

# Islands and human impact:

Under what circumstances do people put unsustainable demands on island environments? Evidence from the North Atlantic.

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## Abstract

This thesis aims to examine the extent to which, and the circumstances whereby people put unsustainable demands on island environments. Firstly, hypothesis-led research focussed on the islands of Suðuroy and Sandoy in the Faroe Islands and the extent to which people have impacted the Faroese environment or not. Secondly, comparative-led interpretations focussed on the importance of the Faroes within the wider Norse North Atlantic (Iceland and Greenland) and aimed to examine the circumstances whereby people put unsustainable demands on island environments. A landscape-scaled, historical ecology approach incorporating original data from landscape mapping, stratigraphic profile analyses, archaeological survey and semi-structured interviews was developed enabling environmental and anthropogenic data to be assessed at a similar comparative scale. Maps were produced of soil degradation and geomorphic features in the Hov catchment and north Sandoy, 226 archaeological structures on two walk-over archaeological surveys were recorded and mapped, in-depth interviews were made with four Sandoy residents, 86 stratigraphic sections were recorded and a chronological framework was provided by 54 radiocarbon dates. The following interpretations were made from the data;

- Two significant environmental thresholds have influenced development of the mid-late Holocene Faroe Islands landscape. The most significant of these occurred prior to human settlement between c.2900 - 2300 cal yrs BP as a result of deteriorating climate in the North Atlantic. The second is less distinct and occurs as two phases, c.60 - 400 AD and c.400 - 650 AD. Human impacts through the introduction of livestock may have caused environmental changes at these times but there is currently no firm evidence of human occupation in the Faroes prior to the sixth century.
- Human impact in the Faroes has been overshadowed by earlier climatically induced impacts. In the wider landscape out with settlement sites, home fields and the communication network, human impact is limited to localised degradation caused by peat cutting and some grazing impact in the highlands.
- Human impact in the Faroes is in part limited because dynamic elements of the landscape were already established prior to colonisation, because the landscape was open and deforested at the time of settlement and because erosion was limited by the diversification of subsistence strategies, particularly the regulated exploitation of pilot whales, seabirds and fish.

In Iceland, analyses of 98 sediment stratigraphies incorporating 1127 tephras and 769 calendar dates across 10 landholdings were compared with the Faroes data. It is concluded that Iceland may have suffered more severe environmental degradation because its biota and soils were sensitive to human impact and because the Norse subsistence strategy focussed principally on pastoral agriculture. The Greenland Norse, however, shared many similarities with the Faroese Norse in terms of the pre-colonisation open landscape, settlement and population size, and communal exploitation of wild food resources.

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## **Chapter 1**

### **Introduction: Islands and human impacts**

#### **Overall aim and objectives**

The overall aim of this thesis is to examine and understand the extent to which, and the circumstances whereby, people make unsustainable demands on their natural environment, and in doing so to consider why socio-environmental crises may or may not develop. To achieve this, the following research objectives were identified;

1. To develop scale-matching and a focus on common problems as ways of enhancing methodologies for integrated studies of human-environment interactions on islands.
2. To develop the interdisciplinary, scale-matched, focussed approaches through;
  - (i) detailed human-environment research in the Faroe Islands, and
  - (ii) an assessment of site-specific research in the Faroe Islands in the wider context of North Atlantic settlement.

#### **Rationale and overall importance of the research**

Environmental degradation resulting from the actions of people is a contemporary issue of global importance and is reflected by increased erosion, desertification, deforestation and species extinction. The outcomes of environmental degradation primarily resulting from short-term impacts may include the decline or extinction of species, a decline in living standards/quality of life, and conflict; however, consequences of longer-term environmental degradation may be that the environment is no longer able to sustain human populations. For example, there are incidences in the past where environmental degradation has caused cultural stress and may have influenced the collapse of societies on different scales from isolated islands, e.g. Easter Island, to complex regional organisations, e.g. the Mayans (Diamond 2005). This thesis is concerned both with the identification of past incidences of environmental change and degradation, and also with the identification of instances where environmental degradation has not been a significant issue. In this case, questioning why human impact is limited is as significant as examining why human impact elsewhere has been acute. The research also aims to examine the form that environmental impact takes, the extent of impact and an understanding of the reasons behind anthropogenically caused environmental degradation, including the conscious or sub-conscious circumstances under which people impact their environment.

One of the most critical issues in historical human-environment research is the extent to which on the one hand climate change has significantly affected the natural environment, or on the other hand, the extent to which people themselves undermine their long-term survival through irrevocable environmental damage. Current historical research emphasises the role of large scale environmental degradation in social collapse (Diamond 2005, Morisson 2006).

The conclusion of the majority of palaeoenvironmental research on Pacific islands is that people have been prominent in radically transforming island environments through species extinction, deforestation, erosion and soil depletion. In the North Atlantic, anthropogenic impact has caused a significant reduction in vegetation cover, destabilisation of slopes and an increase in erosion in Iceland (e.g. Arnalds 1987; 2000, Simpson *et al* 2001, Hallsdóttir 1987), which has been described as “a doomsday scenario for the rest of the world”. Anthropogenically induced environmental impact has also been implicated as a factor in the collapse of Norse Greenland in the 15<sup>th</sup> century (Fredskild 1978, Jakobsen 1991, Sandgren and Fredskild 1991). In the Faroe Islands, however, research regarding the impact of colonisation and long-term settlement on the landscape and environment has been limited (e.g. Hannon *et al* 1998; 2001; 2005, Hannon and Bradshaw 2000, Edwards *et al* 2005a, Lawson *et al* 2005). The relatively small area available for intensive infield agriculture, the steep slopes, the high relative relief of the outfields, and the overall geographical marginality of the islands, might suggest a high degree of landscape sensitivity to anthropogenic impact, but it is not known how impacts on the Faroes compare with impacts elsewhere in Norse North Atlantic, i.e. Iceland and Greenland.

Although the extent of impact can be questioned, the leading hypothesis, therefore, is that human impact has significantly contributed to environmental and cultural stress on islands. Important points not often considered are *why* people made these unsustainable demands on their environment when the outcomes have been obviously (or perhaps not so obviously to those concerned) devastating.

### **The importance of an interconnected human-environment approach**

Attempts to understand the outcomes of factors leading to environmental or cultural collapse have often resulted in the inference of single, causal mechanisms of change. For example, the adage “it got cold and they died” with relation to the fate of the Greenland Norse implies a direct causal relationship between the onset of the “Little Ice Age” cold phases and the disappearance of the Norse Greenlanders. This is an overly deterministic example, but many other less deterministic although mono-causal, explanations have been suggested in relation to incidences of cultural stress or settlement abandonment. Single-factor explanations, whether deterministic or not, are overly simplistic, yet research frameworks are often

established in a way that directs the focus of research on the causal factors, while neglecting to examine how those factors are interrelated. This research aims to examine the impacts of people on the environment and impacts of environmental change on people through recognition and exploration of these various and interconnected complexities.

### **The importance of a historical perspective**

A major (if not the major) current environmental issue is global climate change. There is pressing evidence it exists and that the primary cause is atmospheric impacts caused by industrial activity (IPCC 2007). Yet significant human impact is not confined to the industrialisation of the last 300 years; while the scale of current global issues might seem to overshadow the impacts of indigenous/pre-industrial people on the terrestrial system, many parts of the world have been significantly transformed by long histories of human activity, occasionally resulting in environmental devastation and in some cases cultural collapse. Therefore, in evaluating current human impact, historical perspectives are key, as they enable us to consider not only long term trajectories of change and the causes of human actions, but crucially the consequences and outcomes of those human choices and actions. The extent to which a society approached or crossed critical environmental or cultural thresholds, and the significance of these thresholds (i.e. where a recovery was no longer possible), can therefore be assessed.

### **The importance of an island focus**

There are specific characteristics of many islands, for example, their size, isolation, ecology and the late timing of colonisation by people, that make them exemplary field sites for research into human-environment interactions. Island environments are particularly sensitive to human impact because their generally smaller size means resources are limited, scarce or finite, resulting in increased pressure on those resources. Their often isolated location reduces the options or buffers available to the islanders in times of crisis. For example, in historical island societies it was not always possible to import additional resources in order to alleviate pressure on the islands' existing resources. The late settlement of many islands has meant that island biota has evolved over long periods of time without the influence of people and this makes that biota all the more vulnerable to anthropogenic disturbance when people finally do arrive. Initial rapid human population growth, and the growth of animal introductions, also presents an additional pressure on both the vulnerable biota and on limited resources.

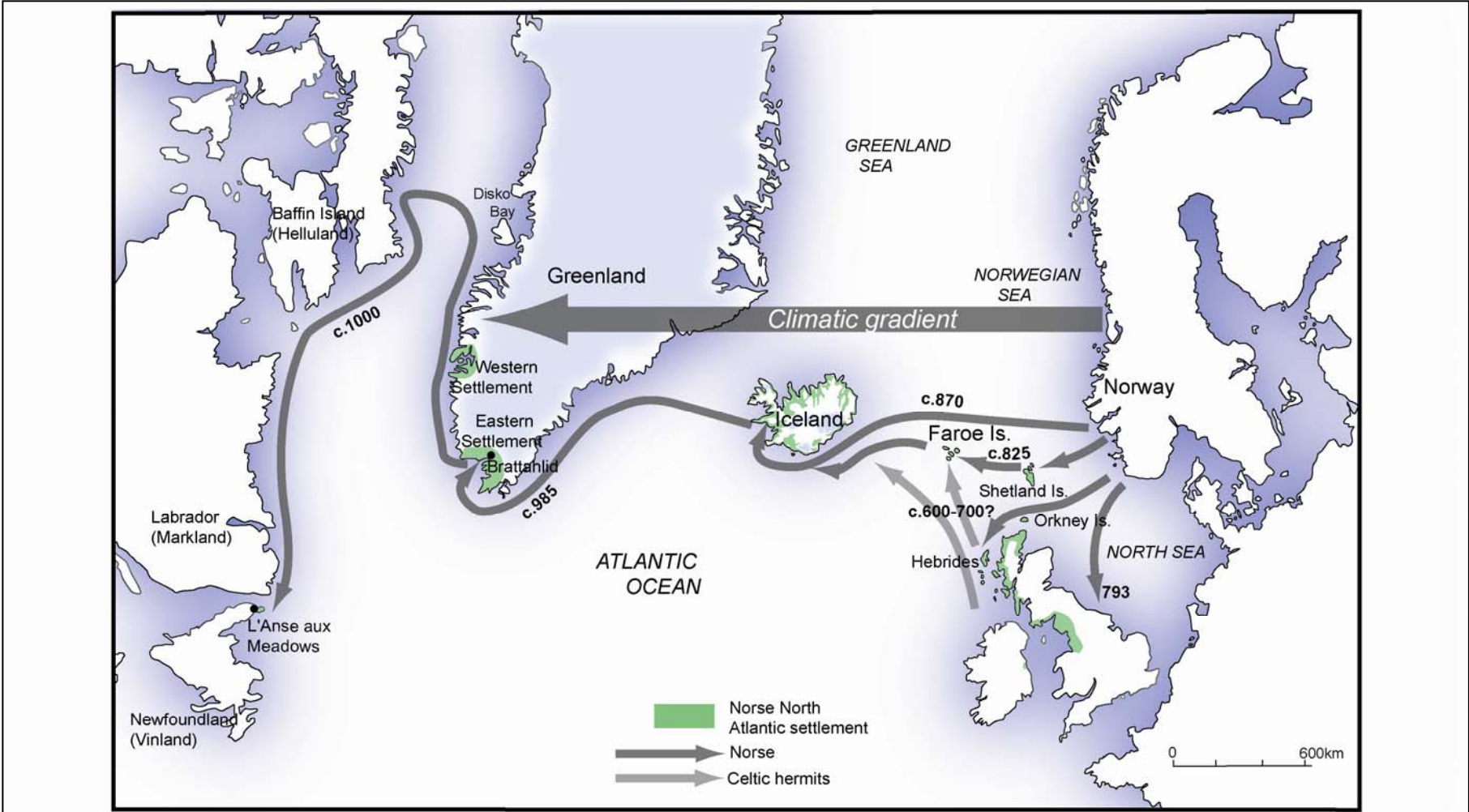
These very same characteristics are what make such islands exemplary locations for researching past human-environment interactions. For example, the relatively recent

colonisation of many islands has created a clear pre-people environmental baseline from which to investigate initial impacts on a previously “pristine” natural environment. Socio-political diversity is also reduced in these island locations by account of their isolation, which allows interconnections between environmental and socio-political change to be more closely examined and increases the visibility of impacts observed in environmental records. Feedbacks, responses to change and thresholds can be investigated at a more manageable level than on continental or landlocked societies where defining geographical, ecological, historic and social boundaries becomes problematic. Furthermore, the islands of the North Atlantic are located at a crucial climatic boundary at the convergence of warm Atlantic and cold Arctic air masses and currents, which render the environments of the North Atlantic islands particularly sensitive to climate changes. The influence of these climatic mechanisms, as well as having a more discernable impact on the people who live there, also contribute to the clearer identification of climatic impacts in the environmental record of the terrestrial landscape, and allow the interactions between people and climate to be investigated.

### **Scales of research**

In investigating the question of under what circumstances people put unsustainable demands on island environments, this research will assess the interconnections between landscape change and human settlement in the Faroe Islands prior to and after Norse colonisation, historically dated to the early 9<sup>th</sup> century (Arge 1991). In considering the Norse colonisation in its wider context, the research embraces a temporal scale covering pre-settlement from around the mid Holocene (c.5 ka BP), through to the pre-16<sup>th</sup> century. The specified temporal scale enables an examination of the pre-human environmental trajectory of the islands, while allowing the subsequent processes of colonisation, initial adaptation and longer-term settlement (i.e. the degree of sustainability) to be considered.

The spatial scale envelops not only the Faroe Islands, but also incorporates the other North Atlantic islands colonised by the Norse; Iceland and Greenland (Figure 1.1). This spatial extent covers a wide environmental and climatic range, from the temperate oceanic climate and associated ecology of the eastern North Atlantic, to the Arctic climate and ecology of Greenland in the west. Geologically, this range incorporates one of the youngest countries on earth (Iceland) and one of the oldest (Greenland). Each North Atlantic island would, therefore, have presented a unique environmental challenge to the settlers. This may have been the lack of trees and limited cultivable land in the Faroes, the impacts of volcanic eruptions and the sensitivity of the fine-grained aeolian soil in Iceland or the problems posed by the Arctic climate, where animal husbandry was at its limits in Greenland. Yet the settlers



**Figure 1.1:** The scale and timing of settlement by the Norse in the North Atlantic. The climatic gradient from east to west refers to the change to a more Arctic climate between the Faroe Islands and Greenland where the Norse pastoral farming economy was at its viable limit.

who colonised these islands brought with them a familiar “cultural capital” and similar pre-conceived ideals of pastoral farming that had been passed down through the experiences of generations and had been developed to suit the environment of their Norwegian homelands. The challenge to the Norse when colonising the North Atlantic islands was, therefore, to adapt in turn to these new environments, while maintaining their traditional Norwegian based pastoral economy, which formed the foundation of their experience. In terms of assessing the circumstances under which the Norse might have made unsustainable demands on these North Atlantic environments, it will be questioned to what extent the Norse attempted to play out their Norwegian-based pastoral farming model in the newly colonised North Atlantic islands and to what extent they were successful.

The North Atlantic islands are therefore ideal to test interactions of the human-environment system. Considered together, they permit a comparison of colonisation, adaptation and longer-term settlement undertaken by comparatively well-known populations, in contrasting environments, across a climatic gradient with contrasting climate change. Ideas of adaptation and utilisation of resources can effectively be tested by studying how the landscape of these islands has changed through space and time. The landscape will be explored at a variety of spatial scales; of individual stratigraphic profiles, transects, across catchments and comparisons between islands. This is why the issue of scale-matching at appropriate steps of the research is of fundamental importance. Although impossible to test directly, the role of cultural explanation, such as how the goals and aspirations of the settlers are connected to the evidence of impact illustrated by the landscape record, is also crucial, and will be considered in the thesis discussion.

### **Thesis structure and summary of research approach**

The thesis structure is outlined by Figure 1.2. There are very few scenarios where the interactions between environment and people are simple enough to be regarded as evidence of linear causality. Such relationships are inevitably more complex and therefore a variety of methodologies that aim to tackle this complexity is desired, and scale-matching at different stages is key. To encompass such a range, a combination of methodologies has been applied. The aim is to link environmental data based on mapping of geomorphology and stratigraphic sediment analyses with cultural data based on archaeological survey and participant interviews. Each of these single methodologies alone yields interesting and informative data, but the real challenge is to begin to incorporate the data and results of multiple approaches, in order to offer a new perspective on the settlement and environment of the North Atlantic. This research develops a historical ecology and multidisciplinary approach that recognises the complex and non-deterministic nature of the relationship

