies. The colonization and conquest of territory outside Scandinavia relieved pressures placed on the population caused by an imbalance between its size and the amount of resources available. The Viking Expansion was an adaptation that provided access to the additional resources needed to restore this imbalance and accommodate further growth.

Vikings were in part the explorers, entrepreneurs, warriors, and kings of Norse society in protohistoric Scandinavia. Armed with sword, axe, and spear they are known for conducting sudden and violent coastal raids against the undefended monasteries and country sides of Europe. "In written Scandinavian sources *viking* actually means piracy or a pirate raid, while a man participating in such a foray was actually called a *vikingr*" (Heath and McBride 1985:4). Innovations in maritime technology throughout the Late Iron Age (AD 400-1200) led to the eventual development of the longship (Brogger and Shetelig 1971,

Crumlin-Pedersen 1978, Graham-Campbell 1989, Heath and McBride 1985). The longship played a significant role in the success of the ensuing Viking Expansion (Magnusson 1979). By employing this type of vessel Viking raiders gained a significant technological and tactical advantage over their neighbors.

> Behind these events lies the fact that without the Viking sailing-ship there could have been no Nordic expansion in this period. The ship was the indispensable means of transport whereby the Vikings advanced, not only abroad but also in Scandinavia itself with its long coastline, many sounds, fjords and rivers (Crumlin-Pedersen, Jorgensen, and Edgren 1992:42).

Adam of Bremen, writing c. AD 1075, describes many aspects of settlement conditions, resource availability, and wealth in Scandinavia during the Viking Age (AD 800-1200). Much of his information was gained from King Svein Estridsson of Denmark. Although somewhat biased in his opinions as a result, his observations demonstrate that it was often necessary to seek resources outside Scandinavia, that a livelihood could be made as a Viking, and that much wealth was imported as a result of these raids.

> ...[Sjaelland] is very celebrated as much for the bravery of its men as for the abundance of its crops...There is very much gold in Zealand, [Sjaelland], accumulated by the plundering of pirates...as soon as one of them catches another, he mercilessly sells him into slavery either to one of his fellows or to a barbarian...Scania is the province of Denmark fairest to look upon...well provided with men, opulent of crops, rich in merchandise...
>
> The Swedish country is extremely fertile...the whole region full of merchandise from foreign parts...they regard as nothing every means of vainglory; that is, gold, silver, stately charges, beaver and marten pelts, which make us lose our minds admiring them...
>
> Norway is the most unproductive of all countries...there are produced very valiant fighters...not softened by any overindulgence in fruits...the Danes...are just as poor...Poverty has forced them thus to go all over the world and from piratical raids they brings home in great abundance the riches of the lands. In this way they bear up under the unfruitfulness of their own country (Adam of

Bremen in Roesdahl 1991:94-95).

A deterioration in the climate prior to the Viking Age (AD 800-1200) prompted the people of Scandinavia to experiment with different ways to ensure the continuation of an accustomed way of life. The strategies they developed met with varying degrees of success and included: the introduction of new socio-economic systems and technologies, changing settlement patterns, colonization, trade, plunder, and the conquest of already settled lands. These adaptations have in common the consequence of providing the resources needed to support large numbers of people and encourage population growth. An abundance of resources provided by the Viking Expansion encouraged the relaxation cultural regulation which would inhibit population growth.

A key component to human demography is that breeding strategies include the ability to regulate family size (Bates 2001). There is a systematic relationship between family size and population growth. As each successive generation reproduces it attempts to produce as many offspring as possible without jeopardizing family success. Times of population increase are positively correlated with increase in family size. These changes occur in an attempt to maintain optimum numbers afforded by prevailing climatic and social conditions. During the Viking Age (AD 800-1200) Scandinavian families shifted towards the establishment of single, independent farms with larger individual family sizes (Widgren 1983). As the number of farms and families increased, so did the overall population and the number of people available to work the fields.

Population pressure was an important factor contributing to developments commonly associated with the Viking Age (AD 800-1200). "Pressure exists only when the balance

between population size and resources is disturbed" (Hygen 1989:141). For example, imbalances can be caused by climatic fluctuations or the institution of different types of social organization. Territorial organization, social structures, and/or the size of the total territory influence population pressures (Hygen 1989:140). In order to restore the balance, adaptation is required to release this pressure. In the Viking Age (AD 800-1200) there are indications that changes were occurring in response to all of these influences. Old territorial boundaries were reorganized, kingdoms began to replace chieftainships, and an emigration to new territories took place.

Rapid population growth was a motivating factor in the Viking Expansion. The Viking Age (AD 800-1200) pursuits of colonization and conquest were dependant on large numbers of people for their success. Indications for this population increase occurs in the historical and the archaeological record. An increase in population occurred during a period of relative benign climatic conditions, known as the Medieval Warm Epoch (AD 900-1300). Pollen analysis from agricultural regions demonstrate that not only was more land in cultivation but that cereal production increased as well during this time. An increase in agricultural production is one indication of population growth (Boserup 1981). The resulting interior colonization of Scandinavia is indicated by the establishment of several new farms, villages, and towns.

Changes in social organization during the Viking Age (AD 800-1200) contributed to an internal conflict in Norse society. The development of the state, establishment of a market economy, adoption of a new religion, and alteration in patterns of inheritance contributed to this conflict. These changes affected access to land and wealth for many, thereby encouraging

large numbers of people to seek those resources outside of Scandinavia. Political fragmentation in England and the Frankish Empire encouraged expansion in those directions. Viking raids became a common and profitable way for large numbers of people to make a living. Larger and more numerous incursions eventually led to the conquest of already occupied territories. Historic sources record in great detail the wealth to be had from these raids, especially in terms of Danegelds.

Data in support of this thesis has been divided into four additional chapters. Chapter two describes the interior colonization of Scandinavia and the subsequent Viking Expansion. Changes in territorial and social organization accommodate population growth while simultaneously encouraging emigration. Colonization and conquest release population pressures while providing the resources needed to encourage further growth. Chapter three discusses the affect improving climatic conditions had on reducing the ecological limitations places on population growth. It also describes how improving conditions resulted in longer summers and the opportunity to increase agricultural production. Chapter four address the role reproductive strategies play in influencing population size. Data is presented which reveals population growth rates in Viking Age (AD 800-1200) Scandinavia. The last chapter summarizes the data and presents conclusions. It reiterates the thesis that mild climatic conditions combined with the success of the Viking Expansion encourage the production of numerous offspring and large families.

CHAPTER 2

THE VIKING EXPANSION

TABLE 1

A CHRONOLOGY OF CULTURE CHANGE IN SCANDINAVIA

Period	Time span
Medieval Period	AD 1200 - 1500
Late Iron Age	AD 400 - 1200
Viking Age	*800 - 1200*
Vendel Period	600 - 800
Migration Period	400 - 600
Early Iron Age	500 BC - AD 400
Roman Iron Age	AD 1 - 400
Pre-Roman Iron Age	500 - 1 BC

Table 1 contains a list of the cultural phases in Scandinavia between 500 BC and AD 1500. The Late Iron Age (AD 400-1200) represents a transitional period between the Early Iron Age (500 BC-AD 400) and the historic Medieval Period (AD 1200-1500). Within this chronology, the Viking Age (AD 800-1200) represents the last cultural phase of the

prehistoric Late Iron Age (AD 400-1200). It is the cumulative result of technological innovation and cultural adaptation initiated in response to changes in climate and social organization beginning c. AD 400. This chapter describes how these adaptations contributed to the Viking Expansion. An examination of settlement patterns and land use of the agrarian landscape reveals changes were made in order to compensate for population growth and the introduction of new social organizations. Information to support this analysis is drawn from archaeological, historical, and geographical sources. Examples from specific regions are considered indicative of a general pattern of development throughout the whole of Scandinavia.

Interior Colonization

A discontinuity in settlement location and agricultural production occurs at the transition from the Early Iron Age (500 BC-AD 400) to the Late Iron Age (AD 400-1200). Coinciding with this transition is a significant deterioration in climatic conditions, which begin c. AD 400. In the following centuries many settlements were abandoned and "...a decrease in agrarian production occurred in the area, coupled with probable disturbances in the relation between arable farming and cattle-breeding. This bears witness to an ecological crisis which had traits of over exploitation" (Widgren 1983:119). The cumulative result of over exploitation, climate change, and reorganization was a reduction in the overall carrying capacity of the landscape. Analysis of the pollen record reveals the total number of farms in operations decreases as does overall agricultural production (Welinder 1975, Widgren 1983). Under these conditions, old territorial organizations and patterns of land use were no longer

viable.