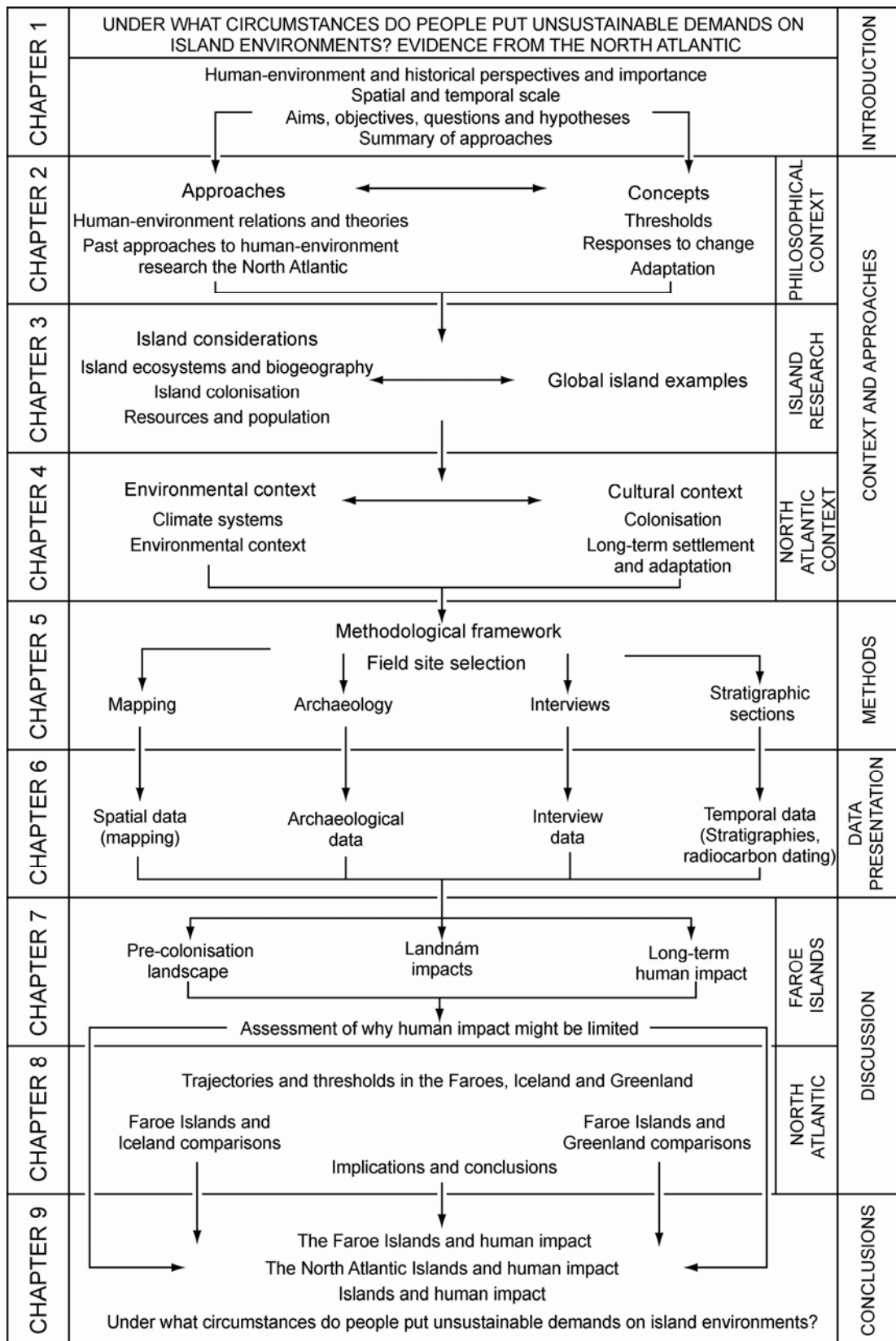


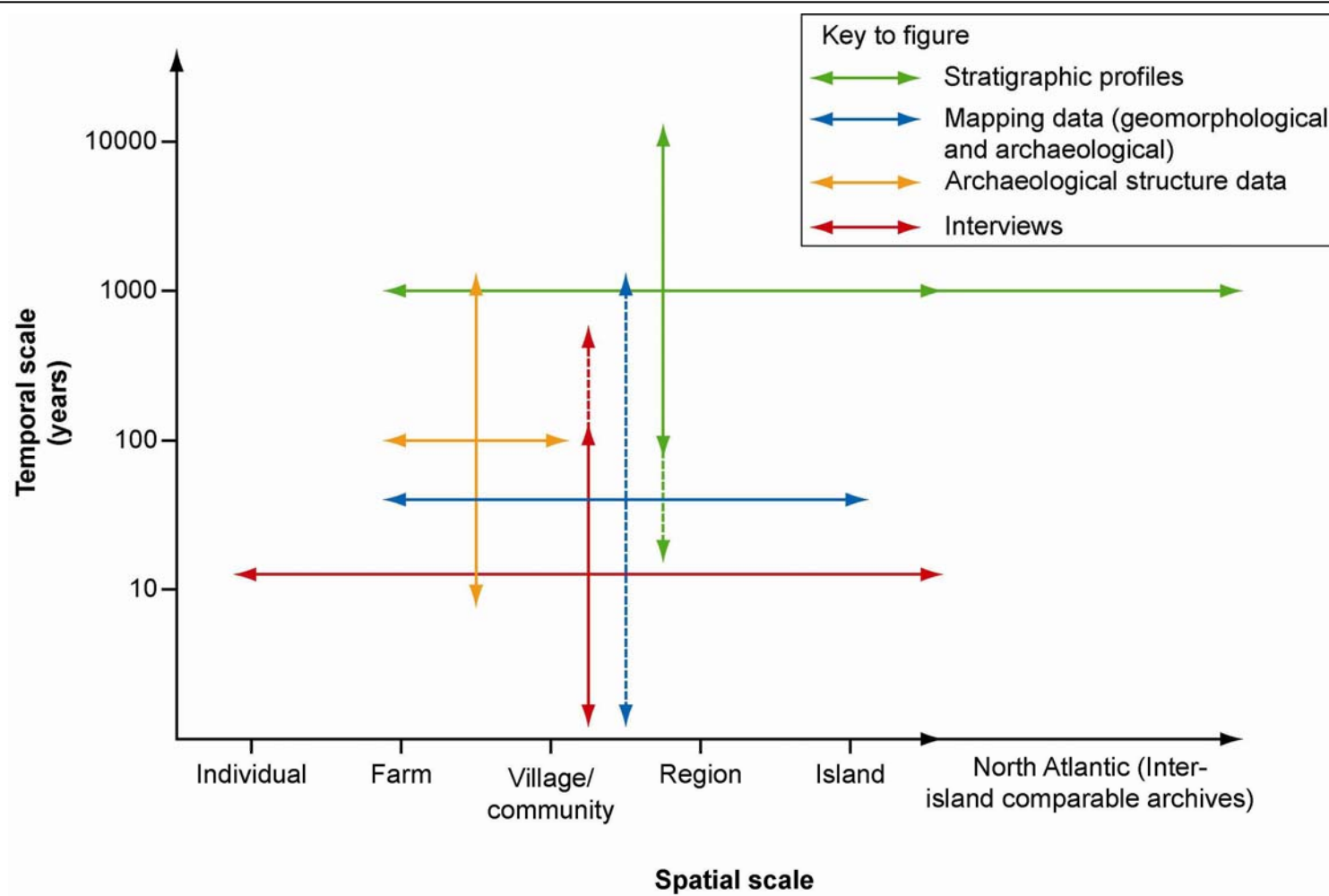
Figure 1.2: Thesis structure

between people and their environment, and seeks to link humans and the environment through the manifestations of both in the landscape (Crumley 1994). This approach is emphasised through the collection of data with overlapping temporal frameworks, and from spatial contexts that encompass a range of scales (Figure 1.3). The multi-scale approach initially focussed on the Faroe Islands as a principle source of original data. The assessment of fundamental issues then required a switch of scales to an assessment of the original Faroe Island case studies in the context of the wider North Atlantic area, and in comparison with island colonisations elsewhere.

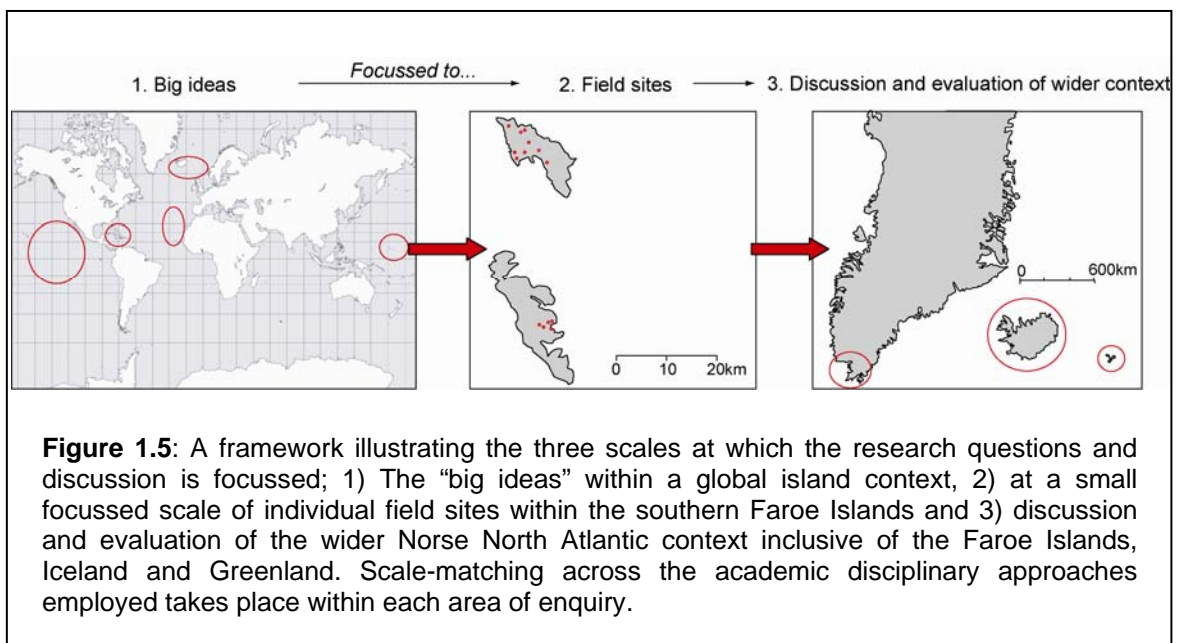
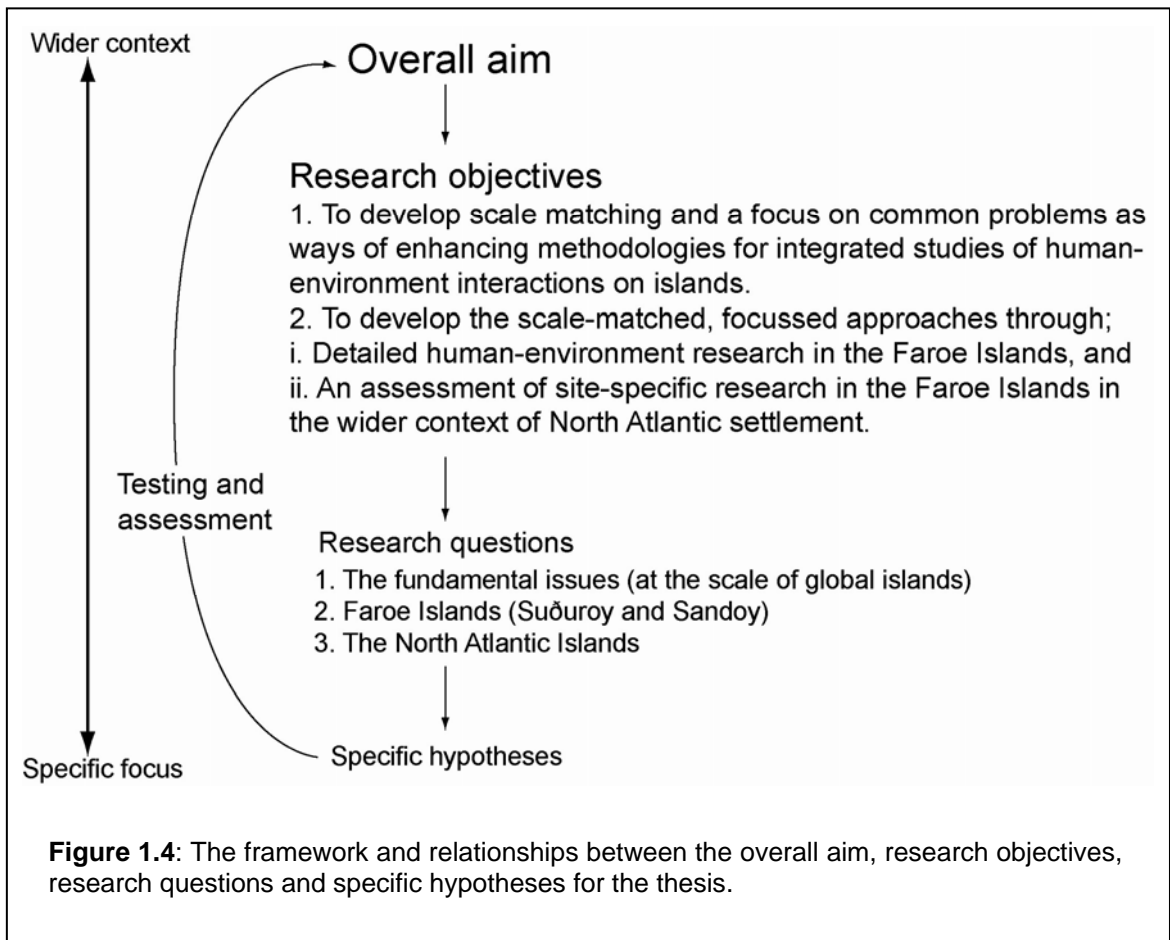
### **Specific research questions and hypotheses**

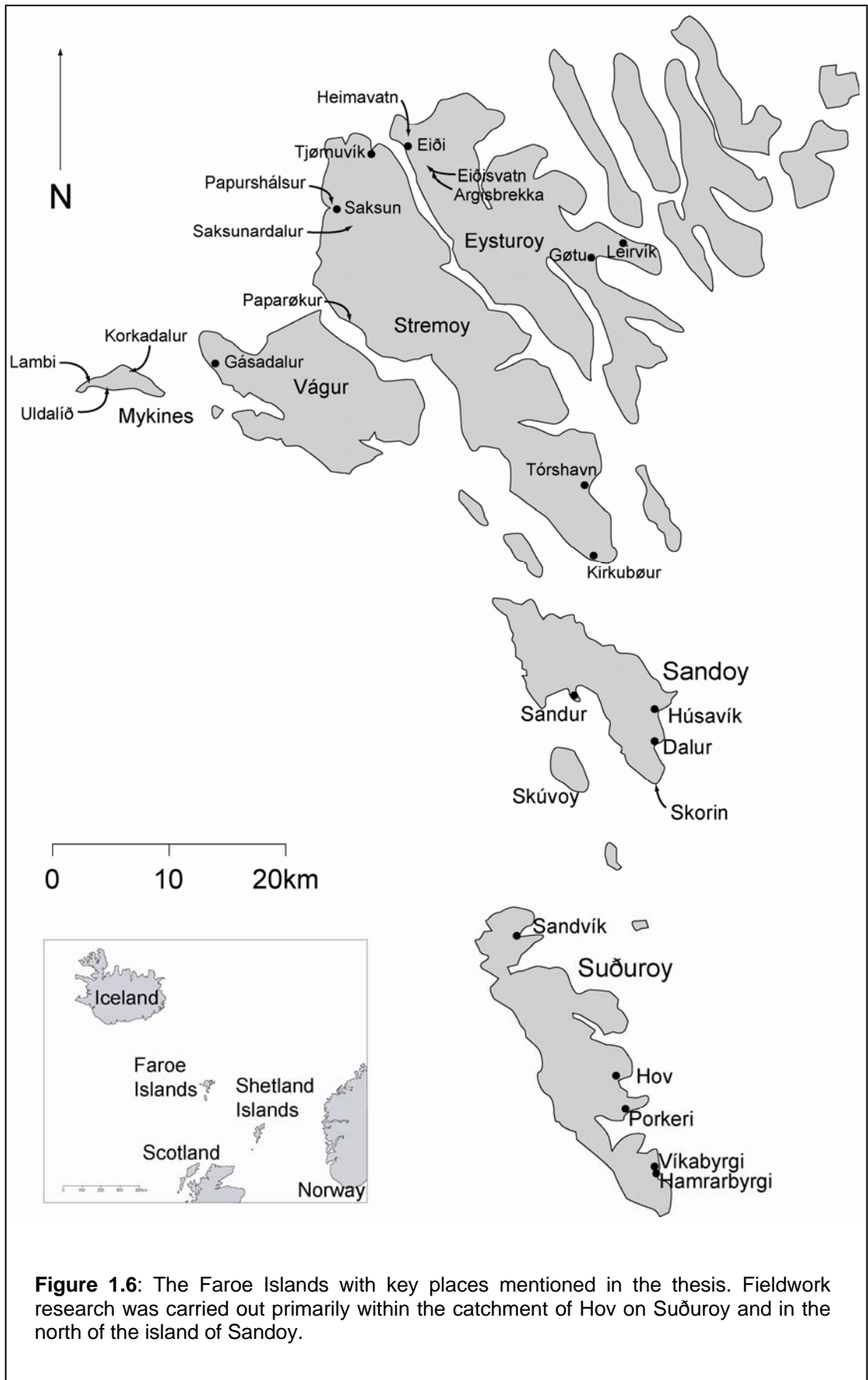
Figure 1.4 outlines the framework and relationships between the overall aim, the thesis objectives, research questions and the specific hypotheses. The overall aim is approached through the thesis objectives that focus on the wider philosophical and methodological context of the research, through research questions that focus more explicitly on particular themes, and by research hypotheses that focus on the site-specific aspects of the research. These are outlined in more detail below.

The overall aim requires investigation at a range of scales that are explored within the framework of research questions below (Figure 1.5). The development of the initial research agenda is focussed towards a global context of island research and targets wider issues of island systems, colonisation, human impact on the environment and adaptation to new environments. In order to form testable hypotheses with which to resolve these fundamental issues, a framework of research questions was developed at a detailed and appropriate scale, focussed on specific catchments in the southern Faroese islands of Suðuroy and Sandoy whose location is illustrated by Figure 1.6. In order to target the wider issues encompassed by the specific and detailed data, and to understand the extent to which these results were applicable only to specific field sites or whether the results could be applied within a more generalised perspective, it was necessary to relate the results from specific catchments in the Faroe Islands back to the wider context. This is achieved through a comparison of the outcomes of human settlement on the Faroe Islands with that of other North Atlantic islands settled by the Norse, specifically Iceland and Greenland.



**Figure 1.3:** Range of temporal and spatial scales provided by a historical ecology approach and methods of data collection used in the thesis.





**Figure 1.6:** The Faroe Islands with key places mentioned in the thesis. Fieldwork research was carried out primarily within the catchment of Hov on Suðuroy and in the north of the island of Sandoy.

Specific research questions applicable to the “fundamental issues” (at the scale of global islands)

1. **What causes “threshold crossing events” to occur in island environments?**
2. **Is it the degree and extent of human impact or the inherent sensitivity of an island environment that matters more in terms of environmental change and cultural collapse?**
3. **At what scales can we understand human-environment interactions on islands?**

Site-specific research questions applicable to the Faroe Islands

1. **Have natural or human impacts been the major driver of landscape development over the last 5 ka in the southern Faroe Islands?**
2. **To what extent did people have an impact on the environment of the southern Faroe Islands and how did those impacts change through time and space?**
3. **Were unsustainable demands made on the Faroe Islands environment?**

Research questions applicable to the wider context (at the scale of the North Atlantic islands)

1. **To what extent are outcomes in terms of environmental degradation and resource exploitation between the Faroe Islands and Iceland similar and why?**
2. **To what extent are outcomes in terms of environmental degradation and resource exploitation between the Faroe Islands and Greenland similar and why?**
3. **Why does impact between the North Atlantic islands vary?**
4. **Are the consequences of human actions taken on the Faroes applicable to understanding human-environment interactions in Iceland, Greenland or even more distant islands?**

Hypotheses

In order to respond to these questions, six principal hypotheses were developed to be tested in the Faroe Islands. These hypotheses are outlined in detail in Table 1.1 and are also examined in relevant sections in Chapters 7 and 8.

### **Chapter summary**

In this chapter, the aims, objectives, research questions and hypotheses that have directed the thesis have been presented and the main structure of the thesis has been outlined. Some of the major themes regarding human-environment research, which form a backdrop to the thesis, have also been introduced.

The following chapter expands on some of these themes with an introduction to some of the principle concepts of human-environment research and a discussion of how theories of human-environment research have developed over time.

<b>Hypotheses</b>	<b>Alternative hypotheses</b>
<b>1. Mid-late Holocene environmental trajectory</b>	
<i>The major landscape threshold in the Faroese Holocene environment was crossed at the time of settlement, i.e. Settlement and subsequent human impacts have been the major determinants of the present day surface landscape.</i>	A significant threshold was crossed some time prior to <i>landnám</i> and hence major landscape change was initiated by an external perturbation not related to people, i.e. Natural impacts have been the major determinants of the present day surface landscape.
<b>2. Formation of top silt</b>	
<i>Deposition of gravels and high-altitude silts is triggered by a single geomorphic event, whereby the silt has to be eroded first from mountaintops/ plateaux followed by the underlying gravel.</i>	The influx of gravel and later silt are the result of two separate processes, the first, whereby peat is eroded, exposing underlying gravels which are washed down slope, the second, resulting in the erosion of silts.
<b>3. The impact of landnám</b>	
<i>The settlement of the Faroe Islands by the Norse around A.D. 800 caused significant landscape changes including a reduction in vegetation cover, destabilisation of slopes and an increase in erosion.</i>	Settlement of the Faroe islands has not caused significant changes to the landscape.
<b>4. Relationship between archaeological structure density and landscape degradation</b>	
<i>Areas with a distinctly high density of archaeological features correspond with areas of higher landscape degradation.</i>	Areas with a distinctly high density of archaeological features do not correspond with areas of higher landscape degradation.
<b>5. Development of human impact over time</b>	
<i>Human impacts diminish through time as people adapt their subsistence practices to the specific landscape, geographical and climate conditions.</i>	Human impact increases through time because people continue to carry out activities that may be environmentally unsustainable over millennial scales or because natural factors, such as climate, exemplify human impacts unless subsistence strategies are amended.
<b>6. Adaptation to the environment</b>	
<i>There is evidence that the settlers did not always adapt to their environment, which resulted in long-term environmental instability and a reduction in natural resources.</i>	There is evidence that the settlers made adaptations to their environment which prevented long-term environmental instability and a reduction in natural resources.

**Table 1.1:** Specific hypotheses tested at field sites in the Faroe Islands.

## Chapter 2

### Approaches to, and concepts of, human-environment research

#### Introduction

In order to develop a suitable approach and methodology to the current research, the history of human-environment research, and the theoretical context to the scientific research, needs to be understood. This chapter is in two parts, beginning with an exploration of the philosophical context of how people interact with their environment and examining how theories regarding interactions between people and the environment have developed over the last century. Part one concludes with how recent theories can be applied to human-environment research on islands, specifically those in the North Atlantic. Part two considers some of the concepts that relate to current human-environment research, which acts as a foundation for a more specific discussion of these concepts in relation to events in the North Atlantic that will be discussed later in the thesis.

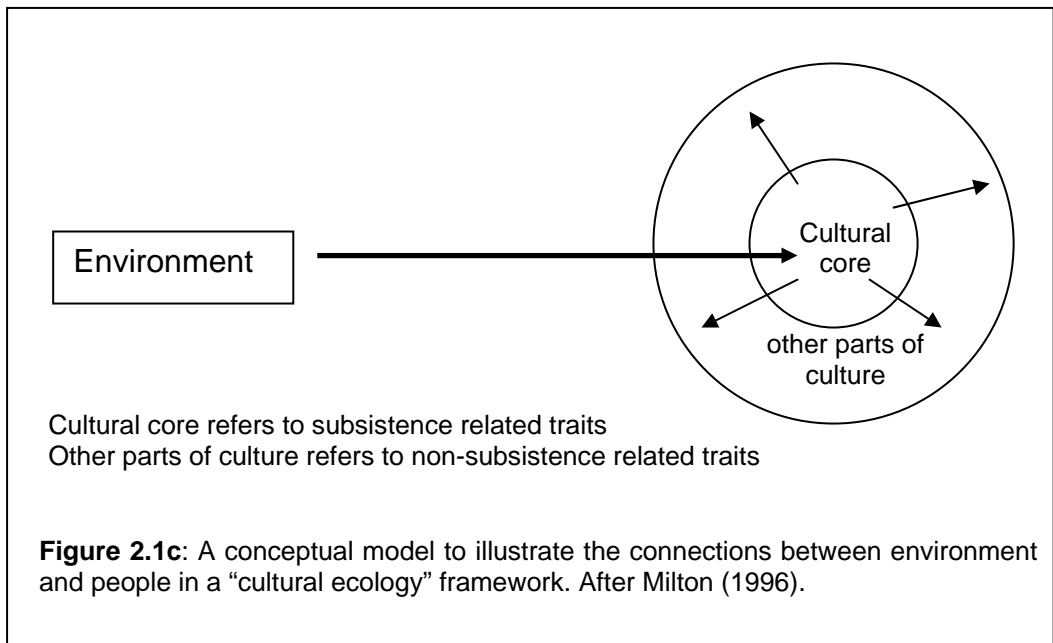
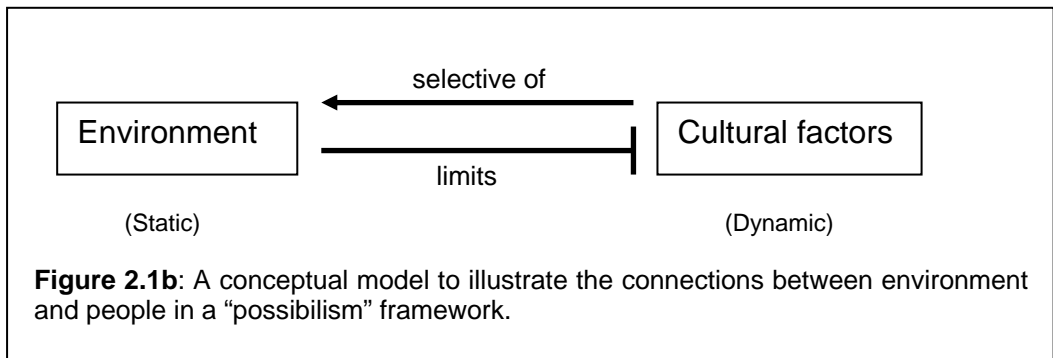
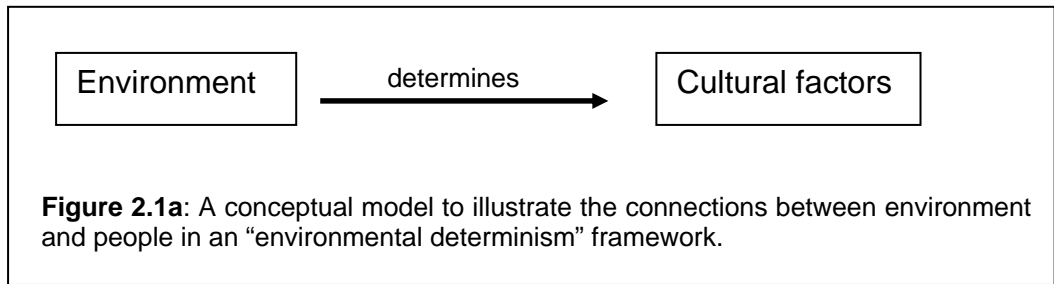
#### 2.1 Approaches to human-environment research

##### Human-environment relations and theories

The study of the relationship between people and environment has a long history, but continues to be of interest, and has perhaps grown in importance, both in terms of philosophical assumptions and practical applications. A recurrent theme in palaeoenvironmental studies has been to establish the relative importance of human and natural factors in instigating particular environmental changes. Prior to the 1950s, major intellectual currents concentrated on human-environment theories that emphasised the determining effect of nature upon human society and culture, with nature regarded as a limiting factor to human possibilities. The common feature of the early theories is that they conceptualised human-environment relations as mainly one-directional, stage-orientated explanations (Moran 1982). In response to this approach, theories of cultural ecology emerged in the 1950s, which although inadequate to explain some aspects of the human-environment relationship, introduced the concept of an integrated system within which cultural and environmental factors interact.

##### *The effect of nature on society and culture: environmental determinism*

A simple model of the relationship between nature and society, or environment and people, is that of environmental determinism (Figure 2.1a), which gave a focus to geographical study



by introducing a task and method of uniting the human and the physical for the first time. Determinism as a broad term refers to explanations that assign a single factor a dominating influence over a whole system. Environmental determinism more specifically, asserts that the natural environment dictates the course of culture. In this model, human society is restricted to a range of outcomes or even a single possible outcome by a particular set of environmental parameters.

Emerging as a concept in the 19<sup>th</sup> century, environmental determinism was stimulated by Darwin's work on the impact of natural conditions on the evolution of organisms, and as a theory it flourished in popularity among geographic scholars between 1870 and 1940. Environmental determinism was used among early academic geographers such as Carl Ritter (1779-1859), Ellsworth Huntington (1876-1947) and Ellen Churchill Semple (1863-1932) to explain social variation within different geographical locations, alleging that individual and natural character, culture, health, religion, economic practices and social life are all derived from environmental influences. For example, Ellen Churchill Semple (Churchill Semple 1911) claimed that the cultural difference between people living in high and low latitudes resulted from environmental and climatic factors. Huntington shared the belief that the physical environment influenced the location and level of civilisation, suggesting that cool temperatures and variable weather promote the most advanced civilisations (Huntington 1915; 1945). These assertions are denounced not only as insensitive to cultural differences, but are also criticised because the relationships proposed by the environmental determinists were grounded in speculation rather than demonstrable fact. The early environmental determinists provided numerous case studies to prove their hypotheses but ignored evidence that was contrary to their case and could prove their theory wrong (McGregor 2004). Environmental determinism is therefore a good representation of how early geographers searched for causal mechanisms using selective sampling, archival data and inductive reasoning.

*Nature as a limiting factor to human possibility: Malthus and Darwin*

In the late eighteenth century, one of the most significant efforts to demonstrate the limitations of the earth for supporting humans was made by Thomas Robert Malthus (1766-1834). In his *Essay on Population* (1798), Malthus examined the increase of population growth deducing that while populations grow exponentially, resources grow only geometrically. Malthus concluded that the population growth rate would outstrip the capacity of land to provide food. As human populations depleted their resources to catastrophic levels, competition for survival would become inevitable, with disease, war, famine and other forms of population control arising to reduce the pressure on resources. Although considered deterministic, Malthus' ideas are still debated in terms of both historic and modern events, for

example, in reference to the collapse of Easter Island (Decker and Reuveny 2005, Brander and Taylor 1998) and the Rwandan genocide (Diamond 2005).

It was Malthus' theory of nature as a limiting factor that helped to form the ecological basis for Darwin's theory of natural selection. In *The Origin of Species* (1859), Charles Darwin (1809-1882) proposed an ecological theory to explain the mechanisms by which species develop and diversify. Darwin assumed that all living things are related, and that the diversity of species results from a continual branching out, which is a product of natural selection. However, in each generation, a natural limit on resources means that more individuals are produced than can survive and therefore competition between individuals arises. Natural selection refers to the survival and reproduction of the most well adapted organisms to a particular environment at the expense of organisms with less favourable characteristics. Darwin asserted that the environmental context determined whether or not a characteristic or variation is beneficial. Geographers and anthropologists developed Darwin's idea, emphasising the impact of natural conditions on the evolution of organisms as a deterministic explanation for the patterns and processes of human civilisation and culture.

*The effect of cultural history on society and culture: Possibilism*

Despite the failings of environmental determinism, the emergence of the concept led to further questioning regarding how the environment affects culture and its development. In response to the strong claims of environmental determinism, Franz Boas (1858-1942) presented an alternative view of environmental limitations, termed historical possibilism, which claims that although nature may circumscribe the possibilities for humans, historical and cultural factors explain what possibility is actually chosen. Boas rejected the environment as a determinant of culture and instead sought an explanation for cultural differences in the particular cultural history of a society. He suggested that the availability of a resource does not predispose a population to use it in a particular manner and concluded that cultural decisions, rather than nature itself, dictates the direction of cultural change (Figure 2.1b). In other words, Boas and others interpreted culture as being environmentally selective (Bennett 1976).

Historical possibilism endeavoured to correct the failings of environmental determinism, but in doing so introduced a strong culture-centeredness with the environment represented as limiting rather than dynamic. Through the assertion that environmental factors do nothing but limit the possible range of socio-cultural variation, possibilism can be considered a form of cultural determinism, and has suffered from the same criticisms applied to environmental determinism. Both concepts over-simplify the human-environmental relationship and lack the potential to account for cultural diversity in any but the most superficial sense. Environmental

determinism and possibilism can establish general principles “applicable to any cultural-environmental situation”, but can say nothing about “the origins of particular cultural features and patterns which characterise different areas” (Steward 1955: 36).

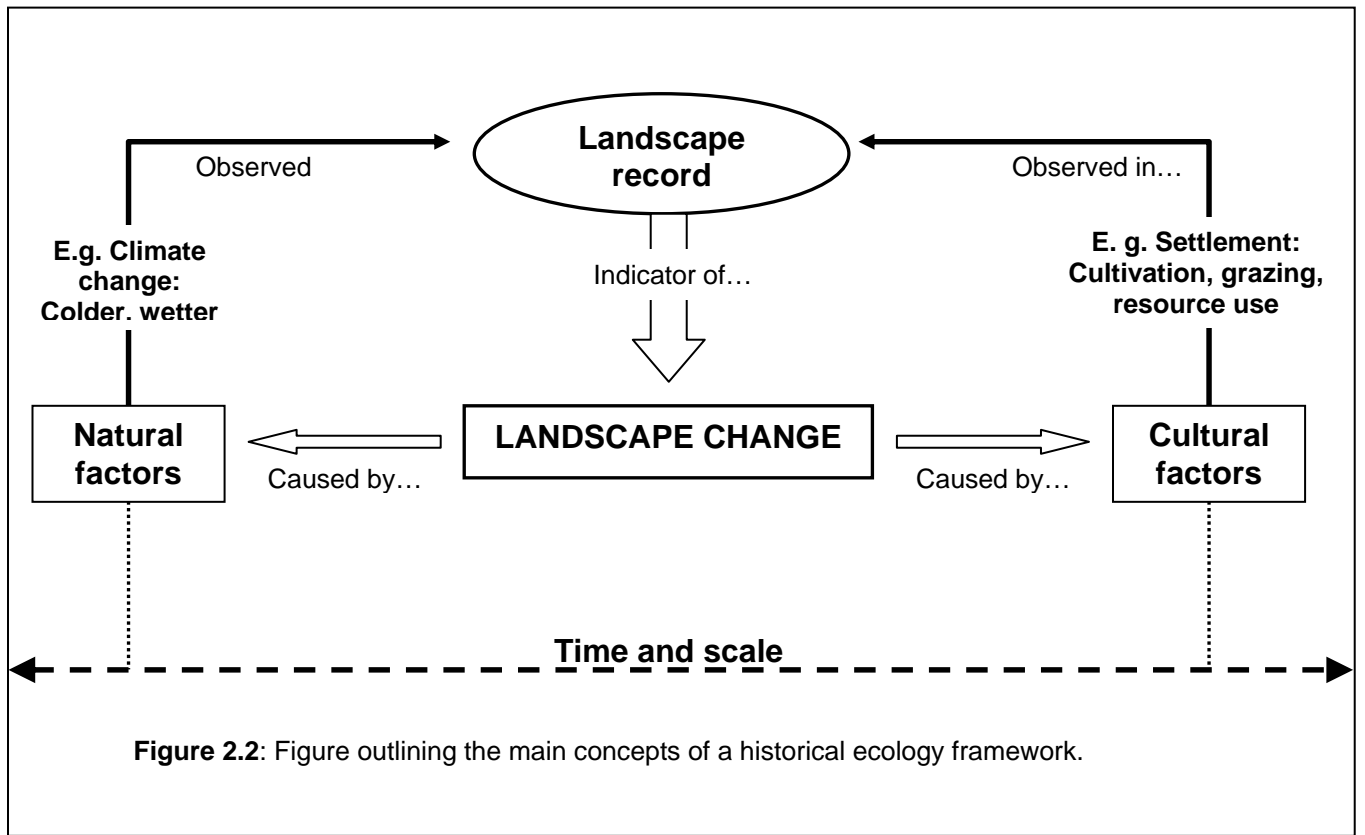
### *Cultural ecology*

In the post-war years, geographers abandoned any concerted attempt at nature-society explanations and most of them realigned with either the study of natural systems or human systems. At this time, anthropologists who were dissatisfied with the rigid theories of cultural change embodied by environmental determinism, yet recognised that local environment influences cultural features, developed a new methodology. Cultural ecology was defined by its proponent, the American anthropologist Julian Steward, as “the study of processes by which a society adapts to its environment” (Steward 1968). The development of cultural ecology represents a significant innovation in the way the relationship between culture and the environment was conceptualised; while environmental determinism and historical possibilism treated environment and culture as separate entities which affect each other externally, cultural ecology introduced the concept of an integrated system within which cultural and environmental factors interact (Milton 1996) (Figure 2.1c).

Despite this obvious advance in terms of understanding human-environment relations, several aspects of cultural ecology have been criticized. Although Steward denounced the environment determinist model for being too general and offering no understanding of how specific cultures related to their local environments, Steward’s own cultural ecology model merely reproduced environmental determinism albeit at a more precise level (Milton 1996). Steward acknowledged that cultural-historical factors, such as population regulation, health and politics may determine some cultural traits, but these factors were often overlooked (Milton 1996). Despite the emphasis of cultural ecology on a more interactive relationship between people and their environment, the process of linear causality retained its dominance.

### *Historical ecology and temporal and spatial perspectives*

Later theories of human-environment interactions emphasise the existence of feedback loops as opposed to linear causality (Figure 2.2). Historical ecology utilises the notion of ecology as an attempt to understand the reciprocal relationship between people and environment and draws its understanding of these relationships from their mutual influence over time. A historical perspective not only increases our understanding of the dynamic nature of landscapes, but provides a frame of reference within which to assess modern patterns and processes, as past events and processes have constrained the range of



**Figure 2.2:** Figure outlining the main concepts of a historical ecology framework.

options open to events and processes today (Dincauze 2000). Historical time series can be assembled from multiple histories and locations whose records provide a richer body of data than documentary records that only cover short periods, or fragments of short periods, and are only available for certain places or periods of interest.

The approach of historical ecology is to produce a time series collated from evidence in the form of the physical landscape and geomorphological changes, which reflect the integration of a range of human and climate phenomena aggregated up to the moment at which the landscape is observed (Crumley 1994; 2000). Historical ecology maintains that landscapes can be understood historically as well as ecologically, with the landscape an artefact of human activity that can be used to understand the development of culture over time. Historical ecology therefore enables and supports interdisciplinary research by encouraging the integration of diverse types of evidence, and because the notion of landscape as an artefact provides a spatial unit readily comprehensible to the methods of most disciplines.

A flexible understanding of timescales is important in a historical ecology approach, particularly the concept of a “baseline” which enables the reconstruction of the natural trajectory of change prior to human influence. Temporal scale is important, because studies of human-environment interaction need to be conducted over times scales sufficiently long enough to have encompassed discrete episodes of climate change, and to have allowed trajectories of cultural trends to be established, which will vary from place to place. At the same time, such studies demand a framework of high temporal resolution, in order that the dynamic effects of both human activity and environmental change can be examined at equivalent temporal and spatial scales. High temporal resolution timescales are also crucial in order to separate events that may have occurred coincidentally and independently from those which can be said to be causally determined. The existence of a correlation between events does not itself prove a causal connection.

#### *A comparative approach*

In historical research, some islands provide a close analogue for scientific experiments where comparison can be facilitated by some factors, either environmental or cultural, being kept constant. Comparison therefore reveals both similarities and differences and exposes the patterns that are masked by outward variation. Comparative approaches have been used recently in the study of variability and outcomes on islands in the Pacific (Rolett and Diamond 2004, Kirch 2000).

Significant investigations have taken place into the archaeology, history and palaeoecology of the Faroes, Iceland and Greenland. However, additional conclusions can be drawn from

comparison between these islands that could not have been drawn from study of an island in isolation. A comparative approach is possible at this scale in the North Atlantic because the islands and landmasses were colonised by relatively well known populations originating from, or dominated by, Scandinavians with a comparatively well known “cultural capital”. Although Greenland had an indigenous population when the Norse arrived, Greenland Norse subsistence practices evolved from a Norwegian-based “cultural capital”, similar to that introduced to the Faroes and Iceland and is therefore comparable. The islands are therefore similar with respect to many (but not all) cultural variables, but differ with respect to other variables of interest, including environmental and climate marginality, topography and degree of isolation, which allows a comparative approach to be attempted.