One example of settlement abandonment can be found on the island of Gotland, off the east coast of Sweden. Archaeological investigations reveal that between 15 to 20 per cent of the farms there were deserted during this time (Widgren 1983:10). Many of these deserted farms lie on agricultural land which was uncultivatable during the Migration Period (AD 400-600). Combined with an overall reduction in the number graves, this abandonment was interpreted as a reduction in the total population. However, it is likely that this abandonment was a product of changes in settlement patterns to a more aggregated system and not necessarily the result of a reduction in the population. "It has, however, often been emphasized that many existing settlements stretch as far back, or even further, in time as the deserted ones, so we must be dealing with a true contraction" (Ambrosiani 1984:242). The general trend of settlement nucleation in the landscape evident throughout the remainder of the Late Iron Age (AD 400-1200) supports the interpretation of a continuity, not reduction, in the regional population of late prehistoric times.

> In the period AD 400 to 700, the stone-wall complexes were split up and the historically known, *by* territories were shaped. This division of the land lies incongruously over the old land-use pattern and implies a radical restructuring...Some of the sites may have been abandoned during the agrarian crisis in the 6th century, while others may have been moved to new sites within the *by* territory as a consequence of the restructuring (Widgren 1983:116).
>
> In a somewhat longer, time perspective - say, AD 500 to 1200 - it is, however, clear that we are dealing with a process of (1) amalgamation of isolated patches of arable land into larger fields and (2), as a consequence of that, a concentration of settlement from single farmsteads to hamlets and villages (Widgren 1983:121).

Concentrations in the settlement of the landscape during the Migration Period (AD

400-600) led to the establishment of new, basic territories. Known as *by* territories, they were relatively large and of similar size, each containing centrally located farms. Settlement concentrations nucleated around these farms, which could eventually grow into hamlets or villages. An analysis of field boundaries, settlement patterns, and pollen samples from the agrarian landscape in Sweden corroborates this assessment (Ambrosiani 1985, Hannerberg 1976, Widgren 1983). These findings confirm a general pattern of development common throughout Scandinavia in the Late Iron Age (AD 400-1200).

> Under all the circumstances, the splitting of the early-Iron-Age units into the *by* territories meant a radical change in the forms of cooperation between farms and between different units. Whether the settlement form was single farms or hamlets, the role of the single farm was strengthened, as compared with the intricate interdependence between the farms in the early-Iron-Age complexes and between different units (Widgren 1983:119).

After this period of reorganization and concentration, an expansion occurs in the habitation of the landscape. In the Viking Age (AD 800-1200) it became necessary to subdivide the *by* territories into smaller units of irregular size in order to accommodate the establishment of new farms (Myhre 1978:244). The establishment of several new farms during the Late Iron Age (AD 400-1200) was in part due to an overall improvement in climatic conditions. Lands abandoned during the Migration Period (AD 400-600) were taken into use again, providing an additional outlet for population growth. This was an adaptation made in response to the increased demands population growth places on agricultural production. An increase in the number of farms would indicate a growth in the number of families, and hence the overall population.

Movement into marginal areas is another adaptation commonly associated with

population growth. Archaeological surveys conducted in the mountain regions of western Norway demonstrate that higher altitudes were able to support a permanent, year round occupation in the Viking Age (AD 800-1200) (Bjorgo 1986).

> In central Norway between AD 800-1000 the area of settlement, forest clearing and farming, which had been more or less unchanged since early Iron Age times, and had retreated in places since AD 400, rather quickly spread 100 to 200 meters farther up the valleys and onto the heights (Lamb 1984:235, 1965:16).

Subsequent excavations of house sites in those areas reveal that a combination of subsistence activities were practiced, including summer pasturing, animal husbandry, hunting, and trapping (Bjorgo 1986:127). Iron production in areas such as southern Norway encouraged further occupation in the mountain regions (Johansen 1973).

Evidence for a similar expansion in the landscape can also be found in Sweden. Pollen profiles reveal the Forest Lowland, located north of the Lake Malaren Plain, underwent renewed agricultural activity c. AD 500-1000 (Welinder 1975:80). In the 12th and 13th centuries the expansion continues, encompassing infertile climate-dependant soils with poor production capabilities in relatively remote regions of Scandinavia. The habitation of the Forest Lowland is contemporary with the occupation of other areas outside of eastern Sweden, such as in Angermanland in northern Sweden. Pollen samples recovered from varved lake sediments in the region record the impact of human activity on the landscape (Wallin 1996).

> In the region around the estuary of the Angermanalven, a period with stronger human impact on natural habitats, which manifested itself in clearing of woodlands for meadows and cereal cultivation began at the beginning of the thirteenth century AD. This was part of a general expansion along the coast of northern Sweden when more remote regions, such as the area around the

study site, Filitjarnen, were exploited (Wallin 1996:310).

There is a reciprocal relationship between changes in landscape organization and changes in social organization during the Late Iron Age (AD 400-1200). Changes in social organization is a second indication of adaptations being made in response to growing population pressures (Hygen 1989). Again, it is important to understand the Viking Age (AD 800-1200) as a transitional period between the chieftainships of the Early Iron Age (500 BC-AD 400) and the feudal monarchies characteristic of the later Medieval Period (AD 1200-1500). An analysis of rune stone engravings gives one indication of how changes in social organization affected the development of the agrarian landscape in the Viking Age (AD 800-1200).

> There is also reason to believe that changed forms of landholding influenced the development of the agrarian landscape during this period. Many of the rune stones served not only as memorials to the deceased but also as documents of inheritance (Jansson 1976:97). The inscriptions witness to the same forms of inheritance of land in the 9th century as in the medieval laws (Carlquist 1977). Furthermore, Randsborg has analyzed a number of inscriptions from Skane and Denmark which points to the emergence of a class of people whose rights to land - as servants of the king - differed from the traditional forms of landholding (Randsborg 1980:25 ff) (Widgren 1983:13).

The reinforcement of social inequality associated with state societies further added to population pressures and contributed to the Viking Expansion. Chieftainships established during the Early Iron Age (500 BC-AD 400) were being replaced by state level organizations, in the form of emerging monarchies, by the beginning of the Viking Age (AD 800-1200). Analysis of grave goods and hoarding practices demonstrate this process was beginning as early as the year AD 700 in Denmark (Hedeager 1992). Similar finds in Sweden (Lamm and

Nordstrom 1983) and Norway (Myhre 1978) corroborate this assessment. New centers of political power were established during the Viking Age (AD 800-1200) which usurped the importance of earlier trade centers under the control of local chiefs. As a result, the landscape became divided into agricultural districts and administrative or commercial urban centers. This division in labor further indicates movement towards development of the state (Marx and Engels 1845:56).

In the new state society the chiefs became important retainers in the service of the new king. The king could then mediate conflict and communication between the former competitors while at the same time reinforcing his importance and status. Kings began to mint their own coinage and instituted market economies. The redistributive economic system collapsed and local chiefs lost a good deal of their influence (Myhre 1978:254). This allowed the kings to exert their influence over larger areas while providing security and stability throughout their territory (Odner 1972:645). It also allowed them to levy taxes against land owners in areas under their control.

> ...the number of tenant farmers increased in relation to freeholders as many freeholders had to sell their lands to pay for the taxes levied. Thus land became much more subject to indirect management. The people who worked the land were under pressure to produce as much hay or to raise as many sheep and cattle as possible, with little thought to possible long-term effects (Bates 2001:180).

> The leaders may also create a pressure on the ordinary population, claiming taxes which reduce the produce available for the farmers themselves. The ruling class thereby has a maximation strategy while the farmers have a strategy of subsistence. Over-exploitation by the rulers may have led to an intensification of agriculture, associated with the historical farm, or to emigration, associated with the later Viking expansion, seeking new land and liberty (Hygen 1989:141).

Combined with the reorganization of the agrarian landscape, excessive taxation had the effect of rendering a percentage of the population propertyless, creating a gap in the distribution of wealth (Marx and Engels 1845). This disparity of wealth is evident in the distribution and composition of grave goods found throughout Scandinavia in the Late Iron Age (AD 400-1200) (Hedeager 1992, Lamm and Nordstrom 1983, Myhre 1978). In order to insure the continued success of the individual family, alternative means of generating revenue had to be explored. The Viking raids became a way for the landless to advance, or the wealthy to maintain, their position in society. In turn, the wealth imported from these raids further contributed to the development of the state and reinforced the strength of the market economy. Out of this social and economic environment the Viking Expansion became a way of life for many, simultaneously contributing to, and releasing, population pressure.

Religious changes were also instituted along with a changes in political organization. Christianity was introduced to Scandinavia during the Viking Age (AD 800-1200), made possible by contact with the people of Europe. Its adoption commonly occurred in areas where newly formed kingdoms were established. The kings of these countries often converted to Christianity for political and economic reasons, and their followers did the same. An important consequence of adopting this religion was an additional alteration in traditional patterns of inheritance. Under Christian law unmarried liaisons and polygamy were condemned and so the inheritance rights of children defined as illegitimate offspring were greatly diminished (Fenger 1992:124). Combined with the practice of primogeneratorship, this would make it increasingly difficult for children of such unions to acquire land of their own as the Viking Age (AD 800-1200) progressed. Consequently, younger sons were forced

to seek lands outside of Scandinavia to make their own.