### **Approaches to human-environment research in the North Atlantic**

Prior to the 1970s, most researchers of the Norse in the North Atlantic were philologists, medieval archaeologists and documentary historians and discussion tended to be dominated by an uneven written record and diverse Saga literature (Friðriksson 1994). For example, in archaeology, ancient monuments were often linked to specific settlers or those mentioned in the Sagas or historical sources. The Sagas pointed to relics that lay in the landscape, and in return, excavation and survey were used to verify the Sagas. Research emphasis has, therefore, been placed on settlements or farms mentioned in the Sagas, resulting in a skewed view. Since the mid-1970s the focus has shifted and a historical ecology approach has provided theoretical underpinning for much North Atlantic research with multiple projects combining archaeology, palaeoecology and history being carried out across the region (e.g. McGovern 1980, Amorosi *et al* 1997, Vésteinsson *et al* 2002, Dugmore *et al* 2005).

## **2.2. Concepts in human-environment research**

This section reviews a number of concepts that can be applied to human-environment research, many of which have developed from evolutionary theory. The importance of introducing such concepts is to demonstrate the theory behind how complex human and natural systems work and in order to provide a theoretical context to later discussions.

### **Environmental change and thresholds**

Environmental change is caused by a perturbation to the landscape system as a result of internal or external natural disturbance or human-induced disturbance. The rate of change following external perturbations to landscape systems (either natural or anthropogenic), can be conceived as either pulsed (i.e. low frequency-high magnitude events) or ramped events (Brunsden and Thornes 1979). In a pulsed model, the imposed disturbance is short in

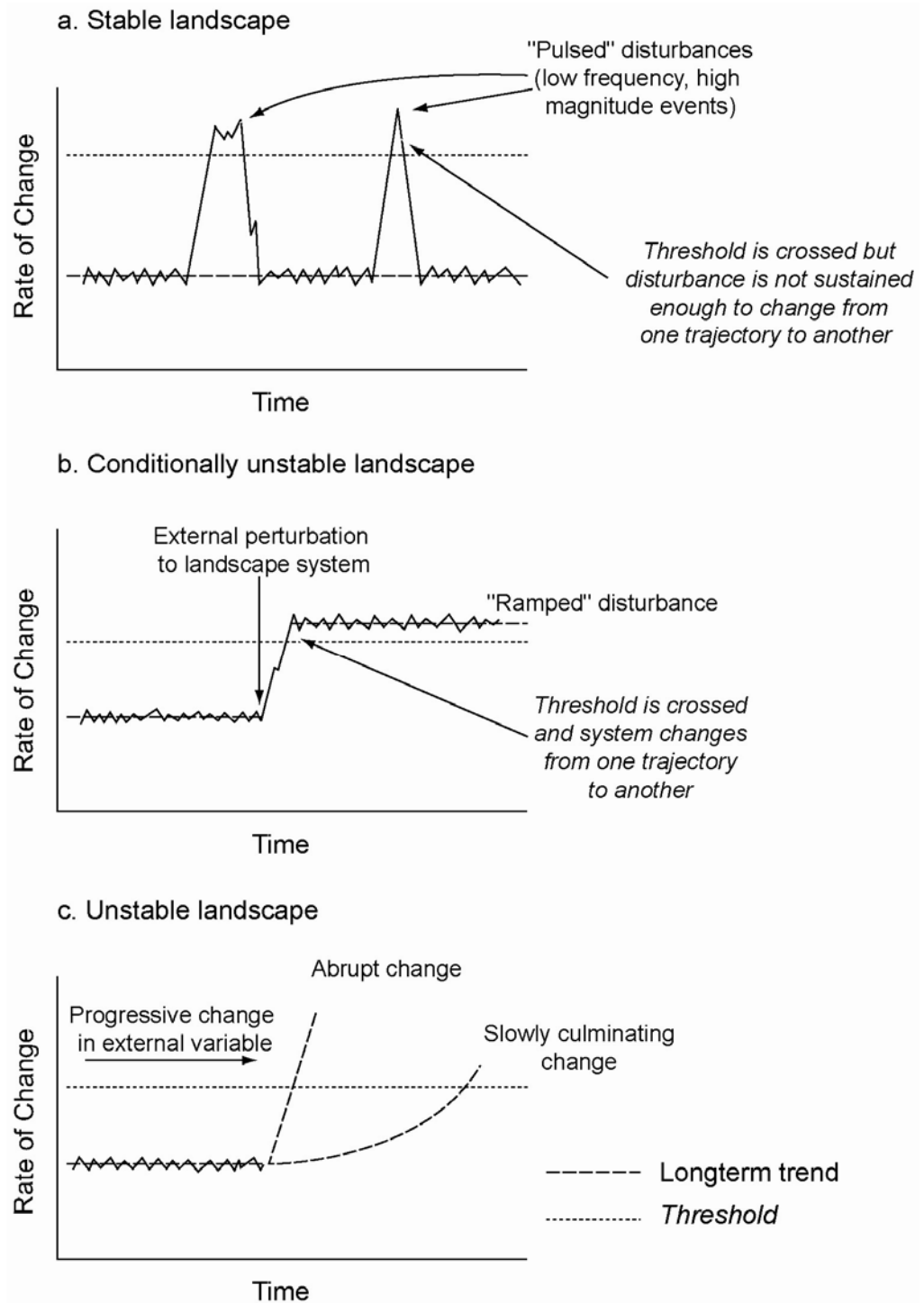
relation to the temporal scale being considered and is followed by a return to, or near, the initial state of the system (Figure 2.3a). Pulsed disturbances are normally spatially and temporally restricted in effect (Brunsden and Thornes 1979). In a ramped disturbance, the changes in inputs are sustained at a new level as a result of permanent shifts in the controlling variables or boundary conditions (Figure 2.3b). Ramped changes may be applied synchronously over a wide area to yield a uniform spatial response (Brunsden and Thornes 1979). Within a ramped model, a progressive change in external variable may trigger an abrupt change within the affected system, or may result in a slowly culminating change within the landscape system (Figure 2.3c).

An environmental threshold refers to a point whereby the environment changes from one phase or trajectory to another (Phillips 2003, Schumm 1979). An environmental threshold can therefore be reached after a period of slow accumulation of natural capital, when an internal or external natural disturbance (that has either been progressively changing, or that changes rapidly), or human-imposed catastrophe, disturbs the existing trajectory. Figure 2.3a illustrates a situation where although a threshold is crossed, the disturbance is not sustained enough to change from one trajectory to another (i.e. the environment recovers). Figure 2.3b, on the other hand, illustrates the crossing of a threshold and a change from one trajectory to another and this will be manifested as a permanent modification of the environment and landscape.

## **Responses to change**

### *Environmental responses: sensitivity and resilience*

The extent and reversibility of human impacts on the environment depends in some part on the actions of people and in some part on the sensitivity of the inherent environment. While sensitivity refers to the high susceptibility of the landscape to external impact, resilience suggests that the landscape has the potential to recover from any degree of damage inflicted by human or other factors. The concept of resilience originates from the study of ecosystems, defined as the magnitude of disturbance that a system can experience before it moves into a different state or “stability domain” (Holling 1986). Resilience has been defined in two different ways in the (ecological) literature reflecting the different aspects of stability that are emphasised. One definition focuses on efficiency, control, constancy and predictability, concentrating on stability near an equilibrium steady-state. The other definition focuses on persistence, adaptiveness, variability and unpredictability (Holling and Gunderson 2002). The latter definition is most applicable to the situation whereby external anthropogenic or natural disturbances create instabilities that can flip a system into another regime of behaviour, in other words, cross a threshold and change to a new trajectory. A



**Figure 2.3:** Examples of rates of change and threshold crossings. Figure 2.3a illustrates a "pulsed" model of change, where the imposed disturbance is short compared in relation to the temporal scale being considered and is followed by a return to, or near, the initial state of the system. Figure 2.3b illustrates a "ramped" disturbance, whereby the changes in inputs are sustained at a new level as a result of permanent shifts in controlling variables or boundary conditions. Figure 2.3c illustrates a "ramped" model, whereby a progressive change in external variable may trigger either an abrupt change within the affected system, or may result in a slowly culminating change within the landscape system. Adapted from Gerrard (1991) and Brunsden and Thornes (1979).

resilient ecosystem or environment is therefore defined as one which is able to withstand disturbances including those induced by people, and rebuild itself when necessary.

The concept of (ecological) resilience has mostly been applied to resource management and sustainability research in modern day environments and societies, but the notion of vulnerability and environmental marginality are also useful to a historical interpretation of the effects of human impact. An environment may be described as marginal if a critical environmental resource, such as good quality soil, is absent or is in short supply, or because an environmental variable, such as climate, changes (Mills and Coles 1998). While a relatively small change in temperature might cause limited impact in, for example, equatorial regions, where the climate is already relatively extreme (e.g. very wet/dry/hot/cold), a relatively small change can have a large impact in other marginal environments. Environmental marginality and landscape fragility therefore relates to factors inherent to the landscape and beyond the influence of human populations. A change in climate, soils or biota can render a landscape more or less marginal over time.

Scales of human impact on the environment are, therefore, not related purely to the degree of impact inflicted on the environment, but are associated with how resilient, sensitive or marginal the initial environment is. As a result, human impacts generally have a more significant effect in environmentally marginal areas. In addition to inherent properties of the environment, the rate of prevailing environmental change may also influence the degree of human impact; if some areas are in the process of undergoing natural change, the scale of this rate of change may critically enhance human impacts. Therefore, a key question to consider is to what extent landscape degradation is influenced more by actual human impact or by inherent sensitivity, or by both in equal measure.

#### *Human responses*

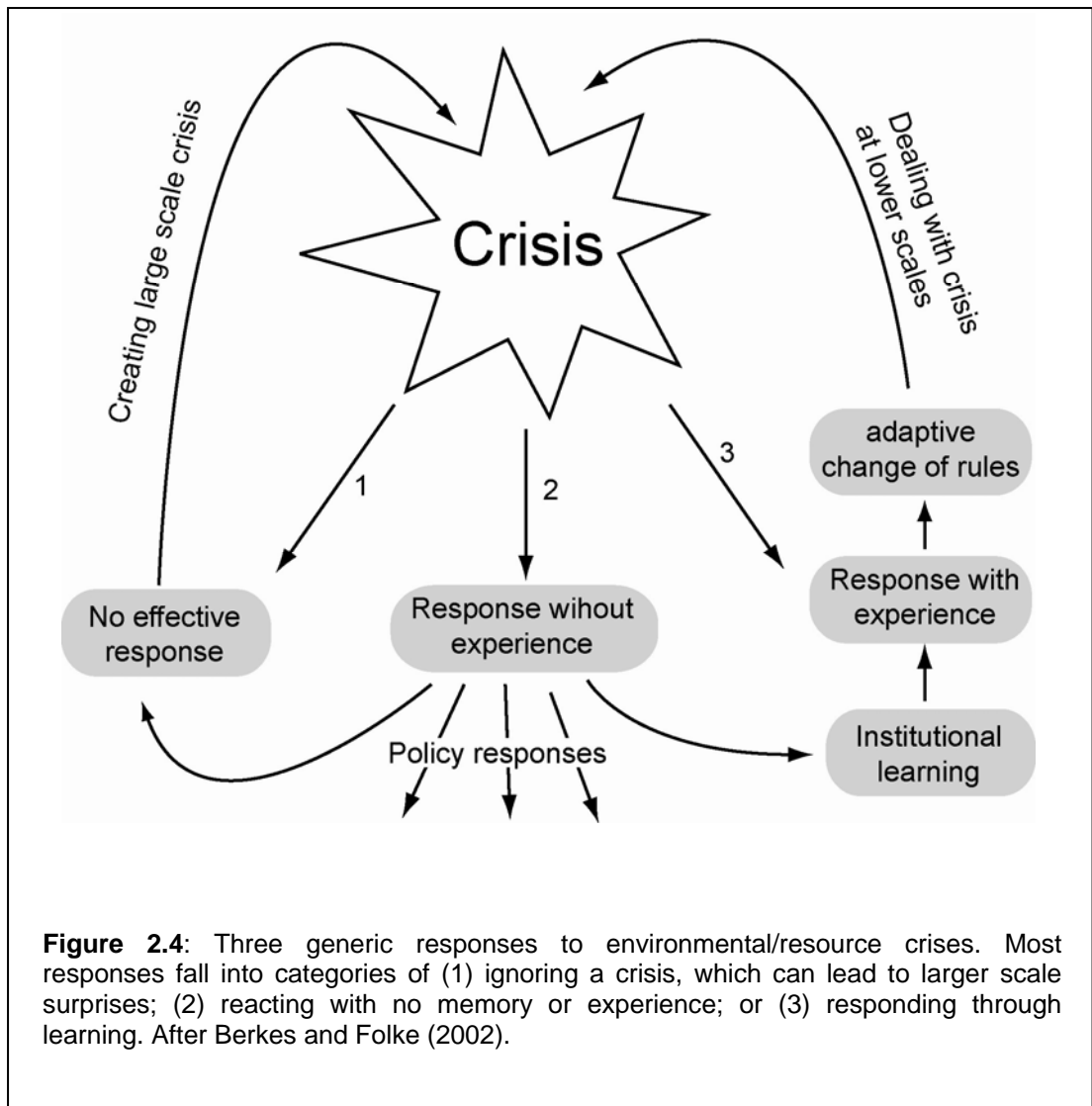
The degree of resilience, or how well the environment recovers from change, is also determined by how people respond to environmental stress, which is dependent upon the technological, social and economic tools they have available with which to respond. As environments with differing degrees of marginality may respond differently to the same impact, societies may also respond in a different manner to similar changes, and may thus exacerbate or alleviate the initial environmental impact. Berkes and Folke (2002) refer to three generic responses that are possible when a crisis occurs; “no effective response”, “response without experience”, in which the institution or community responds to a crisis but does not have previously tested policies with accumulated ecological knowledge at its disposal, and “response with experience”, in which the institution or community has previous experience with a crisis of that kind and policy that has been used on previous occasions

(Figure 2.4). Therefore a society that has experienced a particular environmental crisis previously will react differently to a society which has no prior experience of such a crisis.

Human response also depends on societies' political, economic and social organisation, cultural values, and technology. An economically marginal society, i.e. where there is a fundamental mismatch between the means by which resources are procured from the environment and the resources available in the environment (Mills and Coles 1998), may put more impact on the landscape and lower its degree of resilience. A society may also be described as being socially or politically marginal because of its geographical remoteness from the centre of power, or the presence of religious, ethnic or linguistic differences between the main centre of power and communities living on the edge of larger groupings (Mills and Coles 1998). Concepts of marginality have been used to describe the environments and societies occupying the North Atlantic islands of the Faroes, Iceland and Greenland. Yet even here, there is evidence that the range of conditions which bring about the marginalisation of a human group has as much to do with the inherent qualities of the land itself as to do with wider socio-political organisation and adaptation to a landscape. The Greenlandic landscape, for example, was not environmentally marginal to the Inuit who had adapted to the conditions, but was environmentally marginal to the Norse who took with them a pastoral economy. With this in mind, the following section examines the concept of adaptation and how perception and social memory may serve to influence how people adapt.

### **Adaptation**

Adaptation is a term originating from ecological theory, in which context it refers to the ability of an organism, human or non-human, to survive and reproduce itself in a particular environment (Kirch 1980). Moran (1982) draws a distinction between "adaptation" and "adjustment", essentially contrasting genetic and behavioural responses to environmental constraints. Cultural and social adjustment allows individuals to respond quickly to changes in the environment through adaptive strategies (although strategies may also be maladaptive), based on an individual or a societies knowledge of house construction, clothing styles, subsistence base, technology, settlement pattern, land use, trade and exchange mechanisms, ritual, and forms of social and economic organisation (Moran 1982, Kirch 1980). Processes of adaptation are, therefore, not straightforward responses to environmental change, but are related to how that environment is perceived by an individual or society. People only respond to the changes they perceive, and for most of human existence, perception has only been effective in the short term (Dincauze 2000).

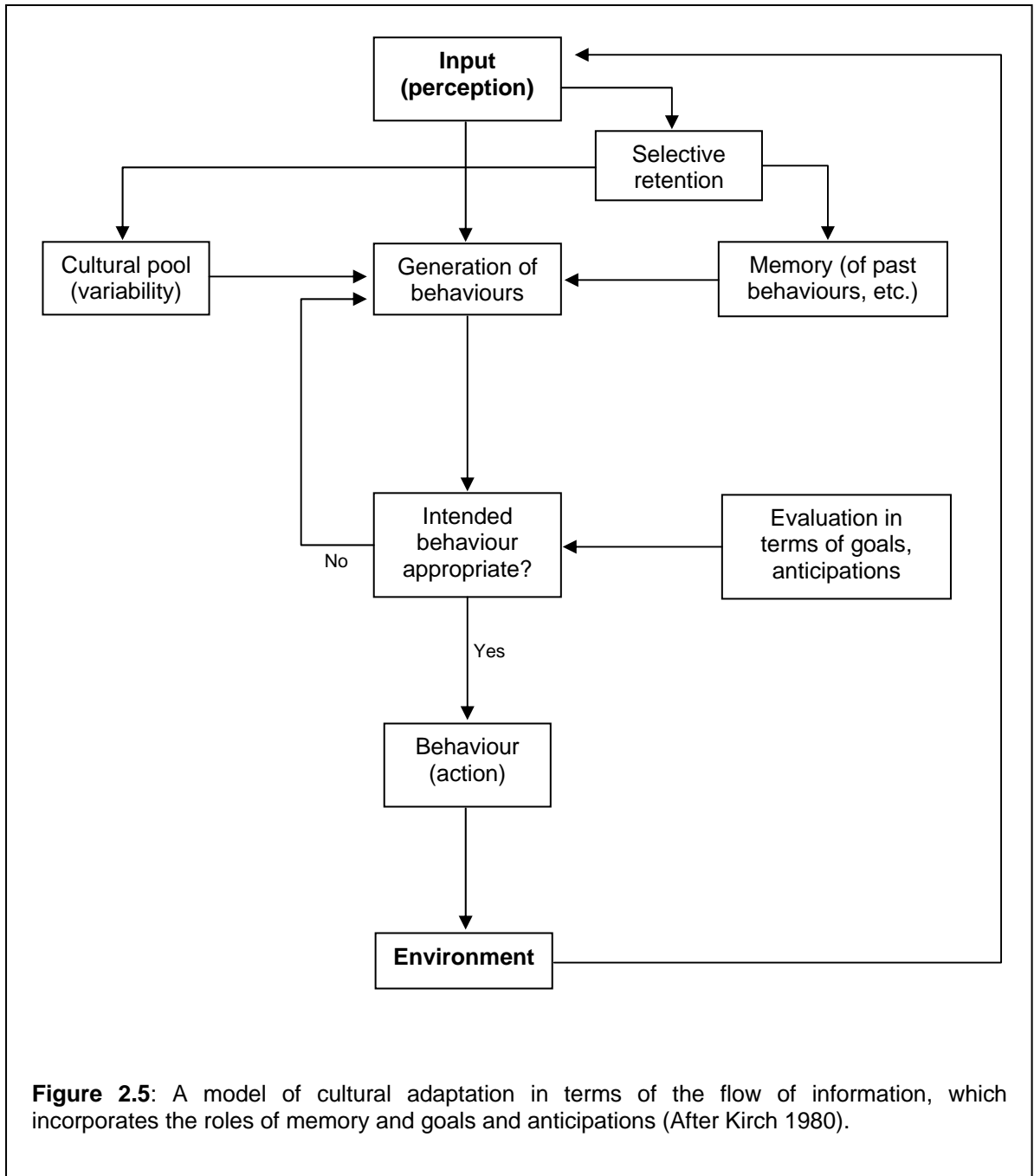


**Figure 2.4:** Three generic responses to environmental/resource crises. Most responses fall into categories of (1) ignoring a crisis, which can lead to larger scale surprises; (2) reacting with no memory or experience; or (3) responding through learning. After Berkes and Folke (2002).

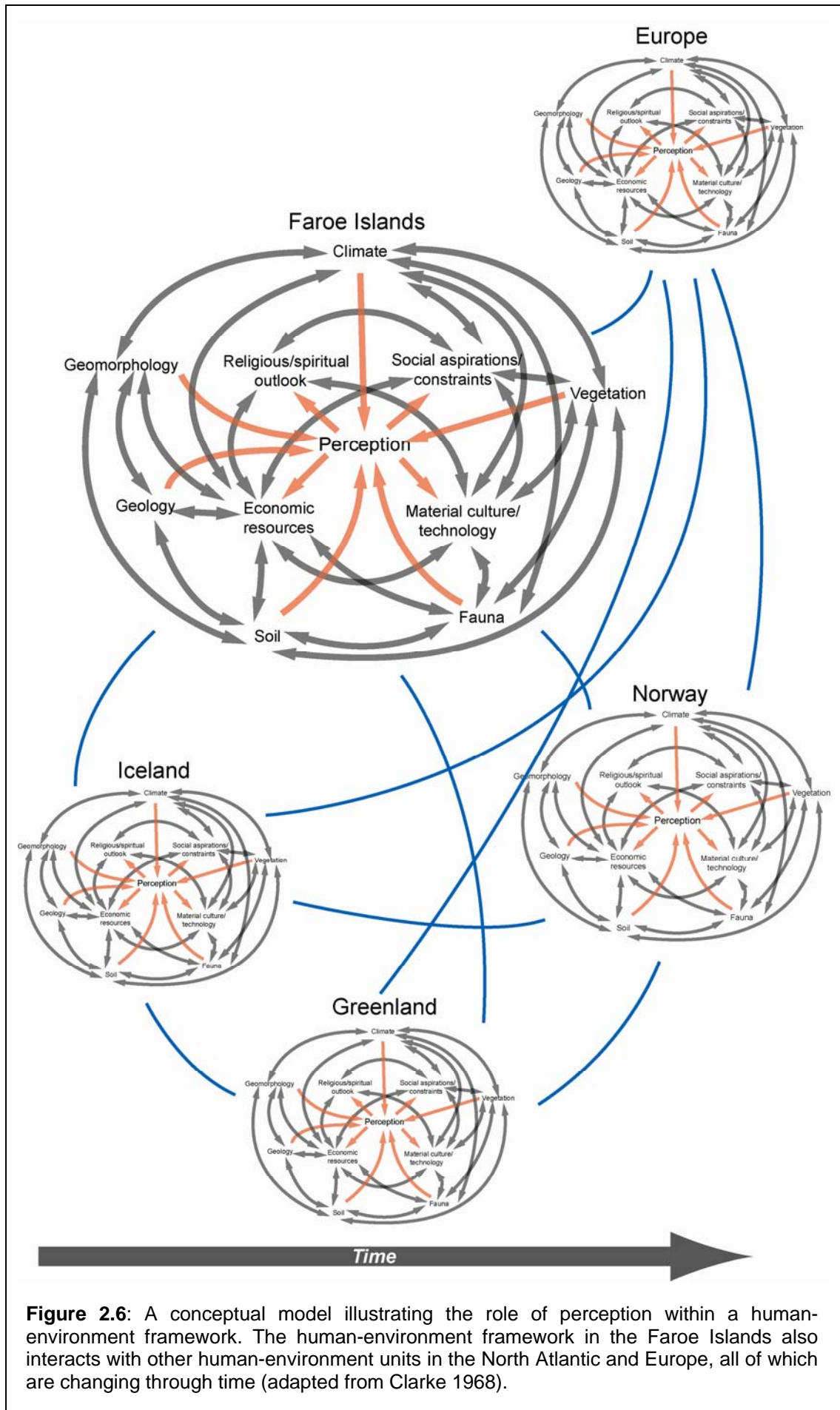
*The influence of information, perception, memory and decision making on adaptation*

Adaptation largely concerns the information processes of human societies, and how this information is managed by a society or culture. This is because people base adjustments to environmental change on how they perceive that environment, according to religious, aesthetic, economic or social terms, rather than the environment itself. Perception of the environment is related to the amount and nature of the environmental information available, memory of past experiences, anticipations of future environmental conditions and evaluation of the intended actions in terms of an individual's or societies' conscious and personal goals (Kirch 1980). Figure 2.5 outlines the connections between human goals, anticipation, memory and consequent impact on environment, while Figure 2.6 illustrates the role of perception within a broader historical ecology framework in a North Atlantic setting. Opinions differ regarding how an individual or society responds to their perception of change. One possible course of action is based on probability, in other words on what adjustment is likely to be the most successful. Decisions may also rely on something that was tried and had worked in the past, or may be based on previous responses to impacts occurring in the most recent past, which expresses the least uncertainty about outcomes (Moran 1982).

When a new country is colonised, initial adaptedness is low, as the new settlers may have no experimental information or previous experience of the country. In the case of the North Atlantic islands, settlers relied on a "false analogy" on arrival, whereby the surface similarities between the characteristics of the homeland ecosystem and the new ecosystem masked critical threshold differences from the actual local ecosystem (McGovern 1994, McGovern *et al* 1988). After settlements have been established for a generation or so, memory of past experiences of the new environment, both of their own and their ancestors', increases in importance. First hand memories apply at human time-scales, which at the time of Norse settlement were much shorter than today, as a result of the much shorter life spans of past populations. In a modern example from the Pacific island of Tikopia, the mechanisms by which elders and chiefs in a traditional society use experience to adapt to disturbance are demonstrated. A variety of responses to a hurricane disaster were implemented by island chiefs, local households and through resource management strategies (Lees and Bates 1990). Hurricanes of a similar intensity occur around once every 20 years, or once a generation, allowing chiefs and inhabitants to respond to the disaster on the basis of experience and oral history, or as referred to by Berkes and Folke (2002), "response with experience" (refer to Figure 2.4). This example illustrates that a disaster of a once-a-generation frequency is well within the response capacity of the local social system but does not, however, address how a local social institution could deal with environmental variability



**Figure 2.5:** A model of cultural adaptation in terms of the flow of information, which incorporates the roles of memory and goals and anticipations (After Kirch 1980).



**Figure 2.6:** A conceptual model illustrating the role of perception within a human-environment framework. The human-environment framework in the Faroe Islands also interacts with other human-environment units in the North Atlantic and Europe, all of which are changing through time (adapted from Clarke 1968).

of a lesser frequency, or how it would respond to a perturbation never before experienced (Berkes and Folke 2002).

First hand-memories only encompass specific events based on the “selective retention” of memories (refer to Figure 2.5). For example, local catastrophic events such as floods and landslides may be eliminated from people’s memories, as the results of these events may be easy to overcome and are quickly forgotten about, even though their short-term impact may have been extremely destructive (Urbanczyk 1998). At the other end of the temporal scale, the effects of an episode of eustatic uplift that covers a timescale of millennia will not be realised by human societies for several generations. The best examples for discussion of human response to environmental change are changes that happen on a middle-range timescale (Urbanczyk 1998), such as in the example of hurricanes on Tikopia, or climate changes which develop steadily and that are remembered, or “retained” by people in subsequent years. In the case of progressively developing climate change however, memories may still be misleading. A new coloniser may lack a sufficiently long memory of events to predict variation in key environmental factors, and may make decisions based on a mistaken judgement of the climatic situation. As accumulated memories are used to anticipate future environmental conditions, if a climatic trajectory switches, for example, from a gradual warming to a cooling, memories are no longer reliable and consequent decision making relying on adjustments that have been successful in the past, may be misguided (Dugmore *et al* 2007a).

As well as misconception of environments due to false analogy, insufficient detail or a short observation series of environmental change (McGovern 1994, McGovern *et al* 1988), humans may perceive an environmental problem but may decide not to act upon it, or they may act to avert any unfavourable impacts but are too late in their actions. Humans are also not always willing or able to forego short-term personal advantage, including political goals or self-enhancing strategies, for a long-term common benefit (McGovern *et al* 1988). Decision makers may perceive a potential environmental problem, but do not feel obligated to take action as long as their own short-term interest is unthreatened. In this situation, a decision may be made by an individual, which although may satisfy their personal goal, is at the expense of the goals of a society and the wider environment.

### **Chapter summary**

This chapter has considered the theoretical approaches that have directed human-environment research in the past and how the current paradigm of historical ecology has developed from theories of environmental determinism, possibilism and cultural ecology. Up to the middle of the last century, interactions between people and environment were

perceived as one-directional linear systems, but current human-environment research favours an approach that emphasises the existence of feedback loops as opposed to linear causality. Theoretical concepts influencing the current view of human-environment research, including rates of change and thresholds, environmental sensitivity, resilience and human adaptation were also defined. These concepts will be considered later in the thesis with specific reference to settlement in the North Atlantic.

The following chapter provides a background context to island research in general and reviews some of the recent research of human impact on island environments.

## Chapter 3

### Island contexts

#### Introduction

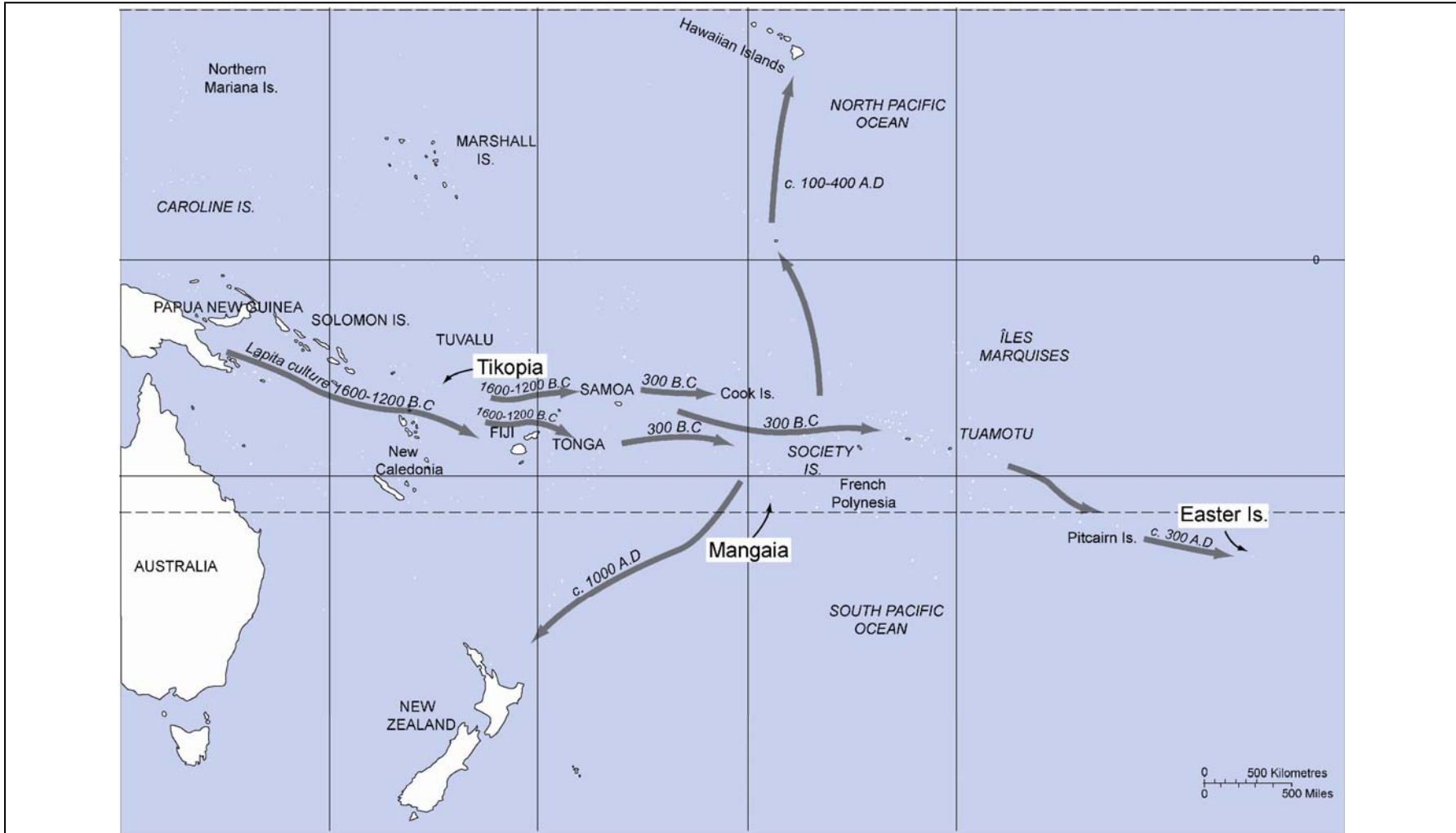
Perhaps the thing that most distinguishes islands, at least oceanic islands... is their extreme vulnerability or susceptibility to disturbance (Fosberg 1963: 559).

This chapter examines the wider context of island research as introduced in the framework in Figure 1.5 with regards to the notion that islands represent a model system, from which globally occurring processes can be understood. The chapter aims to provide a brief overview of islands and what characterises them, both as islands, and as locations from which to explore human-environment interactions. Recent examples of human-environment research in some Pacific islands, where wide ranging archaeological and comparative-led research has been carried out, are also reviewed. From this research, hypotheses regarding human impacts on environments can be developed with regards to the Faroe Islands.

#### Island contexts as models for human impact and global change

The smaller, more manageable spatial scale and insularity of island environments and societies, has made islands (particularly remote islands) popular field locations for research in a variety of disciplines, including biology, ecology, biogeography, ethnography and more recently, environmental archaeology. Islands have been referred to as outdoor laboratories (Kirch 1997a, Fitzhugh and Hunt 1997), where human-environment research can be approached from a comparative perspective, where examples from one island can be transferred to other islands as well as other locations, and where theories of general importance can be developed and tested (Whittaker 1998). Although islands are not closed systems, they are perhaps our best representation of model systems in which globally occurring processes such as human colonisation, population change, landscape and ecological modification, and impacts of climate change can be effectively isolated and measured, allowing cause and effect relationships to be more easily clarified (Kirch 1996).

The existence of several islands in groupings or archipelagos that span a variety of climatic and ecological settings promotes a wide and varied range of research. Islands share some characteristics, but differ slightly in others, allowing comparative studies to be made. Within Remote Oceania (Green 1991) in the eastern Pacific, there are some 7,500 islands which share similar aspects such as climate and cultural origins, but which differ with respect to elevation, ecology, geology, resource availability and degree of insularity (Figure 3.1).



**Figure 3.1:** Pacific islands including proposed routes and timings of colonisation (dating of colonisation after Kirch 2000).

Islands in the North Atlantic, although considerably less numerous than those of the Pacific, share similarities in terms of their common parental population, cultural capital and oceanic setting, but differ in factors including climate and ecology. This allows environmental factors and the impacts of people in the Faroes, Iceland and Greenland to be effectively compared and contrasted.

Islands are often geographically isolated by their nature, and although the perception of isolation changes through time and space (e.g. whereby past societies viewed the sea as a highway rather than a barrier), their discreteness results in the definition of clear environmental and social boundaries. Feedbacks, responses to change and thresholds of change can be investigated at a manageable level in island societies, whereas in continental or landlocked societies, defining geographical, ecological, historic and social boundaries is problematic. Biological and socio-political diversity is diminished in island ecosystems and social systems and this allows interconnections between human and environmental factors to be assessed more specifically, increasing the visibility of impacts observed in environmental records, which is critical in the adoption of a multi-scaled approach.

The relatively short temporal scale of island habitation compared to that of continents also supports the study of human-environment interactions. The length of occupation of most Remote Oceanic and North Atlantic islands has been on a multi-generational scale, which is long enough to look at human-environment interactions, but has not been on a multicultural scale where cultural mixing makes human-environment research more difficult. Remote Oceanic islands such as Hawai'i, Pitcairn, Mangareva and Easter Island were only settled within around the last 1500 years, while the North Atlantic islands of Faroes, Iceland and Greenland were colonised by the Norse after c.1200 years ago. Although these dates may differ by a few centuries, the colonisation periods of the islands of Remote Oceania and the North Atlantic are effectively similar in broad cultural terms. In contrast, Near Oceanic islands such as Samoa and larger islands such as Madagascar and Australia have much longer occupation histories spanning thousands of years and are more culturally complex, while remote islands in the South Atlantic such as Tristan de Cunha, Gough, St Helena and Ascension were not discovered and settled by Europeans until the 16<sup>th</sup> century, which is perhaps too short an occupation period from which to view and understand historical human-environment interactions and adaptations.

In addition to initial colonisation impacts, the islands of Remote Oceania and the North Atlantic are ideal subjects on which to examine the longer-term social and environmental diversifications. Within both island groupings, people with a similar cultural background and language settled the islands and initially adopted a similar mixed farming subsistence economy. Within a few generations, however, individual island populations may have been

following different routes, in order to adapt to or manage to the contrastive environments and differing internal social dynamics. Understanding the similarities and differences between islands is therefore essential for understanding under what circumstances people put unsustainable demands on their environment, because similar sequences of events on islands have produced some very different outcomes. While some islands have undergone a cultural or biotic collapse, the people and ecosystems of other islands have adapted and survived.

### **Island ecosystems and biogeography**

Island ecosystems vary significantly from those of continents. While the biota of Oceanic islands have been comparatively stable, for example climatically, over long periods of geological time, they are highly unstable to rapid ecological change, including that caused by human perturbation (Cronk 1996). Comparisons between the biota of continental regions and Oceanic islands are demonstrated in Table 3.1, while comparisons between Oceanic island and high latitude island biota are illustrated in Table 3.2.

Island ecosystems are determined by their insularity, which is influenced by their isolation and limited size. The insularity of island ecosystems results in the limitation or absence of resources, limited biodiversity, a low species immigration rate and the evolution of endemic species over millions of years. Island ecosystems are well adapted to their pre-human circumstances, having evolved over long periods in isolation from human influence and indigenous mammals. Paradoxically, however, they are extremely vulnerable to invasion by human impact, especially in the eastern Pacific and more remote areas. In comparison to continents or regions such as Africa or Asia where the ecology has evolved alongside people, on islands, biotic systems have evolved in isolation and have developed a stable equilibrium that is particularly susceptible to disruption. Endemic species are susceptible to impact by perturbations of the environment caused by humans and other introduced animals, such as grazing mammals, which were previously absent. Also, Pacific plants, which have evolved with little experience of fire, are not able to recover as easily from burning as continental species that had evolved alongside humans or where natural fires were more common (McNeill 2001). However, the vulnerability of islands to disturbance results in easier identification and measurement of the palaeoenvironmental record and threshold crossing events can be compared across islands and archipelagos.