The private ownership of land in the Viking Age (AD 800-1200) was the basis of wealth, freedom, and influence in Scandinavian society. The selling, or losing through conflict, of land was interpreted as a sign of extreme poverty. "Land was the precondition for the survival of kindred and individual alike. The landless were either thralls or paupers, or were the merchants and craftsmen who became the citizens of the towns that originated and expanded between the years 800 and 1200." (Fenger 1992:120-121) Alternatively, the landless could take up arms as a Viking, seeking land, fame, and wealth, in order to acquire elsewhere what they could not in Scandinavia.

Outward Movement

An interior colonization of the agrarian landscape, development of the state, changing patterns of inheritance, emphasis in social inequality, and new religious law had the cumulative effect of contributing to a growing population pressure. As a natural consequence of these conditions people began to look for territory outside of Scandinavia to make their own. Expansion was a successful response to these conditions, so much so that an intensification of this practice became a defining characteristic of the Viking Age (AD 800-1200). The Viking raids successfully provided a livelihood for many, procuring the resources needed to support a growing population. Three ways in which this was made possible were through the occupation of newly discovered territories, the conquest of already settled lands, and the extraction of tribute in the form of Danegelds.

The westward expansion is an excellent example of the occupation of newly

discovered lands during the Viking Age (AD 800-1200). This colonization differed from the conquests and raiding associated with the Viking Expansion in that fewer people were involved and they did not primarily concern themselves with the looting and pillaging characteristic of Viking activity. The primary means of subsistence for the occupants of the Atlantic islands were the traditional pursuits of agricultural and animal husbandry. Colonists began to inhabit the islands of the North Sea by the end of the 8th century. The Faeroe, Orkney, and Shetland Islands, the Hebrides and parts of northern Scotland were some of the first areas outside Scandinavia to come under Norse influence. In some cases this presence began as early as the year AD 780 (Jones 1968:198). In the mid 9th century Norse explorers expanded their travels in the North Atlantic with the effect of locating new territories to inhabit. Iceland was discovered by the Norsemen in the AD 840s, who were likely informed of its location by Irish monks. Full scale colonization began in the AD 860s and continued for another sixty years.

In the following centuries exploratory expeditions from Iceland continue to move west. Erik the Red discovered the colonization potential of Greenland c. AD 985 and incites others to follow him to this new land. A western and eastern settlement are soon established and remained viable into the 14th century before abandonment (Jones 1986). A permanent settlement was even eventually established in Newfoundland c. AD 1000, marking the first European settlement in North America (Ingstad 1977). Occupation of these areas coincides with the general expansion of farms on the landscape of Scandinavia. This is further indication of a population growth encouraging a culture to expand outside its home territory.

In addition to exploration and colonization, Vikings carried out numerous coastal

raids in Europe and England. These raids generated the wealth necessary to compensate for the pressures caused by a lack of resources in Scandinavia. In turn, the influx of capital generated this way strengthened the establishment of the market economy while reinforcing class differentiation. With the wealth garnered this way freemen and kings alike could maintain, or improve, their status in Norse society. Viking raids were the product of this social structure and the technology that facilitated the expansion, namely, the longship. With this new kind of vessel Viking raiders were able to make sudden coastal raids in areas not previously thought possible. The details of these raids are clearly documented in historical sources from the time. In the year AD 793 the Anglo-Saxon Chronicle records the first of these Viking raids to occur in England:

> in this year dire portents appeared over Northumbria and sorely frightened the people. They consisted of immense whirlwinds and flashes of lightning, and fiery dragons were seen flying in the air. A great famine immediately followed those signs, and a little after that in the same year, on 8 June, the ravages of heathen men miserably destroyed God's church on Lindisfarne, with plunder and slaughter (Roesdahl 1991:193).

This is the first of many Viking raids to come over the next two and a half centuries. These unprecedented raids made a strong impression on the people of Europe. The threat they posed soon became of important concern to kings and clergy alike. They not only represented a weakness in physical security but were often interpreted as an attack on the sanctity of holy Christian sites. This had a profound psychological impact on the victims which reinforced the barbaric and violent reputation attributed to these pagan peoples from the North. In response to the news of the attack on Lindisfarne, Alcuin of York writes King Aethelred of Northumbria:

> ...never before has such terror appeared in Britain as we have now suffered from a pagan race, nor was it thought that such an inroad from the sea could be made. Behold, the church of St. Cuthbert spattered with the blood of the priests of God, despoiled of all its ornaments; a place more venerable than all in Britain is given as a prey to pagan peoples (Alcuin of York in Graham-Campbell 1989:26).

Soon after reports of Viking raids were common in continental Europe as well as in England. Initially, reformations instituted by Charlemagne protected the coastal regions and kept Viking raiders at bay. However, after his death the Frankish Empire enterred into a period of increasing political fragmentation (Simmons 1974). The Vikings began intensifying raids in areas no longer under the protection of a strong monarch. In the year AD 837 the Annals of Xanten, from a monastery on the Rhine, records the first of these attacks in Frankish territory:

> Immense whirlwinds frequently erupted and a comet [Halley's comet] has been seen with a great train of light in the east about three cubits long to the human eye, and the pagans laid waste the Walcheren [an island at the mouth of the river Schelde in southern Holland] and abducted many captive women as well as an immense amount of various goods (Roesdahl 1991:53).

This marks the beginning of a series of attacks that would inflict western Europe. The success of these raids encourage others to participate in this profitable endeavor. Viking raids became a way of life for many. Intensification of this practice was made in response to the increased demands for additional resources need for a population increasing in size. As a result, throughout the 9th century the number of Viking raids continued to increase. Historic sources record the impact numerous Viking raids had on their neighbors. Ermentarius of Noirmoutier reports on the damage done in France by Viking incursions during the AD 860s:

> The number of ships increases, the endless flood of Vikings never ceases to grow bigger. Everywhere Christ's people are victims of massacre, burning, and plunder. The vikings over-run all that lies before them, and none can \withstand them. They seize Bordeaux, Perigeux, Limgoes, Angouleme, Toulouse; Angers, Tours and Orleans are made deserts. Ships past counting voyage up the Seine, and throughout the entire region evil grows strong. Rouen is laid waste, looted and burnt: Paris, Beauvais and Meaux taken, Melun's stronghold is razed to the ground, Chartres occupied, Evreux and Bayeux looted, and every town invested (Ermentarius of Noirmoutier in Jones 1968:215).

In the 9th and 10th centuries the Vikings began conquering and ruling new territories, in addition to seeking plunder. It was becoming increasingly apparent that the monarchs of France and England were unable to provide adequate defenses against these raids. They fought among themselves as much as they fought with the Vikings. This lack of solidarity provided the opportunity needed for Vikings to invade their lands. The Viking invasion of England is one example of this conquest. Beginning in AD 845 Viking fleets began to winter in England for the first time, rather than returning to Scandinavia. Beginning in AD 865, the armies of Danish kings start to maintain a permanent military presence in England. The ensuing conquest led to the eventual establishment of the Danelaw by treaty c. AD 886 (Jones 1968:421-424).

The Danelaw consisted roughly of the northeastern two-thirds of England. This conquest established a Norse presence, politically and socially, in England and opened the way for settlement by colonists in areas under Danish control. The Viking capital and center of Norse influence in England was the town of Jorvik, known today as York. Along with historic records, evidence for this occupation can be seen in the numerous place names associated with Danish settlements north of the Danelaw (Fellow-Jensen 1984). There are

also approximately 400 loan words in English from Old Norse. Further evidence of Scandinavian involvement in English society is represented by the coronation of Cnut the Great as king of England, Denmark, and Norway from AD 1018-1035.

In addition to taking land and plunder the Vikings also accepted payment to cease their activities in certain areas. One common form of tribute was the Danegeld. Danegelds are large cash payments designed to protect towns and country sides from being sacked. The first recorded Danegeld was payed to Ragnar Lodbok in AD 845 by Charles the Bald of France. The price payed to stop Ragnar's raids along the Seine is recorded as being 7,000 pounds of silver. Twelve more Danegelds were eventually paid out by French monarchs. The details of seven are known, totaling over 685 pounds of gold and 43,000 pounds of silver (Graham-Campbell 1982:35).

In England the first Danegeld was paid in AD 865 by the inhabitants of Kent in exchange for peace with Vikings wintering in the region. This payment establishes a precedent which lasts for over 150 years. Between the years AD 991-1014 alone the Vikings extorted over 150,000 pounds of silver in payment as Danegeld from English kings. This weight in silver is the equivalent of approximately 36 million coins (Roesdahl 1991:110).

> To attack the unhappy country was to be paid to go away, and to be paid to go away kept your army in being till you attacked again. The weight of tribute still astonishes: 16,000 pounds in 994, 24,000 in 1002, 36,000 in 1007, 48,000 in 1012: literally, England paid for her conquest with her own money (Jones 1968:365).