The biogeography of islands is dependent on the dispersal of groups of plants and animals, to a large degree affected by the distance from both mainland source regions and between other islands that act as stepping stones. Also critical to island biogeography are the possibilities for new species to evolve and as a result, speciation has led to high degrees of

	Oceanic	Continental
Ultimate stability (geological time)	HIGH	LOW
Proximate stability (ecological time)	LOW	HIGH
Ultimate diversity (uniqueness)	HIGH	LOW
Proximate diversity (species number)	LOW	HIGH

**Table 3.1:** Comparisons between oceanic island and continental biota. After Cronk (1996).

	Low/mid latitude	High latitude
Ultimate stability (geological time)	HIGH	LOW
Proximate stability (ecological time)	LOW	HIGH
Ultimate diversity (uniqueness)	HIGH	LOW
Proximate diversity (species number)	LOW	LOW

**Table 3.2:** Comparisons between low/mid latitude island and high latitude island biota. Adapted from Cronk (1996) by A. Dugmore (*pers. comm.*).

endemism in certain islands or archipelagos, e.g. Hawai'i (Kirch 2000). Island faunas are also very different from those of continental regions as islands have limited, or no populations of mammals and reptiles, but a richer diversity and abundance (prior to colonisation) of sea and land birds, invertebrates and access to sea mammals. These aspects had important consequences for colonising human populations (Kirch 2000). As people moved from the large Near Oceanic islands into Remote Oceania, they increasingly found the newly discovered islands lacking in many familiar plants and animals. In the more remote islands, there were few indigenous plants with edible tubers or fruits and few edible fauna except land and nesting sea birds. The high ultimate diversity or uniqueness, and low proximate diversity or species number (Cronk 1996) of oceanic islands therefore make islands and their ecology vulnerable to human impact. This inherent instability may be significant in understanding the circumstances whereby people put unsustainable demands on island environments.

In terms of biotic evolution, the islands of the North Atlantic have evolved differently from those of the Pacific (refer to Table 3.2). While the ultimate or geological stability of low latitude Pacific islands has been high, allowing the evolution of unique species, in the North Atlantic, ultimate or geological stability has been low because of repeated glaciations, resulting in very limited time for the development of endemism. As a result, the ecology of the North Atlantic islands would be expected to be less affected by external perturbations, such as human settlement, than the biota of low latitude islands.

### **Colonisation of remote islands**

The factors involved in the colonisation of islands is exemplified by islands in the east Pacific, or Remote Oceania, that are far from the mainland, and often small in size, making navigation difficult. Although expansion into the near Pacific began around 40,000 years ago (Kirch 2000), further development of voyaging and the expansion into Remote Oceania did not begin until after 1500 BC. The reasons for the onset of remote island colonisation is unclear; while improvement and introduction of new technology would have been required before people and their resources could be moved across such massive distances, this alone would not have led to the expansion of colonisers into remote islands. In addition to technology, an ideology was also required that viewed the sea as a highway rather than a barrier. Major advances in maritime technology in Oceania can also be correlated with the advent of a food-producing, horticultural economy, and as human populations grew, the search for new lands to plant and control became a driving force of cultural change. This encouraged the build up of another new ideology bound to a social structure whereby the discovery of new landscapes could be "claimed, named, divided, planted and inherited" (Kirch 2000: 304). Reasons for the colonisation of the less geographically remote islands of

the North Atlantic (the Faroe Islands, Iceland and Greenland) are also varied and may not be dissimilar to those cited in relation to Pacific islands. Explanations have included land hunger, the development of Scandinavian shipbuilding, the increase in trade of luxury goods, changes in mainland Scandinavian society or as part of general independent seaborne expansion across the North Atlantic.

After colonisation of Remote Oceania, long ocean journeys may have become regularised through repeated economic transactions for trading and social transactions, for example, by visiting neighbouring islands for marriage or to trade natural resources (Kirch 2000). Through these repeated journeys, the colonisers developed a complex network of interactions that were vital to the sustainability of cultural and environmental island systems. As with Oceanic islands, the colonisers of the North Atlantic maintained a network of interactions between other islands and the mainland, although climatic changes or socio-political issues inhibited contact during some periods.

On settling a new island, the colonisers would have sought to transform their new environment into a familiar and manageable landscape by creating “transported landscapes”, also referred to as a “portmanteau biota” (Crosby 1986) or “cultural capital” (Diamond 2005) that echoed the environment of their homelands and promoted ecological homogenisation. A transported landscape consisted of a combination of specific plants, animals and subsistence methods as well as knowledge, beliefs, and social organisation that were introduced and implemented from the homeland to each newly colonised island. Colonisers of Remote Oceania brought with them a cultural capital of pigs, dogs, chickens and rats and edible plants such as the taro, yam, sweet potato, banana, coconut and breadfruit. The Norse introduced a cultural capital to the islands of the North Atlantic of cows, pigs, sheep, goats, horses, ducks, geese, dogs and barley. The use of fire to assist vegetation clearance and the heavy reliance on wild marine resources such as molluscs, fish and turtles, were also introduced features and part of the transported landscape that became familiar across Oceania, while a reliance on birds and marine resources was crucial in the Atlantic islands. The introduction of a suite of farming and subsistence practices to an island where these were previously unknown causes a change in the natural landscape and ecology. The outcome of initial unexpected impacts caused by the introduction of unfamiliar biota may have been a circumstance that induced the colonisers to make unsustainable demands on their environment. In Iceland, for example, although the plant/bird ecology of the island would have appeared outwardly similar to that of mainland Scandinavia and accustomed to by the Norse, tephra or volcanic ash from previous eruptions lay only a few centimetres below the stable looking surface vegetation. Unbeknown to the settlers, penetration of the sod layer above a thick tephra deposit could lead to a sudden catastrophic destabilisation of the whole farm (Dugmore and Buckland 1991, Dugmore *et al* 2000).

### **Timing of colonisation**

The timing of colonisation is a key issue with regards to the extent of human impact in island environments because to determine human impact as having been rapid on the one hand, or prolonged on the other, is dependent on for how long the island has been colonised. However, there remains a problem of dating the colonisation of islands when reliable historical data is not available. Direct, unequivocal evidence of human colonisation is one line of evidence, most often based on archaeological remains or evidence of introduced species. Indirect evidence of inferred human impact, such as a significant increase in erosion, is another line of evidence. Direct evidence is often spatially limited and difficult to date, while indirect evidence is more extensive. However, in both cases there are problems concerning the accuracy and precision of the dating. These issues have arisen in determinations of the timing of arrival and earliest environmental impacts of the first New Zealanders, where debate has centred on the accuracy of radiocarbon dates of materials accepted as anthropogenic, and in the interpretation of environmental change as having an anthropogenic cause (Newnham *et al* 1998). As a result, divergent models concerning the length of New Zealand's prehistory have arisen in part because of varying interpretations of the same palynological data. The significance of the issues encountered in dating the timing of colonisation in New Zealand extends to migrations to central East Polynesia, as Anderson (1995: 128) states:

...the archaeological hypothesis of late colonisation might turn out to be wrong, but it has the great virtue of being eminently falsifiable. One manifestly early site or one clear indication of anthropogenic change in the environmental record in central East Polynesia, or better still in the marginal archipelagos, would do it (Anderson 1995).

This is also a key issue to consider regarding the timing of colonisation of the Faroe Islands, which is discussed in more detail in chapter 4.

### **Human impacts and environmental change in remote islands**

Since Europeans began voyaging to Pacific islands in the 18<sup>th</sup> century, it was often maintained that small-scale, non-western island societies were so much a part of their natural surroundings that their presence did not alter the natural equilibrium (McNeill 2001, Spriggs 1997). In the late 19<sup>th</sup> and early 20<sup>th</sup> century, although the impacts of humans on island environments was becoming more evident, the observed changes were attributed to impacts caused by the arrival of Western peoples who had introduced new plants and animals. Disturbances caused by indigenous/pre-industrial populations were thought to have been minor or insignificant. Only more recently was this paradigm reviewed. In the 1970s

research began to suggest that rather than living in an idealised state of nature, indigenous Pacific populations experienced various forms of exploitative relationships with the environment, which often resulted in degradation (Dodson 1992, McNeill 2001, Kirch and Hunt 1997, Kirch 1982; 1983; 1997a). Although the impacts of indigenous hunter gathering people may be *relatively* slight, the cumulative effects of high density agricultural peoples on their landscapes have been highly significant (Kirch 2000).

Evidence for historical degradation, erosion and depletion of global island environments and resources by early colonisers is today widespread. Human induced changes on islands began with the first permanent colonisers and their initial exploitation of resources, which probably caused massive ecological changes and disruption of habitats on many, if not the majority, of islands (e.g. Kirch 1982, Olsen and James 1984, Spriggs 1986, Flenley *et al* 1991, Steadman 1989 and Bayliss-Smith *et al* 1988). McNeill (2001) suggests that human modification of Polynesian island environments followed a two stage process, beginning with the exploitation and depletion of resources that were the easiest to utilise, with a second stage leading both to depletion of the most obvious resources and exploitation of new resources, achieved by developing new sources of food or emigrating elsewhere. Exploitation of local resources and the introduction of new species, both domesticates such as pigs, and stowaways, especially the rat, led directly to faunal and floral depletions and extinctions. Repeated forest clearance for gardens and orchards, and burning as part of shifting cultivation practices, caused the destruction of habitats, the depletion of wood resources and consequently increased soil erosion. Evidence of major vegetation changes, soil erosion, extinction of endemic species and decreasing biodiversity linked to human land-use actions is displayed in Pacific islands as varied as New Guinea, Vanuatu, New Caledonia, Fiji, Yap, the Cooks, the Society Islands, New Zealand, Easter Island and Hawai'i (Athens 1997, Athens and Ward 1993; 1995; 1997, Athens *et al* 1992, Bussell 1988, Dodson and Intoh 1999, Elliot *et al* 1995, Ellison 1994, Flenley and King 1994, Flenley *et al* 1991, Flenley and Bahn 2002, Diamond 2005, Hope and Hope 1976, Hope and Spriggs 1982, Hughes *et al* 1979, McGlone and Basher 1995, Parkes 1997, Stevenson 1998, Stevenson and Dodson 1995).

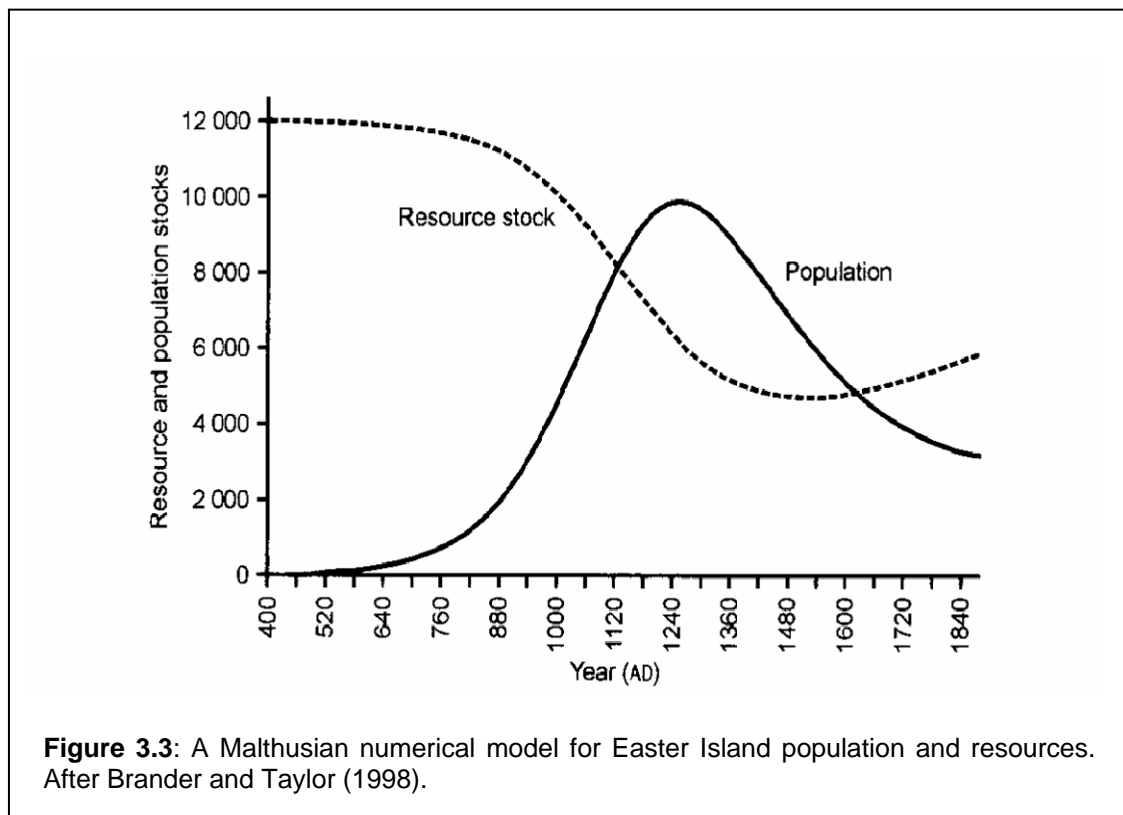
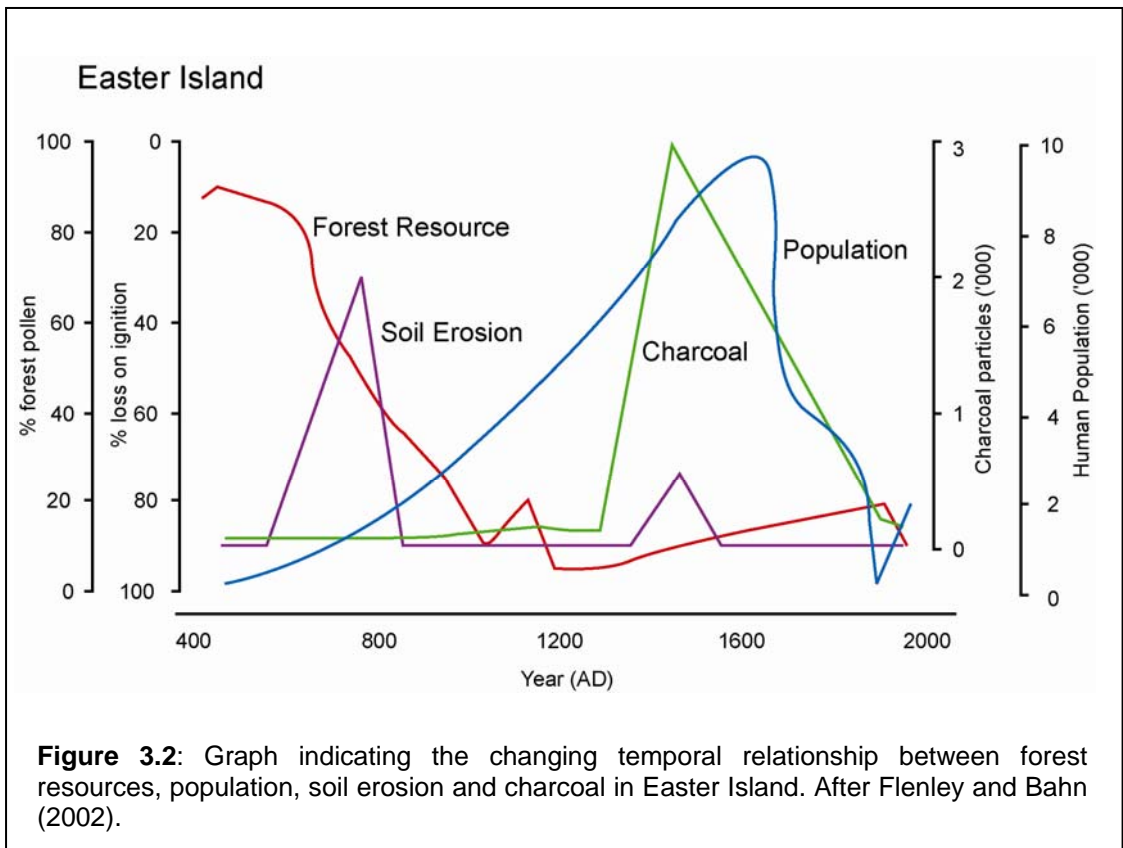
Although human impacts on the environments of remote Pacific islands have been most well documented, and floral and faunal depletions have been most severe, accounts of detrimental human impact are also recorded following colonisation of the North Atlantic islands, particularly with regards to the exploitation of forest resources, exploitation of wild food resources and soil erosion related to the introduction of grazing animals. Human impact on the North Atlantic islands is referred to in more detail in chapter 4.

### **Population and resources on remote islands: cultural stress and collapse**

The impact of human colonisers on island environments has not only caused environmental degradation, but in some cases, the unsustainable demands put on island environments by colonisers instigated episodes of cultural stress. On some islands, such as Easter Island and Mangaia in the Cook Islands, this concluded with a sharp decline in population (Diamond 2005, Kirch 1997a; 1997b). Some of the events leading up to cultural collapses and their wider context are discussed below in order to explore the extent to which unsustainable demands made by the colonisers on island environments may have led to cultural stress.