One indications of the wealth accumulated during the Viking Expansion can be found in the numerous hoards that occur in Scandinavia. "A hoard is normally defined as two or more objects made of precious metal deliberately hidden in the ground..." (Roesdahl

1991:110). Over one thousand of these hoards from the Viking Age (AD 800-1200) have been found in Scandinavia, containing more than 200,000 coins. An analysis of the composition of the hoards give an indication as to the source of this wealth. Over 85,000 coins are of Arabic origin (Roesdahl 1991:111). "...some 70,000 German coins are known from Scandinavia, together with well over 40,000 Anglo-Saxon ones. The latter figure represents a larger total than that of the number of Anglo-Saxon coins to have survived in England from that period..." (Graham-Campbell 1982:35).

This chapter has presented information that demonstrates how population pressure was a contributing factor in instigating the Viking Expansion. In the Late Iron Age (AD 400-1200) older territorial divisions and land use patterns were no longer sufficient. A reorganization in the landscape occurs during the Migration Period (AD 400-600), resulting in the establishment of new, basic territories. These territories were further subdivided during the Viking Age (AD 800-1200) to allow for the establishment of more farms. Social structures also changed along with the reorganization of the landscape. The first kings originated at this time, and social inequality became more pronounced. This development altered traditional accessability to resources for many. Combined with an increase in the population, this forced many to alternative ways of procuring a livelihood. Eventually, the total territory of Scandinavia was no longer sufficient in size to support further increases in population. Emigration, in the form of the Viking Expansion, compensated for the imbalance between population growth and resource availability. It alleviated population pressure by providing additional territory and wealth that could not be attained in Scandinavia.

CHAPTER 3

CLIMATIC CONDITIONS

TABLE 2

A CHRONOLOGICAL SEQUENCE OF CLIMATIC EPISODES IN SCANDINAVIA

Period	Time span
The Holocene	10,000 BC - present
Little Ice Age	AD 1350 - 1800
Medieval Warm Epoch	*AD 900 - 1300*
Roman Climatic Optimum	400 BC - AD 400

Table 2 displays a list of climatic episodes in Scandinavia. Throughout the Holocene (c. 10,000 BC-present) the climate has fluctuated between relatively warmer and cooler periods. These variations, relative to present conditions, are approximately +1 °C during the warm periods and -1 °C during the cool periods (Karlen et al 1995:53, Selsing 1991:227). The Viking Age (AD 800-1200) occurs during one of these warm periods, known as the Medieval Warm Epoch (AD 900-1300). This chapter will emphasize the contributing effect of climatic fluctuations on population pressure and the synchronizing effect these variations had on human adaptation. The reconstruction of climatic variations is based on a combination

of historical and meteorological data. Information has been collected from a variety sources and locations throughout Scandinavia, the north Atlantic, and northern Europe. Combined, these data present a cohesive indication of climatic change over a wide region during the period in question.

Resource Availability

According to the Malthusian hermeneutic, population growth is a dependent variable, limited primarily by ecological conditions and disease. Changes in climate contribute to pressure put on a population by placing restrictions on resource availability. A deterioration in the climate may severely diminish the amount of resources available to support a given population. This kind of change can contribute to population pressures which result in a reduction in agricultural productivity and hence the overall population. In this circumstance adaptation is required in order to ensure the continuation of traditional value systems (Odner 1972:623). There is evidence for this dynamic influencing culture change and population growth in the Late Iron Age (AD 400-1200).

For example, the Roman Climatic Optimum (400 BC-AD 400) was a time of relatively benign conditions. It allowed for an increase in the population and habitation of areas not possible afterwards. Summer temperatures at that time were approximately +1.5-2 °C higher than present (Hafsten 1981:59). However, c. AD 400 a deterioration in the climate begins which lasts for approximately the next three centuries. The coldest temperatures in northern Scandinavia occurred during the AD 530s and 540s (Briffa et al 1992:117). The cooling trend of the 6th and 7th centuries is reflected in tree ring analysis from northern Fennoscandia

(Briffa et al 1992, 1990), peat formations in western Norway (Hafsten 1981), raised bogs from Denmark (Aaby 1976), and marine sediments from the Skagerrak (Hass 1996). Ice cores from Greenland also indicate the same cold period (Dansgaard et al 1975, Hass 1996:135). This cold period was a significant factor contributing to the population pressure that instigated the reorganization of the landscape associated with the Migration Period (AD 400-600).

Alternatively, improvements in climatic conditions can result in population growth and a corresponding increase in agricultural production. After the Viking Expansion had begun, more favorable conditions are reestablished by the year AD 900. Improvements in climatic conditions after c. AD 800 allow for the occupation of previously marginal areas, resulting in the establishment of several new farms throughout Scandinavia during the Viking Age (AD 800-1200). The increase in the number of farms is one indication of population growth. More farms results in an increase in agricultural production, which in turn encourages population growth and eventually leads to the establishment of more farms. When there is not enough room to establish more farms without intensification or new technologies, the total territory for the population is no longer sufficient. This restriction in the availability in land then contributes to population pressure. The Viking Expansion resulted from adaptation made in response to this pressure. By acquiring new territory and importing mass wealth restriction in resource availability were in part reduced. The corresponding reduction in population pressure stimulated further population growth.

The Medieval Warm Epoch (AD 900-1300) is generally characterized by warm summers and mild winters. Prevailing temperatures in northern Europe between AD 1000-

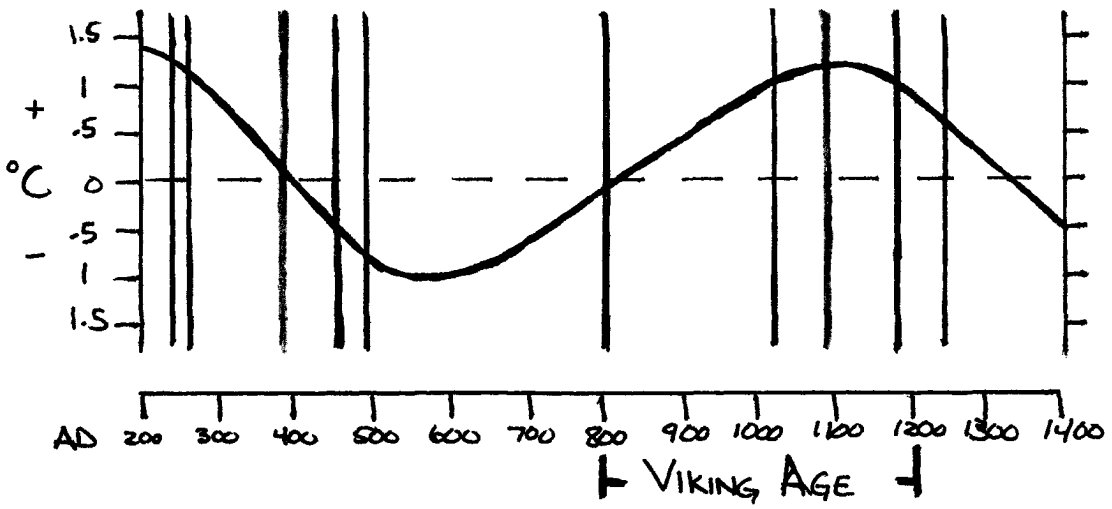
1200 were +1-2 °C above present values (Lamb 1965:17). Sea surface temperatures in the North Sea increased by +1.5 °C, and up to +4 °C in the fjords of Greenland (Hass 1996:136). "Evidence of early Norse burials in southwest Greenland, and plant roots deep in ground now permanently froze, suggests that annual mean temperatures there must have been 2-4 °C above present values" (Lamb 1965:16). In northern Sweden tree ring analysis reveals a warming trend in summer temperatures between the years AD 800-1000. Consistently warm temperatures existed between c. AD 970-1120 (Briffa et al 1992:117).

Figure 1, Climatic Changes and Temperature Variation in Scandinavia from AD 200-1200, demonstrates climatic temperature variation throughout Scandinavia from AD 200-1400, relative to present conditions. All sources of data reflect similar fluctuations, of similar magnitude, in the climate. However, some differences may occur in the frequency or amplitude of these variations at higher latitudes or altitudes, or in certain regions. The data used to construct temperature variation are derived from radiocarbon dated sediment cores from proglacial lakes in northern Sweden (Karlen et al 1995), isotope derived temperatures from stalagmite formations in northern Norway (Lauritzen 1996), and glaciological data from southern Norway (Nesje and Kvamme 1991). Marine sediments from the Skagerrak also reflect the same trends in climate variation throughout this period. Changes in current energy and water mass properties clearly document the Roman Climatic Optimum (400 BC-AD 400). This is followed by cooler and wetter period from AD 400-700, the Medieval Warm Epoch (AD 900-1300), and the eventual onset of the Little Ice Age (AD 1350-1800) (Hass 1996).

The red lines in Figure 1 indicate climatic shifts in raised bogs in Denmark (Aaby 1976). The data were derived from radiocarbon dates taken from levels indicating climatic

FIGURE 1

CLIMATIC CHANGES AND TEMPERATURE VARIATIONS
IN SCANDINAVIA FROM AD 200-1400



Present conditions

Climatic changes indicated in Danish bogs (Aaby 1976)

Glacier advances (Karlen et al 1995, Nesje and Dahl 1990)

High alpine tree limit established (Karlen et al 1995, Hafsten 1981)

Temperature variations relative to present conditions

changes. The shift indicated at AD 500 is reflected in four different bogs in Denmark (Aaby 1976), and one in south Norway (Hafsten 1981). "Raised bogs are therefore supposed to react as biological low pass filters only reflecting general long term tendencies in climate, and the 260-yr cycle seems to be the shortest period revealed" (Aaby 1976:281-282). This change denotes the onset of cooler and/or more humid conditions at the end of the Roman Climatic Optimum. No changes in peat formations were noted from layers dating to the 8th century. The 8th century should be viewed as the mid point of 700 years of general improvement, with temperatures similar to those of today. Therefore, indication of a significant shift in the climate should not be expected. "Although the raised bogs do reflect past climate, not every climatic shift is indicated in the peat structure because of the rate of decay is rather slow. The degree of decomposition may therefore rather depend on general environmental conditions during an extended period" (Aaby 1976:281).

The blue lines in Figure 1 mark glacial advances in Norway and Sweden. Radiocarbon dates from glacier moraine and peat layers in western Norway indicate advances during the 5th century (Nesje and Dahl 1990). These moraines were formed by the advance and retreat of local mountain glaciers, which are more sensitive to climatic fluctuations than continental ice sheets. This marks the beginning of a period significant glaciation in western Norway that lasts until after AD 595-645 (Nesje and Dahl 1990:3). Proglacier sediment records and moraine stratigraphy in northern Sweden indicate glacier advances at AD 300, 800, and 1200 (Karlen et al 1995).

The green lines in Figure 1 denote when the alpine tree levels in Norway and Sweden attained their highest elevation of growth. The altitude at which *Pinus* can grow is highly

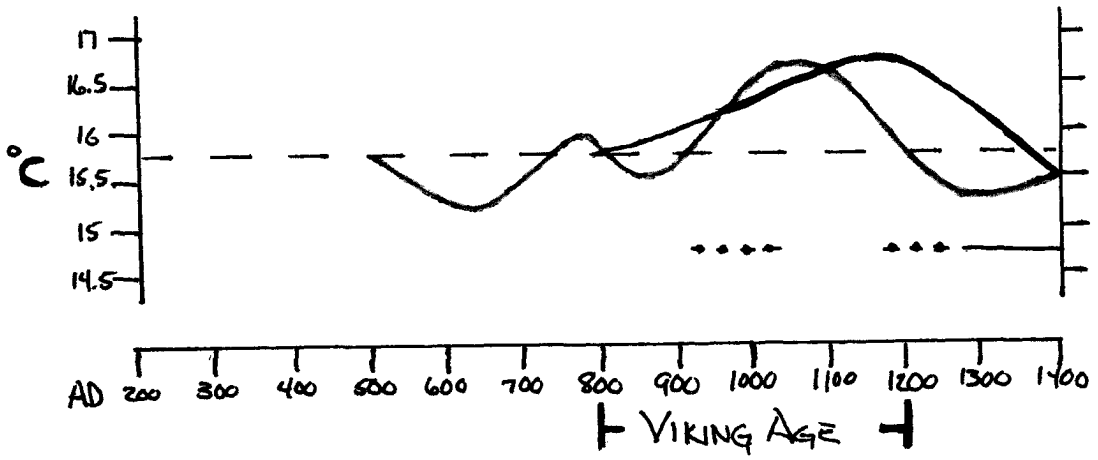
dependant on summer temperatures, and therefore a good indication of temperature variation. High alpine limits established during the Roman Climatic Optimum (400 BC-AD 400) remain until c. AD 400. In southern Norway evidence for a climatic regression after AD 400 is indicated by the formation of peat bogs occurring stratigraphically above tree stumps dating to the Roman Iron Age (AD 1-400) (Hafsten 1981). In northern Sweden data on alpine limits is based on radiocarbon dates from lacustrine sediments (Karlen et al 1995). Elevations of pine growth from the Roman Climatic Optimum (400 BC-AD 400) do not reestablish themselves until the peak of the Medieval Warm Epoch (AD 900-1300).

Figure 2, Summer Temperature Improvements in England and Fennoscandia, demonstrates the overall improvements in summer temperatures during the Medieval Warm Epoch (AD 900-1300). Throughout this period summers became correspondingly milder and longer. Long and mild summers helped facilitate the raiding activity associated with the Viking Expansion. With better conditions Vikings could travel farther and safer on the oceans in a single season. Warmer summers also positively correlate with increased agricultural production and land occupation during the Viking Age (AD 800-1200). "...the corresponding changes in central Norway would probably be sufficient to account for the drastic changes in the extent of land that was settled and farmed before and after the climax of the medieval warm period" (Lamb 1965:34).

The red lines in Figure 2 denote the occurrence of drift ice off the coast of Iceland. Information on the appearance of drift ice is reconstructed from documented occurrences recorded in the Icelandic sagas (Bryson and Murray 1977). A reduction in the appearance of drift ice around Iceland indicates a prolonged warm epoch in the North Atlantic from c.

FIGURE 2

SUMMER TEMPERATURE IMPROVEMENTS IN
ENGLAND AND FENNOSCANDIA



Present conditions

Variation in Fennoscandian summer temperature, relative to present conditions (Briffa et al 1992)

Summer temperature in England, absolute values (Lamb 1984, 1966, 1965)

Occurrence of drift ice in North Atlantic (Bryson and Murray 1977, Lamb 1966)

AD 950-1190. Peak conditions last from c. AD 1100-1150 (Lamb 1965:22). "The Arctic pack ice had melted so far back that appearance of drift ice in waters near Iceland and Greenland south of 70N were rare in the 800's and 900's and apparently unknown between 1020 and 1200, when a rapid increase of frequency began" (Lamb 1966:64).

The blue line in Figure 2 demonstrates the absolute values of summer tetratherm (June - September) temperatures in England conditions are generally benign throughout the whole of the Medieval Warm Epoch (AD 900-1300). These values are derived from the analysis of meteorological and historical data. For example, the Domesday Book, commissioned by William the Conqueror in AD 1068, records the location, production, and quality of several vineyards in England. Climatic data is extrapolated from their location and length of operation when compared to vineyards in France (Lamb 1984, 1965).

The green line in Figure 2 reproduces variations in summer temperatures relative to present conditions. Data was derived from an analysis of tree ring widths from northern Fennoscandia (Briffa et al 1992, 1990). The slight regression in overall improvements during the 9th century coincides with glacier advances in northern Sweden c. AD 800, indicated in Figure 1. The same regression is also represented in the sediment composition of the Skagerrak (Hass 1996) and ice cores from Greenland (Dansgaard et al 1975). This regression placed a noticeable pressure on the population of the Viking Age (AD 800-1200), evident by the numerous Viking incursions occurring in the 9th century. The Viking Expansion was an immediate and successful adaptation made in an attempt to alleviate population pressures instigated by this short term climatic regression.

Agricultural Production

Improving summer conditions also impacted the length of the summer growing season. Under optimum conditions the length of the growing season increased by five to seven weeks (Lamb 1984:230). Longer growing seasons provided for an increase agricultural productivity and the establishment of farms in areas not possible prior to the Medieval Warm Epoch (AD 900-1300). "...during the climatically most favorable epoch of the Middle Ages, cultivation of barely was possible at the summer farm level, and a fundamental basis for a permanent settlement at the summer farm level was present" (Selsing et al 1991:227). Archaeological investigations in the mountain region of western Norway confirms this assessment (Bjorgo 1986). Evidence for increased agricultural activity, and hence population growth, can be found in the pollen record from agricultural districts throughout Scandinavia during the Viking Age (AD 800-1200) (Welinder 1975, Widgren 1983).

> During a second farming expansion phase at ca. AD 1200, rye cultivation became more important. The increased farming activity during this period was most pronounced at the coast and in the river valley, but more peripheral regions away from the river valley were also exploited (Wallin 1996:301).

In counter point to the Malthusian paradigm, Ester Boserup has proposed a model where in population growth is a variable independent of technological limitations (Boserup 1981). Population size is still correlated with agricultural production, however, ecological limitations can be overcome by introducing technological innovations and agricultural intensification. Intensification is defined as an increase in yield per area unit per time unit. This can be accomplished by using more efficient tools, putting more workers in the field, cultivating more land, and by decreasing the time in which fields remain fallow. The end

result of this intensification is an increase in agricultural production, which indicates and contributes to population growth.

There is evidence for agricultural intensification occurring in association with population growth during the Viking Age (AD 800-1200). Expansion in the habitation of the landscape resulted in the creation of more farms. These farms were then occupied by relatively large families which meant there were more people available to work the growing number of fields. Increased production results in population growth, which necessitated the need for more farms. When there was no longer sufficient room left to establish new farms then more territory had to be acquired in order to ensure the continuation of this growth. The Viking Expansion may be interpreted as an expression of this need for more land.