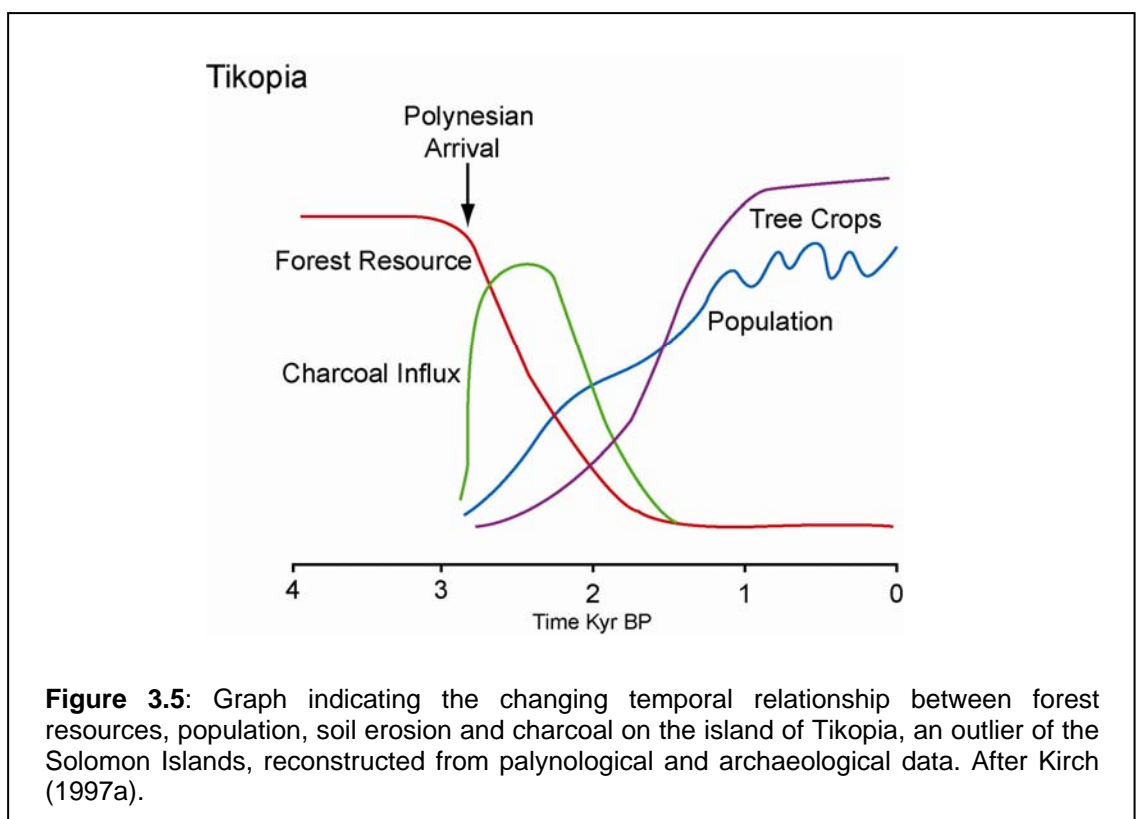
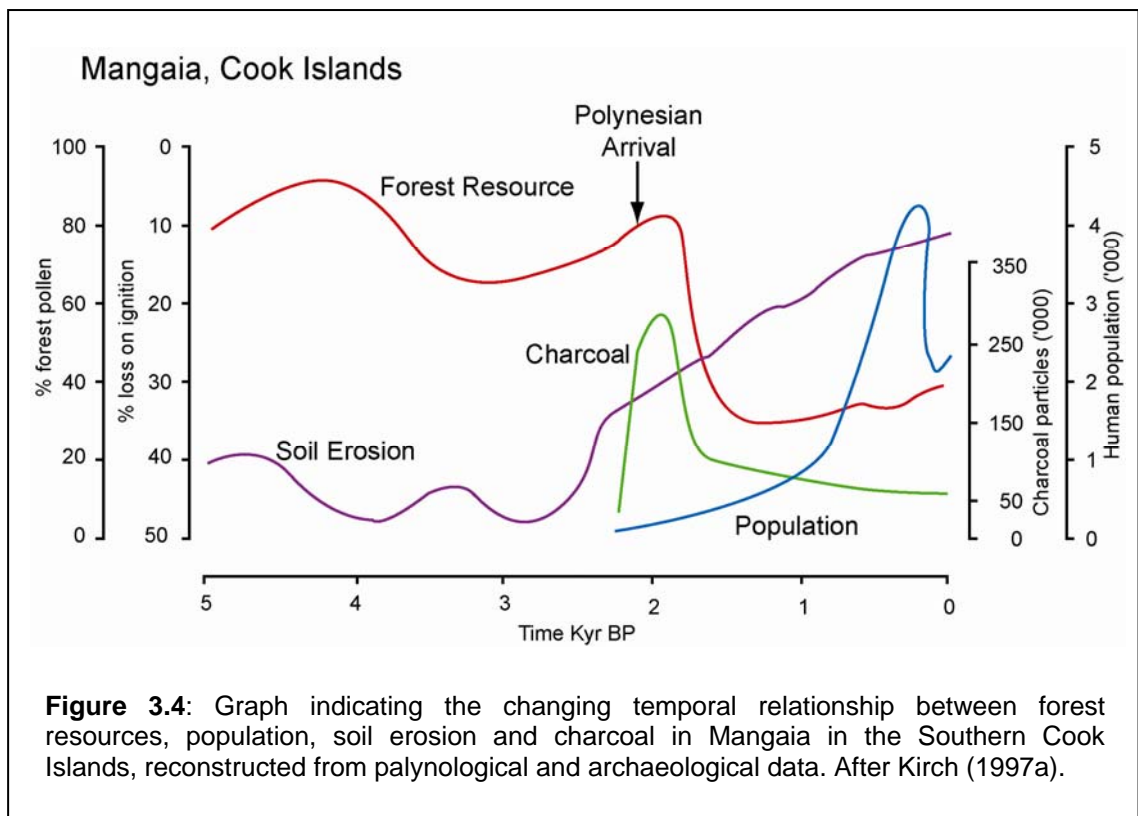
Easter Island is characterised by its isolated location in the Pacific Ocean, more than 3200 kilometres away from the nearest continent of South America. It is a relatively small volcanic island, measuring 165 square kilometres, and has a relatively mild climate and predominantly gentle topography lacking deep valleys. A volcanic origin provides the island with fertile soils, but the island geology and low elevation limits supplies of fresh water. The origin of the islanders is controversial and will not be discussed here (Heyerdahl 1950; 1989 or see Flenley and Bahn 2002 and Kirch 2000 for an overview). The timing of settlement is also debated with current estimates placing colonisation at around 300-400 AD (Kirch 1984), although some estimates suggest a later date of 650-900 AD (Spriggs and Anderson 1993). The timing of colonisation of Easter Island therefore occurs at a similar period to that of the Norse settlement of the North Atlantic islands, at least in broad cultural terms.

Conspicuous forest clearance becomes visible in pollen diagrams from Easter Island after about 800 AD, most likely a direct result of human impact. Palynological investigations suggest that when the settlers arrived, Easter Island was covered by 21 species of trees, all of which are now extinct, along with woody bushes, scrubs, herbs, ferns and grasses, all of which had evolved over long time scales (Flenley and King 1984, Orliac 1998). The most common tree in the pollen record is a species of a now extinct large palm that was probably used for transporting and erecting the giant statues that epitomise the island, as well as providing a source of timber for fuel and for large rafts and canoes. However, the once widespread forest, including the large palm, had disappeared from the island by 1600 AD. Forest clearance initiated auxiliary environmental problems, such as soil erosion and a lack of wood with which to build boats to take advantage of good fishing in the area, thereby reducing access to resources at a time when they were most needed. A graph comparing data from the pollen record on Easter Island alongside estimated population and stratigraphic evidence of disturbance through soil erosion and charcoal is illustrated by Figure 3.2.



As well as forest, there is evidence that the islanders over-exploited natural resources such as fish, porpoises, shellfish and seabirds. With at least 25 nesting species, Easter Island was once the richest seabird breeding site in Polynesia, but the colonies of more than half of the seabird species breeding on Easter Island or its offshore islets were wiped out and every species of native land bird became extinct after colonisation (Steadman 1989). The publication of recent research (Hunt and Lipo 2006) documents a later date for settlement than previously assumed. This implies that the construction of statues and degradation of the environment was initiated much sooner after colonisation than previously thought, beginning almost immediately after human colonisation. Palaeoenvironmental data from some parts of Iceland also documents the almost immediate clearance of forest, within less than fifty years of settlement (Hallsdóttir 1987, Mairs 2006). The consequence of this, at least in Easter Island, with a smaller area and less total forest cover, is that people begin to put unsustainable demands on island environments immediately after colonisation.

By around 1600 AD, Easter Island society declined into chaos and cannibalism, to some degree related to the detrimental human impacts on the environment and over-exploitation of resources (Diamond 1995, Flenley and Bahn 2002). Some researchers suggest that the cultural collapse on Easter Island exemplifies Malthusian theory (e.g. Bahn and Flenley 1992, Brander and Taylor 1998, Brown and Flavin 1999, Diamond 1999; 2005, Flenley and Bahn 2002, Keegan 1993, Kirch 1997a; 2000 and Ponting 1991) and recent modelling experiments have also demonstrated such a relationship (Decker and Reuveny 2005, Brander and Taylor 1998) (Figure 3.3). Although technological progress and innovation play a role in alleviating resource constraints (Boserup 1981 and Simon 1996), even when incorporating technological innovations in their model, Decker and Reuveny (2005) found that endogenous innovation such as that envisioned by Julian Simon and Ester Boserup would have had limited ability to change Easter Island's fate. Technology-population-environment linkages may well be much more complex than is currently understood and Decker and Reuveny (2005) suggest that when per capita utility falls below some level, as it does on Easter Island, people may resort to violent conflict over resources, which in turn may limit the physical and mental capabilities of the population and reduce its ability to innovate. Easter Island, however, is an exceptional case, as there was very little or no communication with other islands, so it was effectively a closed system with finite resources. The majority of islands, whether in the Pacific or North Atlantic, experienced at least sporadic trade with neighbouring islands. Even so, evidence for parallel outcomes with that of Easter Island can be found on other islands such as Mangaia, the most southerly of the Cook Islands in central east Polynesia (Figure 3.4 illustrates the main proxy signals of change over the last 7000 years of Mangaia's history). The environment of Mangaia differs somewhat from that of Easter Island and is geologically the oldest island in the Pacific, extremely degraded and nutrient poor. The island is approximately 70 square kilometres and is



volcanic, with a central cone surrounded by a ring of upraised reef limestone known as *makatea*. Interdisciplinary research carried out on Mangaia (Kirch *et al* 1991, Kirch *et al* 1992, Ellison 1994, Steadman and Kirch 1990 and Kirch 1997a; 1997b) has highlighted the degree of human impact on the island's environment. For example, following the arrival of people, 8 of 13 of the land birds and 3 of 9 species of sea birds that were present at the time of human arrival were lost (Steadman and Kirch 1990), and there were devastating declines in populations of fruitbats and of marine resources. Forest clearance and increased erosion rates also dominate the palaeoenvironmental records (Kirch 1996; 1997a) and human impact on both forests and native birds appear to have been swift and absolute, similar to on Easter Island (Steadman and Kirch 1990). In addition, pigs which were a culturally prized food resource were eliminated because they became too competitive with the human population for the same food (Kirch 1997a). Parallels are therefore evident between Mangaia and Easter Island, not only in terms of the considerable reductions in forest cover and natural biotic diversity, heightened soil erosion and increased fire regimes, but also in terms of the unchecked population growth, again drawing parallels with Malthusian theory.

### **Population and resources on remote islands: population regulation and sustainability?**

A key question to consider is to what extent the cultural consequences experienced on Easter Island and Mangaia were inevitable, or to what extent people themselves direct their responses to enhance self-inflicted environmental change. Evidence from Easter Island and Mangaia suggests that people overexploited their resource base leading, perhaps somewhat inevitably, to a devastating population crash and social stress. However, evidence from the island of Tikopia in the southwest Pacific illustrates that despite significant environmental impact and erosion, comparable with that of Easter Island and Mangaia, significant cultural collapse *can* be partially prevented by the direct actions of the islanders. Tikopia is a small (4.6 square kilometres), isolated island, yet at its peak its population has reached as many as 1700 people, and the island has supported continuous occupation for over 3000 years. Initial human impacts of forest clearance, burning, and increased erosion and the exploitation of wild foods such as sea and land birds, fruit bats, fish, shellfish and sea turtles, led to depletion of the island's biodiversity including extinction of the population of fruit bats and five of Tikopia's bird species (Kirch 1997a) (Figure 3.5). Less than a millennium after human settlement, the quantities of fish and bird bones being deposited in middens had declined by a factor of three and molluscan remains by a factor of ten (Kirch 1997a), indicating a significant reduction in available wild food resources. Pigs, which were introduced by the first settlers and were culturally important, were increased significantly as other natural protein sources were reduced and this caused further environmental pressure. However, rather than a situation of conflict and population collapse developing, the islanders

initiated active measures which allowed a steady population to be sustained. For example, native trees were replaced by extensive orchards that provided edible fruits and nuts, and around 1600 AD all the island's pigs were killed in a decision made collectively by the islanders in order to reduce environmental pressures (Diamond 2005). Population control and regulation was also applied, through wide-ranging methods including infanticide, abortion, celibacy and ritualised suicide. Despite environmental stress, the population of Tikopia was sustained, but only as a result of adaptation and decision-making made collectively by the population.

Overpopulation and the associated over-exploitation of environmental resources is a considerable issue for many Oceanic islands and may also be significant in the North Atlantic islands. Population pressure (or conversely a lack of population with which to carry out subsistence activities) can be identified as a circumstance whereby people put unsustainable demands on island environments. Discussion of population-environment linkages in the North Atlantic islands are discussed in chapter 8.

### **Inherent sensitivity of island ecosystems**

Although many environmental impacts on Oceanic islands can be related to human arrival, the scale and extent of human impact may not be entirely dependent on the impacts themselves but may be connected to the island's inherent disturbance potential, i.e. the intrinsic fragility, sensitivity or vulnerability of the island environments. For example, the biota of low latitude oceanic environments is more sensitive to human disturbance than those in the North Atlantic, as a result of their geological stability and biotic evolution over a long period of time and the evolution of endemic species (Cronk 1996). The inherent fragility of several of the Pacific islands has been considered in a paper by Rolett and Diamond (2004) who examined nine environmental variables; rainfall, elevation, area, volcanic ash fallout and Asian dust transport, the presence of *makatea* (upraised reef limestone) terrain, latitude, age and isolation, and used these to model the intrinsic fragility of the island ecosystems. On the basis of these variables, Easter Island with low tephra and dust fallout, an isolated position at relatively high latitude, the absence of *makatea* and terrain that is low and dry, was exemplified as an inherently fragile island and would therefore be expected to be more vulnerable than other islands to human impact. Accordingly, Rolett and Diamond (2004) suggested that the massive scale of environmental and cultural deterioration on Easter Island was not a result of imprudent decision-making on behalf of the population, but because the settlers faced one of the Pacific's most fragile or sensitive environments. Although inherent environmental sensitivity may well be a circumstance under which people put unsustainable demands on island environments, it has been demonstrated, for example,

in the case of Tikopia that the actions of people are also important, and that effects of human impacts can not be assigned entirely to inherent environmental sensitivity.

Inherent environmental sensitivity may also be a factor that has influenced landscape impact in North Atlantic islands, as specific variables, such as climate or geology, might make certain North Atlantic islands more sensitive to change than others. Therefore, it will be crucial to consider the pre-colonisation landscape of the Faroe Islands in order to determine the influence of environmental sensitivity on the degree of human impact, in addition to the actions or adaptations that people implemented in order to deal with such impacts. This issue is discussed in chapter 7.

### **Climatic change on islands**

Climatic changes occur at time scales ranging from millions of years to annual variations, but in terms of human communities and populations climate changes on a century to decadal scale are most significant. At this scale, extremes of climate may affect individuals and small family groups, but does not necessarily impact island communities. Societies are likely to survive even when the loss of individuals is high, because most of the time strategic responses and cultural buffers intervene between communities and catastrophes (Dincauze 2000). However, islands are particularly vulnerable and susceptible to disturbance, not only to that caused by people but also to natural disturbance such as climatic change. Depending on the size and geographical location of an island, different factors may assume importance in terms of climate, such as temperature, rainfall, storminess or windiness. A further consideration is that the variability, intensity, spacing and frequency of adverse climatic events assume greater importance than absolute temperature or rainfall variability when examining the interactions between climate and people (Dugmore *et al* 2007a).

Most Pacific islands lie within the tropical to subtropical range of climate, so although temperature change is the most significant climatic factor for North Atlantic islands, adequate rainfall is the most significant climatic factor for agricultural populations of Oceania. Although most Pacific islands receive adequate precipitation for agriculture, ENSO (El Niño Southern Oscillation) events may cause short-term changes in the Pacific island climatic regime, resulting in droughts in the western and central Pacific, and heavy rains, floods and increased cyclone frequency in the eastern Pacific. Short-term climatic shifts may also devastate fish populations and the seabirds that depend on them (Kirch 2000), with ramifications for the human populations dependent on these resources as food. However, Flenley and Bahn (2002) have illustrated that although an island's resources may vary in relation to periodic droughts, and that crisis may be reached in a drought year, drought is probably not the underlying cause of such a crisis.

While most researchers accept that human impact has caused the most significant changes to the vegetation and landscape of the Pacific islands over the settlement period, others have emphasised the impacts of natural change, such as the climate shifts caused by ENSO events (Nunn 1990; 1991; 2003). Yet although climatic shifts are important on a short-term scale with regards to impact on human populations, it is questionable whether climate change alone could have caused the scale of impacts observed in the palaeoenvironmental records of Pacific islands, which indicate large scale changes in soil cover and vegetation. Other extreme natural events, such as volcanic eruptions or tsunamis, may also have short-term impacts within the period of human occupation (Kirch 2000), but again, it is not obvious how these short-term impacts would have affected Pacific island environments to the degree illustrated by palaeoenvironmental records. Natural changes such as subsidence, tectonic uplift and sea level change might be significant on longer-time scales for a small number of islands (McNeill 2001), but probably not within the time-scale of human colonisation.

The overwhelming evidence from human-environment research on Pacific islands suggests that people have caused large scale environmental change, in some cases leading to environmental and cultural collapse. Although climate impact may not have been a significant factor in the human-environmental history of the Pacific islands, it will need to be assessed as to how the impacts of climate could cause people to make unsustainable demands on North Atlantic island environments, because of their geographic situation spanning key climatic and ecological thresholds.

### **Summary: A global model of island colonisation and human impact?**

Although the outcomes on Pacific islands exemplify the significance of human impact on island environments, palaeoenvironmental evidence of deforestation and slope erosion in Iceland suggests that human impact in the North Atlantic islands may have been as great as that in the islands of Remote Oceania. It is therefore assumed at the outset of this research (refer to aims and hypotheses in chapter 1) that a model based upon the degradation of island soils and vegetation caused by human colonisers could be applied to a wide geographical variety of island colonisations encompassing the North Atlantic as well as the Pacific. Although the patterns of prehistory and the environments of the world's islands are diverse, and nearly every island is in one way or another a special case (Dewar 1997), when compared, many extreme examples of human-environment interactions of island colonisations encompass the universal themes and wider significance of colonisation, long-term settlement and subsistence. Through a study of the circumstances by which islands in the North Atlantic were colonised, specifically the Faroe Islands, this study will assess if an understanding of a unique island in the North Atlantic can be applied, and contribute to, the

development of a North Atlantic, or even global model of island colonisation. Within this model the following factors will be considered;

- The nature and importance of the long-term exploitation of birds and marine resources
- The importance of introduced domesticates
- The limited availability of fuel and building resources
- The role of population control by disease
- The degree of isolation and history of communication and outside contact
- The impacts of climate change and the significance of climatic thresholds
- The levels of extinction and reduction of biological diversity
- The degree of material/cultural competitiveness
- The degree of cultural/population collapse

Some of these factors have been considered above in relation to Polynesian islands and will be discussed in relation to the North Atlantic islands in chapters 7 and 8.

### **Chapter summary**

This chapter has introduced some important factors to be considered when viewing islands as representations of model systems for investigating human-environment relationships. Islands make ideal field locations to research interactions between people and their environment because of their manageable size, isolation, relatively short human histories and limited cultural and ecological complexity. This chapter also summarised results of recent research carried out on remote islands, including on Easter Island, Mangaia and Tikopia in Polynesia. The recurring conclusion of recent research is that most island environments are characterised by significant and detrimental human impact, beginning with initial colonisation and in some cases leading to cultural stress. These conclusions form an overarching hypothesis that human impact on island environments is significant and detrimental. This thesis is approached against the backdrop of this overarching hypothesis.

The following chapter considers the Faroe Islands and the wider North Atlantic region within the framework of the wider literature, outlining environmental and cultural factors in their spatial and temporal context.

## Chapter 4

### North Atlantic context: environmental trajectories and cultural change

#### Introduction

This chapter considers the geographical and historical context of the Faroe Islands within the wider North Atlantic region. Part one considers the specific climatic factors that are a consideration in the North Atlantic and examines how climate factors might act at different cultural, temporal and spatial scales. Part two outlines the geographical and ecological contexts of the Faroe Islands and Iceland, where original data was collected. Part three presents a brief synopsis of Faroese history, while parts four and five explore the historical context of North Atlantic colonisation and present an overview of Faroese and Norse subsistence practices over longer-term settlement. Part six concludes the chapter with a summary of recent research regarding human impact on North Atlantic island environments.