Innovations in farming technology included the adoption of new tool types and field management systems. More efficient types of iron tool types were introduced to Sweden c. AD 500. They included a sickle designed for reaping cereals, a scythe with a longer blade, and the iron ard-share (Widgren 1983:13). Additionally, the adoption of a two-course field rotation system replaced earlier field management systems. Dividing fields into two parts and alternating yearly planting between each part resulted in increased yields without jeopardizing long term productivity potential. This reduced the time fields were left fallow and is a key component of agricultural intensification (Boserup 1981). However, fallow fields are non productive and take up space that could have otherwise been in cultivation. In order to compensate for this loss of productive potential more lands had to be taken into use, eventually doubling the total amount of land in cultivation during the Viking Age (AD 800-1200) (Hannerberg 1976:24). This expansion in the landscape was further supported by

favorable climatic conditions and population growth.

Figure 3, Indications of Agricultural Production Based on Pollen Analysis from Eastern Sweden, reproduces the results of pollen analysis from agricultural areas in eastern middle Sweden (Welinder 1975). A significant increase in agricultural productivity occurs during the Viking Age (AD 800-1200). Analysis of the pollen record and landscape organization (Hannerberg 1976) indicates that two-course field rotation was commonly used in Scandinavia c. AD 1000 (Widgren 1983), though it may have been employed earlier in certain regions (Welinder (1975).

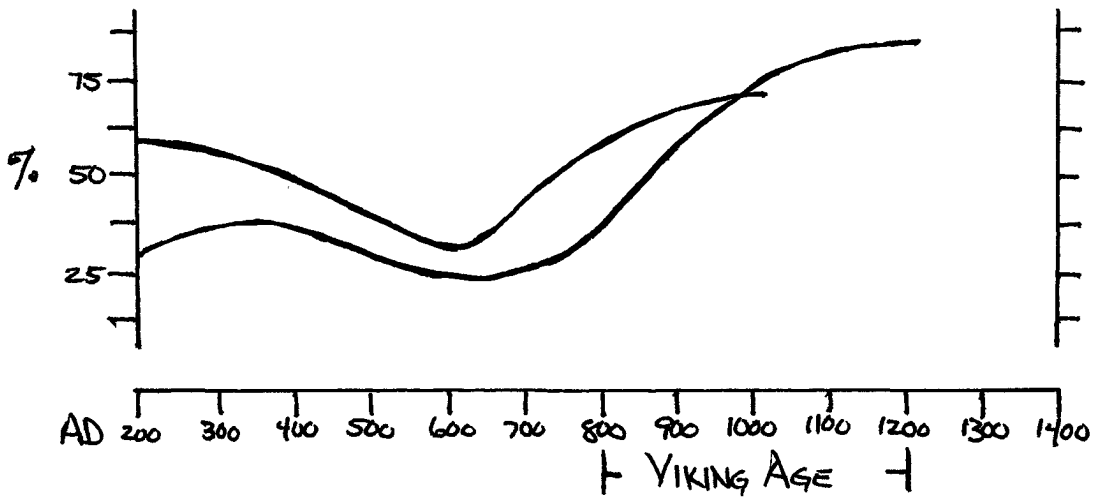
The red line in Figure 3 reflects the relative level of influence agricultural pursuits had on the pollen record in the test area. The abandonment of farms during the Migration Period (AD 400-600) coincides with a reduction in human influence in the pollen diagram. As summer conditions improved during the Medieval Warm Epoch (AD 900-1300) a marked increase occurred in the diagram. Between the years AD 700-1200 human influence in the pollen diagram increases by over 400%.

> An influence diagram shows the sum of human influence upon the natural vegetation, that is farming, grazing, drainage, forest clearance, etc. The scale of the diagrams is in the first place relative, in fact rather arbitrary. Thus, an influence diagram provides only a rough measurement of the food production in the area covered by the diagram...The diagram should not be interpreted as a common histogram, but rather as a summary of stages of expansion of human influence, that is in the first place agricultural activity (Welinder 1975:68).

The blue line in Figure 3 represents the *Cerealia/Plantage* ratio evident in the same pollen record. At the beginning of the Late Iron Age, c. AD 400, when climatic conditions were at their worst, a proportionateley smaller percentage of the landscape was used in

FIGURE 3

INDICATIONS OF AGRICULTURAL PRODUCTION BASED ON POLLEN ANALYSIS FROM EASTERN SWEDEN



——— Pollen influence diagram, relative values (Welinder 1975:69)

——— *Cerealia/Plantage lanceolata* ratio (Welinder 1975:71)

cultivation. The yield per hectare was presumably lower as well. As climatic conditions improved and the population increased, more land was taken into cultivation.

> The ratio between the percentages of pollen grains of *Cerealia* and *Plantage lanceolata* is used as an indication of the relative value of grain cultivation and stock raising, which activities are indicated by the two types of pollen grains, respectively. An increase in the ratio *Cerealia/Plantage lanceolata* indicates an increase in the relative importance of grain cultivation, thus probably indicating an increase in the food production (Welinder 1975:70).

This chapter has provided information on climatic conditions in Scandinavia during late prehistoric times. It demonstrates the synchronizing effect fluctuations in the climate had on human adaptations in the Late Iron Age (AD 400-1200). For example, a deterioration in the climate prior to the Medieval Warm Epoch (AD 900-1300) corresponds with the reorganization of the agrarian landscape in the Migration Period (AD 400-600). Further, a regression in conditions during the 9th century coincides with the onset of the Viking Age (AD 800-1200). During the Medieval Warm Epoch (AD 900-1300) the pollen record indicates a significant increase in agricultural productivity. Increased productivity is indicative of population growth, made possible by favorable climatic conditions, an expansion in the habitation of the landscape, and agricultural intensification. As the population of Scandinavia continued to increase it became necessary to acquire to new lands in order to accommodate the growing number of people. The Viking Expansion provided access to new lands where numerous people could continue the traditional practice of farming and raising families.

CHAPTER 4

POPULATION GROWTH

Population growth throughout the Late Iron Age (AD 400-1200) contributed significantly to the Viking Expansion. "It is obvious that in the Viking period there was better crop production and population survival. A greater number of surviving children resulted in increased population pressure which led to the foundation of many new farms in the Scandinavian woodland region" (Ambrosiani 1984:245). The period AD 700-1200 represents five hundred years, or approximately twenty-five generations, worth of general improvements in resource availability. During this time the living memory for the need to restrict population growth due to harsh climatic conditions would have been lost. The successful territorial and economic acquisitions provided by Viking raids released increasing pressure resulting from population growth. In times of plenty the development of large families, with numerous children, would be ideal, allowing for the exploitation of the multiple resources necessary to support the independent farms typical of the Viking Age (AD 800-1200). Additionally, there is little or no evidence supporting a demographic transition taking place, wherein families of the upper class in society begin to produce fewer offspring. Thus, it is reasonable to conclude that the cultural prohibitions against the production of large families were relaxed during this time.

Historical sources give some indication of how the population was able to reproduce

itself so rapidly. In pagan Scandinavia polygamy was commonly practiced. "According to Adam of Bremen, every Swede whose means allowed had two or three wives, while the wealthy and high-born set themselves no limit" (Jones 1968:197). Additionally, people were allowed to marry at a relatively young age. The minimum legal age of marriage was14 for males and 12 for females (Fenger 1992:124). With the adoption of Christianity in the Viking Age (AD 800-1200) new laws were instituted which further contributed to infant survival. While it is uncertain to what extent infanticide was practiced in pagan Scandinavia, the establishment of ecclesiastical law in the 10^{th} and 11^{th} centuries prohibited infanticide by the exposure of infants. Under Christian influence the baptism of all newborn children was required, except in Denmark and Sweden where those with birth defects were denied this rite (Fenger 1992). Consequently, the institution of new religious practices, combined with favorable climatic conditions, insured that a larger percentage of the population would reach the age of maturity, further exacerbating the rate of population growth.

An increase in population size produced an essential component needed to insure the continued success of the Viking Expansion: large numbers of people with reason to seek a livelihood outside Scandinavia. With this outlet consistently available to accommodate excess population, there was little reason to adopt a value system designed to restrict growth. The trend of total population growth in prehistoric Scandinavia is evident from the introduction of agriculture to the end of the Viking Age (AD 1200). Examination of the archaeological record indicates the population density in Neolithic Scandinavia was approximately 0.1 persons per km^2. This value increases to approximately 4 persons per km^2 in the Viking Age (AD 800-1200) (Welinder 1975:72). Other sources corroborate these findings, suggesting

a growth rate of more than +4% per year during the period AD 400-700 (Widgren 1983:113).

> Settlement studies based upon analyses of existing ancient monuments show that settlement expansion during the Viking Age and Early Medieval Ages must have been very large. In the Malar province settlement between the years 500 and 1000 increased at last four times, and during the following 300 years increased still four more times (Ambrosiani 1981:143).

Wherever Norse colonists settled the numbers of farms, families, and people increased. The colonists emigrating to new lands continued to practice traditional methods of farming, hunting, and fishing. This pattern reinforces the importance of cultural strategies in terms of regulating population growth. According to the saga *Landnamabok* (the Book of the Settlements) 430 individual settlements were originally established in Iceland. The saga *Islendingabok* (the Book of the Icelanders) indicates that the remaining available land was completely occupied by AD 920 (Roesdahl 1991:266). By the end of the Viking Age (AD 1200) the population of Iceland had grown to approximately 60,000 people (Odner 1972:640). A similar rate of population growth can also been found in Greenland. The first settlers began to arrive and establish colonies there in the mid AD 980s. At peak occupation, the colonies of Angmagssalik and Godthaab had a total of 280 farms and an associated population of approximately 3,000 inhabitants (Bryson and Murray 1977:68, Jones 1968:79).

> An expansion of this kind can be established in east Sweden where 1000-2000 farms in the 8th century increased to c. 4000-5000 farms in c. 1100 and to three or four times that number c. AD 1300. In south Scandinavia much of the population expansion is also reflected in a pronounced growth of villages (Ambrosiani 1984:245).

The establishment of numerous hamlets, villages, and towns in the Viking Age (AD 800-1200) is a prominent indication of population growth. The development of towns is consistent with the pattern of settlement nucleation initiated in the Migration Period (AD 400-

600). Seasonal trading centers such as Ribe, Hedeby, and Birka originate as early as the 8th century. These centers facilitated international trade during the summer but were abandoned in the winter. As the population continued to increase, craft specialization and class distinction became emphasized, and the landscape became divided into differentiated agricultural and commercial centers. This division in labor is typical of state level societies and occurs in combination with an increase in population (Marx and Engels 1845).

Strongly influenced by European example, several centers of royal and ecclesiastical power were established by the emerging monarchies of the Viking Age (AD 800-1200). Eventually, trading centers mediated by chiefs were replaced by capitals occupied by kings. These planned urban centers, often established in previously unsettled areas, had good access to arable land and important trade routes. By the end of the Viking Age (AD 1200) there were approximately 27 towns of varying sizes throughout Scandinavia (Sawyer 1992:130). Examples of new towns founded c. AD 1000 include Odense, Oslo, Roskilde, Sigtuna, Trondheim, and Viborg. They were able to accommodate the growing number of people unable to secure the private ownership of property. Inhabited year round, the permanent population initially consisted mainly of craft specialists and administrative officials. As the towns continued to grow in size they also began to include commercial and industrial centers and the people engaged in those pursuits as well.

Final evidence supporting the interpretation of population growth contributing to the Viking Expansion was documented c. AD 1020. The cleric Dudo of Normandy records that the excessive sexual indulgences of the Norse people led to overpopulation and a shortage of land. While his account obviously contains certain biases, it does indicate the importance

contemporary observations placed on population growth being responsible for the Viking Expansion. Specifically, it supports the interpretation of numerous large families and the consequential need to acquire more land in order to support their children in their accustomed lifestyle. When land was no longer available it became necessary to move outside Scandinavia in order to acquire more. As a result, colonization and conquest became a characteristic aspect of the Viking Age (AD 800-1200).

> ...these people who insolently abandon themselves to excessive indulgence, live in outrageous union with many women and there in shameless and unlawful intercourse breed innumerable progeny. Once they have grown up, the young quarrel violently with their fathers and grandfathers, or with each other, about property, and if they increase too greatly in number, and cannot acquire sufficient arable land to live on, a large group is selected by the drawing of lots according to ancient custom, who are driven away to foreign peoples and realms, so that they by fighting can gain themselves counties where they can live in continual peace (Dudo of Noramandy in Roesdahl 1991:187-188)

This chapter addresses the importance cultural strategies had in regulating population growth and settlement pattern. Improving climatic conditions provide an opportunity for growth, however, it is human adaptation to these conditions that makes growth possible. Reproductive strategies of the Viking Age (AD 800-1200) had the intent of producing as many offspring as possible without jeopardizing the success of the family. The resulting growth disrupted the balance between population size and the availability of resources, placing stress on the population. The establishment of several new farms, villages, and towns in Scandinavia and the colonization of areas like Iceland and Greenland helped restore this balance by providing access to additional territory and resources.

CHAPTER 5

SUMMARY AND CONCLUSIONS

The following summary reiterates the main points of this thesis, demonstrating the relationship between population growth, climatic improvements, and the Viking Expansion.

1) At the beginning of the Late Iron Age (AD 400) a significant and identifiable deterioration in the climate occurred in Scandinavia. After this regression the climate continually improved until the onset of the Little Ice Age (AD 1350-1800). Optimum conditions during this time are known as the Medieval Warm Epoch (AD 900-1300). Improvements in climatic conditions reduce the ecological limitations placed on population growth. Mild summers provide for longer growing seasons and the opportunity to increase agricultural productivity.

2) A reorganization of the agrarian landscape occurred between AD 400-600. Early Iron Age (500 BC-AD 400) field systems were replaced by the historical *by* territories. After AD 700 areas with limited agricultural potential became arable again and farms were established in these areas. An interior colonization is indicated by concentrations of settlements in the landscape and the subdivision of *by* territories into numerous independent farms. Expansion in the occupation of the landscape is one indication of population increase. It also places pressure on the population when not enough territory was not available to accommodate further increase. Reorganization of the landscape and occupation of new

territory are adaptations that release this pressure.

3) New socio-economic systems were introduced to Scandinavia during the Viking Age (AD 800-1200). Chieftains of the Roman Iron Age (0-AD400) are replaced by the monarchies of the Viking Age (AD 800-1200). The country side becomes divided into agricultural and commercial/administrative districts. Additionally, market economies instituted by kings replaced redistributive barter systems. Combined with an analysis of grave goods, this provides evidence for the formation of state level social organization and class distinction. This change had the effect of altering traditional patterns of inheritance and land ownership. The emphasis of class differentiation contributed to conflict in society by rendering a percentage of the population propertyless. This disparity encouraged large numbers of people to become Vikings or colonize new lands in order to procure a livelihood for themselves and their families.

4) Improvements in environmental and economic conditions encouraged the relaxation of cultural prohibitions restricting population growth. Reproductive strategies of the Viking Age (AD 800-1200) were designed to produce as many offspring as possible without threatening the success of the family survival. As climatic conditions improved a greater percentage of children reached the age of maturity. As the size and number of individual families increased, so did the overall population. Population growth is associated with an increase in agricultural production and the establishment of several new farms and villages in the Viking Age (AD 800-1200). It also encouraged large numbers of people to look outside of Scandinavia for new lands to inhabit. Population growth in the colonies of Iceland and Greenland represent the importance reproductive strategies have in influencing

human demographics.

5) The Viking Expansion was influenced by a combination of factors, including climatic conditions, population pressure, internal conflict, and external strife. Viking expeditions and emigrations became a way of life for many. The successful acquisition of land and wealth as a result of these raids ensured the continued intensification of this adaptation. Expansion had the effect of alleviating pressures placed on resource availability, thereby negating the need to instill cultural restrictions that would inhibit population growth. The Viking Age (AD 800-1200) pursuits of conquest and colonization were dependent on this population growth for their continued success.

A population increase occurred during the relatively mild conditions of the Medieval Warm Epoch (AD 900-1300). Growth is indicated by an increase in agricultural production and an expansion in the habitation of the landscape. Changes in social organization further contributed to conflict within Norse society. This resulted in an imbalance between the needs of the population and the resources available to support it. The colonization and conquest of territory outside Scandinavia was facilitated by the development of the longship. Viking activity restored the imbalance in resource availability by providing access to additional land and wealth. Given the consistent pattern of development reflected by the various data sources presented in this paper it has thus been demonstrated that the Viking Expansion may be interpreted as the product of a complex interrelation between technological innovations, changes in social organization, improvements in climatic conditions, and a growing number of people.

REFERENCES CITED

Aaby, Bent

1976 Cyclic climatic variations in climate over the past 5,500 yr reflected in raised bogs. *Nature* 263:281-284.

Ambrosiani, Bjorn

1985 Specialization and urbanization in the Malaren valley - a question of maturity. In *Society and Trade in the Baltic during the Viking Age.* Sven-Olof Lindquist, ed. Pp. 103-112. *Acta Visbyensia VII.* Uddevalla, Sweden: Bohuslaningens Boktryckeri AB.

1984 Settlement Expansion - Settlement Contraction: A Question of War, Plague, Ecology or Climate? In *Climatic Changes on a Yearly to Millennial Basis.* N.-A. Morner and W. Karlen, eds. Pp. 241-247. Dordrecht, Netherlands: D. Reidel Publishing Company.

1981 Changing Water-levels and Settlement in the Malar District since AD 700. In *Florilegium Florinis Dedicatum.* L.-K. Konigsson and K. Paabo, eds. Pp. 140-143. *Striae,* Vol. 14. Uppsala, Sweden: University of Uppsala, Department of Quaternary Geology.

Bates, Daniel G.

2001 *Human Adaptive Strategies. Ecology, Culture, and Politics.* Second edition. Boston: Allyn and Bacon.

Bjorgo, Tore

1986 Mountain Archaeology. Preliminary Results from Nyset-Steggje. *Norwegian Archaeological Review* 19(2):122-127.

Boserup, Ester

1981 *Population and technological change: a study of long-term trends.* Chicago: University of Chicago Press.

Briffa, K.R., P.D. Jones, T.S. Bartholin, D. Eckstein, F.H. Schweingruber, W. Karlen, and P. Zettterberger

1992 Fennoscandian summers from AD 500: Temperature changes on short and long timescales. *Climate Dynamics* 7:111-119.

Briffa, K.R., T.S. Bartholin, D. Eckstein, P.D. Jones, W. Karlen, F.H. Schweingruber, and P. Zettterberger

1990 A 1,400 - year tree-ring record of summer temperatures in Fennoscandia. *Nature* 346:434-439.

Brogger, A. W. and Haakon Shetelig

1971 *The Viking Ships. Their Ancestry and Evolution.* New York: Twayne Publishers, Inc..

Bryson, Reid A. and Thomas J. Murray

1977 *Climates of Hunger. Mankind and the world's changing weather.* Madison: University of Wisconsin Press.

Crumlin-Pedersen, Ole

1992 Seafaring and Ships. In *From Viking to Crusader. Scandinavia and Europe 800-1200.* E. Roesdahl and D. M. Wilson, eds. Pp. 42-46. New York: Rizzoli International Publications.

1978 The Ships of the Vikings. In *The Vikings.* Thorsten Andersson and Karl Inge Sandred, eds. Pp. 32-41. Stockholm: Almquist & Wiksell International.

Dansgaard, W., S.J. Johnsen, N. Reeh, N. Gundestrup, H.B. Clausen, and C.U. Hammer

1975 Climate changes, Norsemen and modern man. *Nature* 255:24-28.

Fellows-Jensen, Gillian

1984 Viking Settlement in the Northern and Western Isles - The Place-Name Evidence as Seen from Denmark and the Danelaw. In *The Northern and Western Isles in the Viking Age. Survival, Continuity and Change.* Alexander Fenton and Hermann Palsson, eds. Pp. 148-168. Edinburgh: John Donald Publishers Ltd.

Fenger, Ole

1992 Scandinavian society. In *From Viking to Crusader. The Scandinavians and Europe 800-1200.* Else Roesdahl and David M. Wilson, eds. Pp. 120-125. New York: Rizzoli International Publications.

Graham-Campbell, James

1989 *The Viking World.* London: Frances Lincoln Publishers Limited.

1982 Viking Silver Hoards: An Introduction. In *The Vikings.* Robert T. Farrell, ed. Pp. 32-41. London: Phillimore & Co., Ltd..

Hafsten, Ulf

1981 Palaeo-ecological Evidence of a Climatic Shift at the End of the Roman Iron Age. In *Florilegium Florinis Dedicatum.* L.-K. Konigsson and K. Paabo, eds. Pp. 58-61. *Striae*, Vol. 14. Uppsala, Sweden: University of Uppsala, Department of Quaternary Geology.

Hannerberg, D.

1976 Models of medieval and pre-medieval territorial organisation, with a select bibliography. *Journal of Historical Geography* 2(1):21-34.

Hass, H. Christian

1996 Northern Europe climate variations during the late Holocene: evidence from marine Skagerrak. *Palaeogeography, Palaeoclimatology, Palaeoecology* 123:121-145.

Heath, Ian and Angus McBride

1985 *The Vikings.* Osprey Military Elite Series. London: Osprey Publishing Ltd.

Hedeager, Lotte

1992 *Iron Age Societies. From Tribe to State in Northern Europe, 500 BC to AD 700.* Oxford, UK: Blackwell Publishers.

Hygen, Anne-Sophie

1989 Befolkningsvariasjon og ressurspress som arsaksfaktorer i forhistorien. *Viking Bind* 7:128-142.

Ingstad, Anne Stine

1977 *The Discovery of a Norse Settlement in America.* New York: Columbia University Press.

Johansen, Arne

1973 Iron Production as a Factor in the Settlement History of the Mountain Valleys Surrounding Hardangervidda. *Norwegian Archaeological Review* 3:84-101.

Jones, Gwyn

1986 *The Norse Atlantic Saga. Being the Norse Voyages of Discovery and Settlement to Iceland, Greenland, and North America.* Oxford: Oxford University Press.

1968 *A History of the Vikings.* London: Oxford University Press.

Karlen, Wilbjorn, Axel Bodin, Johan Kuylenstierna and Jens-Ove Naslund
1995 Climate of Northern Sweden During the Holocene. In *Holocene Cycles: Climate, Sea Levels, and Sedimentation.* Charles W. Finkl, Jr., ed. Pp. 49-54. *Journal of Coastal Research Special Issue No. 17.* Charlottesville, Virginia: The Coastal Education & Research Foundation.

Lamb, Hubert H.
1984 Climate and History in Northern Europe and Elsewhere. In *Climatic Changes on a Yearly to Millennial Basis.* N.-A. Morner and W. Karlen, eds. Pp. 225-240. Dordrecht, Netherlands: D. Reidel Publishing Company.

1966 *The Changing Climate.* Selected Papers. London: Methuen and Co., Ltd.

1965 The Early Medieval Warm Epoch and Its Sequel. *Palaeogeography, Palaeoclimatology, Palaeoecology* 1:13-37.

Lamm, J.P. and H.-A. Nordstrom, eds.
1983 *Vendel Period Studies.* Museum of National Antiquities (SHM), Stockholm, Studies 2. Stockholm: Statens Historiska Museum.

Lauritzen, Stein-Erik
1996 Calibration of speleotherm stable isotopes against historical records: a Holocene temperature curve for north Norway? In *Climate Change: The Karst Record.* Stein-Erik Lauritzen, ed. Pp. 78-80. *Karst Waters Institute Special Publications 2. Extended abstracts.* Charles Town, WV: Karst Waters Institute.

Lundstrom, Agenta
1982 Vendel and the Vendel Period. In *Museum of National Antiquities (SHM), Stockholm, Studies 2.* Pp. 105-108. Stockholm: Statens Historiska Museum.

Magnusson, Magnus
1979 *Viking. Hammer of the North.* London: Orbis Publishing.

Marx, Karl and Friedrich Engels
1845 Feuerbach: Opposition of the Materialist and Idealist Outlook. In *Anthropological Theory. An Introductory History.* R. Jon McGee and Richard L. Warns, eds. Pp. 53-66. Mountain View, California: Mayfield Publishing Company.

Myhre, Bjorn
1978 Agrarian Development, Settlement History, and Social Organization in Southwest Norway in the Iron Age. In *New Directions in Scandinavian Archaeology*. Kristian Kristiansen and Carsten Paludan-Muller, eds. Pp. 224-271. Odense: Fyens Stiftsbogtrykkeri.

Nesje, A. and M. Kvamme
1991 Holocene glacier and climate variations in western Norway; Evidence for early Holocene glacier demise and multiple Neoglacial events. *Geology* 19:610-912.

Nesje, Atle and Svein Olaf Dahl
1990 Late Holocene glacier fluctuations in Bevringsdalen, Jostedalsbreen region, western Norway (ca 3200-1400 BP). *The Holocene* 1(1):1-7.

Odner, K.
1972 Ethno-historic and ecological settings for economic and social models of an Iron Age society: Valldalen, Norway. In *Models in Archaeology*. David L. Clark, ed. Pp. 623-651. London: Methuen & Co., Ltd..

Roesdahl, Else
1991 *The Vikings*. London: Allen Lane The Penguin Press.

Sawyer, Peter
1992 Resources and settlements. In *From Viking to Crusader. The Scandinavians and Europe 800-1200*. Else Roesdahl and David M. Wilson, eds. Pp. 126-135. New York: Rizzoli International Publications.

Selsing, Lotte, Oddveig Foldoy, Trond Loken, Einar Solheim Pedersen and Erik Wishman
1991 A preliminary history of the Little Ice Age in a mountain area in SW Norway. *Norsk Geologisk Tidsskrift* 71:223-228.

Simmons, Gerald
1974 *The Birth of Europe*. Time Life Books. Time-Life International (Nederland) B.V..

Wallen, Jan-Erik
1996 History of sedentary farming in Angermanland, northern Sweden during the Iron Age and Medieval period based on pollen analytical investigations. *Vegetation History and Archaeobotany* 5(4):301-312.

Welinder, Stig
1975 Prehistoric agriculture in Eastern Middle Sweden. *Acta Archaeologica Lundensia, Series in 8* Minore* N*4.

Widgren, M.
1983 Settlement and farming systems in the Early Iron Age. *Acta Universitatis Stockholmiensis. Studies in Human Geography 3.*