#### Background to North Atlantic research

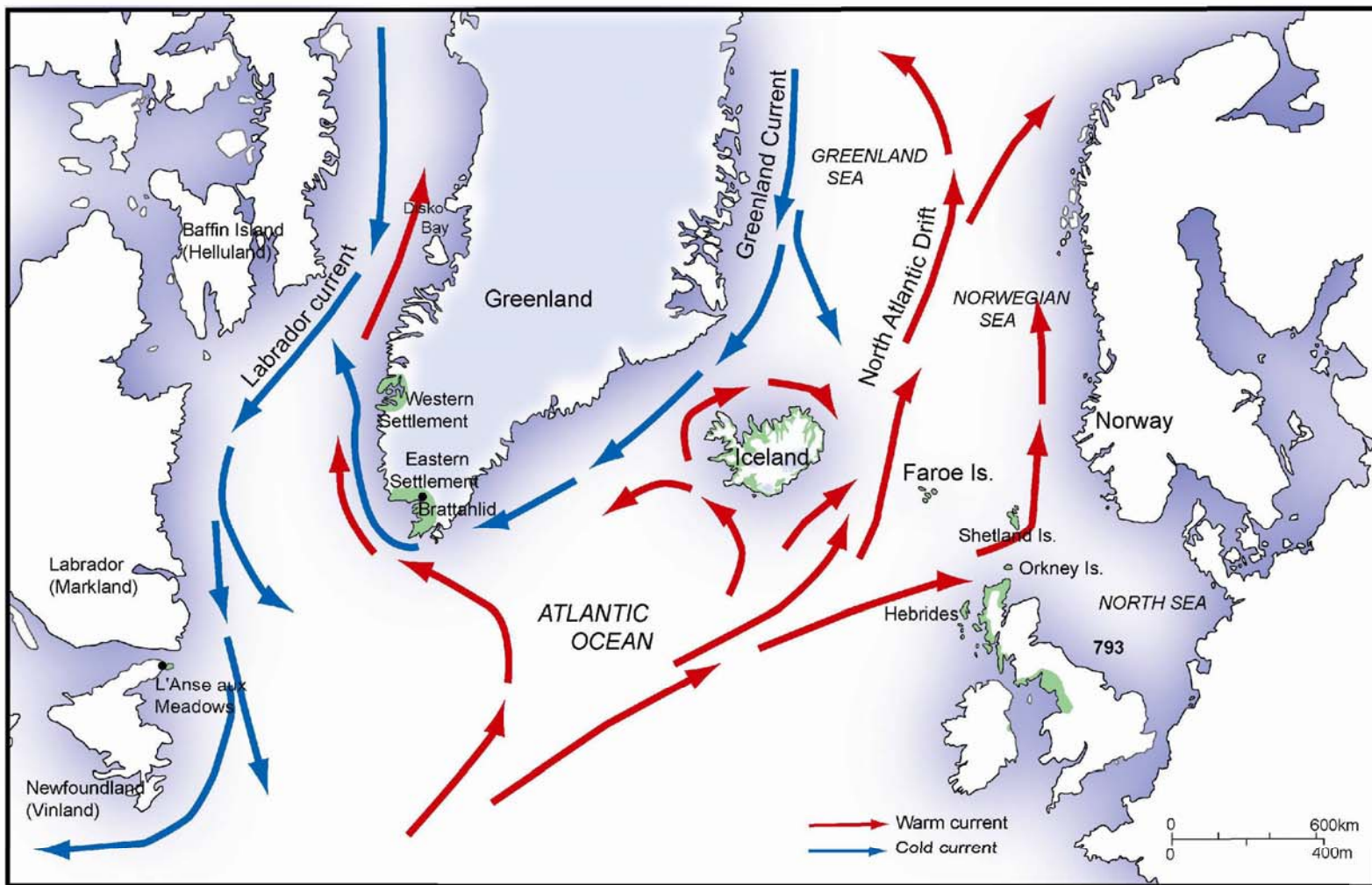
Research on islands has been predominantly limited to the Pacific islands and island chains like the Aleutians and Caribbean islands and although the archaeology of the Norse North Atlantic has a long scholarly history, the region has only recently emerged as a well-defined area of international interest (McGovern 1990). Iceland has been relatively well researched particularly in relating the archaeology to the Sagas, and more recently using the method of tephrochronology, whereby volcanic ash has been used to date archaeological and environmental contexts. Norse Greenland has been researched relatively extensively (Keller 1989, Albrethsen and Arneborg 2004, Dugmore *et al* 2007b), although there is significant unevenness in emphasis, in terms of areas studied, methods used and when studies were carried out. Despite these limitations, far more has been achieved in terms of Norse Greenland research than in terms of Norse Faroes research (Hannon *et al* 2001; 2005, Hannon and Bradshaw 2000). The Faroes were the first of the North Atlantic islands to be colonised by the Norse and they occupy an important setting from which to model the development and adaptation of Norse colonisation and adaptation westwards. The Faroe Islands represent the first “stepping stone” on an environmental gradient across the Atlantic, and were the first “pristine” landscape to face the Norse settlers on their westwards colonisation. The Faroe Islands, therefore, may pose unique questions with regards to understanding the degrees of success of Norse settlement in the North Atlantic islands.

Although perhaps less seductive than the islands of Remote Oceania, the North Atlantic islands are equally significant in assessing issues of environmental change and impacts of

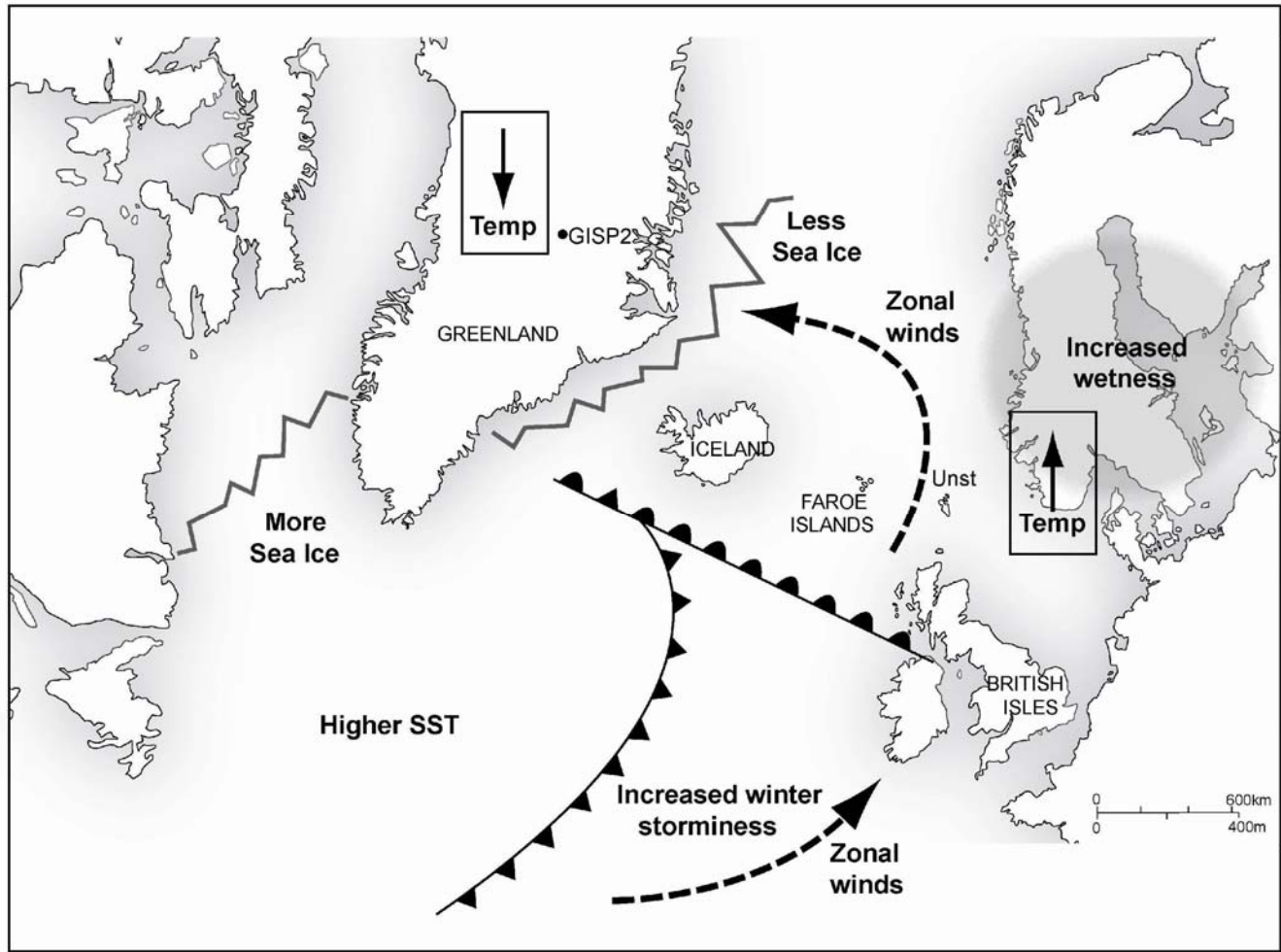
people on the environment. The islands of Shetland, Orkney, Western Isles, Fair Isle, St Kilda and the Isle of Man have human histories spanning back thousands of years to the Mesolithic, with the legacy of a relatively complex multi-cultural history. In the Faroes, Iceland and Norse Greenland, the cultural record is well constrained as the islands have relatively short human histories of c.1200 years, approximately coincidental with the timing of settlement of islands in Remote Oceania. Uniquely, the timing of settlement in the North Atlantic islands is alluded to in historical sources; in Iceland contemporary written accounts are available that document some aspects of the North Atlantic society, as well as the societies of the partners they traded with (e.g. Friðriksson 1994, Karlsson 2000, Vasey 1996, Vésteinsson 2000). Although the timing of colonisation of Iceland and Greenland is relatively well known, in the Faroe Islands, as in many Pacific islands, the timing of colonisation is poorly constrained or unknown (Anderson 1995, Newnham *et al* 1998). The position of the North Atlantic islands is also advantageous to assessing the impacts of climate on people, as they lie at the meeting of warm and cold air and ocean masses, and beneath a variable storm track, rendering them particularly sensitive to climatic change. Furthermore, environmental changes such as soil erosion can be well constrained, particularly in Iceland where tephra provides a high resolution chronology, with possibilities for correlation across the North Atlantic region using microtephras in Faroese peat and tephra particles and acidity peaks in Greenland ice cores.

#### 4.1 North Atlantic climate systems

The climate of the Faroes and Iceland is distinctive for its northern latitude. The islands lie close to the Polar Front at the meeting of warm and cold air masses and are also situated at the convergence of warm waters brought north by the North Atlantic drift and cold polar currents moving south off the east of Greenland (Figure 4.1). The Faroes, Iceland and Greenland are affected by the North Atlantic Oscillation (NAO), which is a large-scale mode of natural climate variability that has important impacts on the weather and climate of the North Atlantic region, particularly winter climate variability (Figure 4.2). The NAO is characterised predominantly by cyclical fluctuations of air pressure and changes in storm tracks across the North Atlantic. A Positive NAO index phase shows a stronger than usual subtropical high pressure centre and a deeper than normal Icelandic low, resulting in more and stronger winter storms crossing the Atlantic Ocean on a more northerly track. This results in warm and wet winters in Europe and in cold and dry winters in northern Canada and Greenland. A negative NAO index phase results in a weak subtropical high and a weak Icelandic low, with the reduced pressure gradient resulting in fewer and weaker winter storms crossing on a more west-east pathway, bringing cold air to northern Europe. The oceanic climate of the Faroe Islands produces windy, humid and changeable weather, with cool summers and mild winters. The dominant aspect of the Faroese climate is storminess;



**Figure 4.1:** The movement of ocean currents in the North Atlantic. After Pinet (1992).



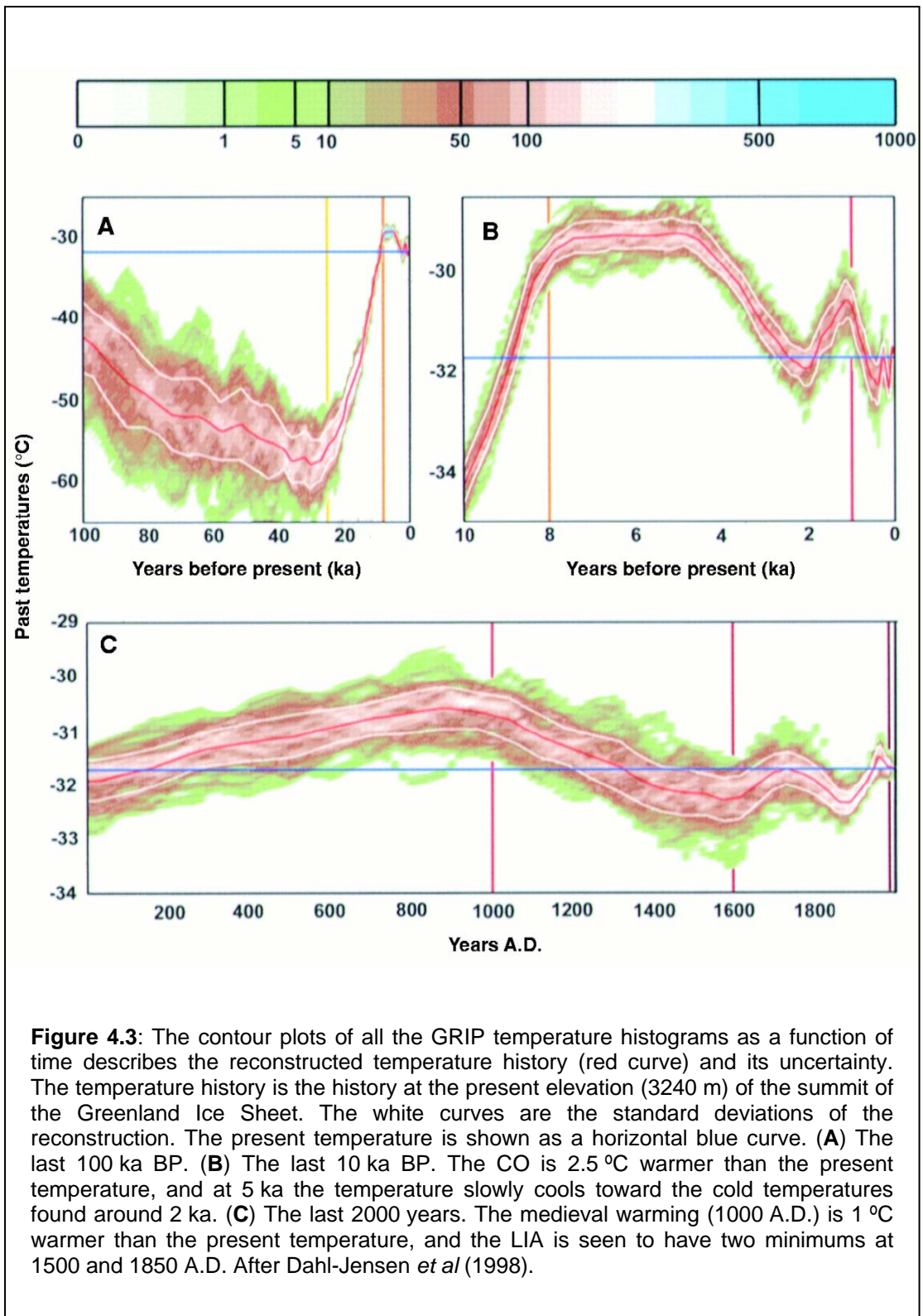
**Figure 4.2:** Regional variability of winter weather and climate across the North Atlantic during a positive phase of the North Atlantic Oscillation (NAO). After Dugmore *et al* (2007a). Refer to text for a more detailed explanation.

cyclones and depressions are common, precipitation is registered on three out of every four days and fog is especially commonplace. Wind strength and exposure are also significant features of the Faroese climate, especially affecting higher altitudes. In Greenland, owing to its situation where the Atlantic meets the Arctic Ocean, cold ocean currents constantly cool the coast. This, together with the radiation of cold from the inland ice, gives Greenland its Arctic climate, which is significantly different from that of Iceland and the Faroes. This climatic variation would have been important to the settlers colonising first the Faroes, then Iceland and Greenland, because as they moved and settled across this climatic gradient, from warmer maritime to cooler continental climates, they would have experienced a corresponding reduction in growing days for crops, fodder and grazing. Therefore, by the time the Norse reached Greenland, their pastoral economy was close to its environmental limit. Because they are environmentally marginal for Norse subsistence agriculture, the North Atlantic islands are ideal locations for demonstrating the impacts of change and thresholds. Less environmentally marginal areas (for pastoral farming) will be largely unaffected by significant climatic changes, but environmentally marginal areas can be affected by relatively minor changes, which are recorded by shifting local thresholds. The North Atlantic islands are also ideal for exploring the circumstances under which adaptations may or may not be made, which relates critically to the question of why people put unsustainable demands on island environments.

#### **North Atlantic pre-colonisation climate trajectories**

The Holocene was traditionally regarded as a period of stable climate, but historical and proxy data reflected in forest limits (Briffa 2000), peat profiles (Barber *et al* 1994), isotopic traces from Greenland ice cores (Johnsen *et al* 2001), ice-rafted debris (Bond *et al* 1997; 2001), glacial fluctuations (Matthews *et al* 2000, Barlow 2001), foraminifera and diatom records (Jennings and Weiner 1996, Jiang *et al* 2002, Birks and Koç 2002) as well as historical accounts and wine harvest records, have revealed high-frequency Holocene climate changes on both regional and global scales (e.g. Jensen *et al* 2004). Reconstructions of climate change over the Holocene are presented in Figure 4.3. Although late Holocene climatic fluctuations may be considered minor when viewed in the context of glacial-interglacial cycles (Figure 4.3A), they have had a major impact on the living conditions and cultural decisions of people in the North Atlantic (Ogilvie 1998); changes occurring on multi-decadal and multi-century scales are critical in terms of human colonisation and long-term settlement.

As well as climate changes occurring at these scales during settlement, the identification of climatic shifts occurring prior to colonisation are necessary to establish environmental trajectories upon which subsequent human impacts may be superimposed. Significant



climatic events have been observed during the late Holocene, which may have affected both the pre-settlement environment and the trajectory of settlement itself. In the late Holocene, prior to colonisation of the North Atlantic, fluctuating climatic conditions between c.5000 BP and c.3000 BP have been identified in northern temperate environments with a gradual deterioration in climate becoming progressively marked between 3000 BP and 2500 BP (e.g. Dahl-Jensen *et al* 1998, Møller *et al* 2006, Fredskild 1983, Funder and Fredskild 1989, Kaplan *et al* 2002, Kerwin *et al* 2004, Bond *et al* 1997, Andersen *et al* 2004, de Jong *et al* 2006, Denton and Karlén 1973, Karlén *et al* 1995, Dahl and Nesje 1994). This period has been identified as a late Holocene deterioration (also known as the Sub-Atlantic cooling) and is generally considered to have been cold and humid, with positive anomalies of annual mean precipitation prevailing in most of the Northern Hemisphere (Klimenko 2004). Although this climatic shift would not have directly affected human populations in the North Atlantic islands, as they had not yet been settled, environmental changes caused by a climatic shift may have altered the landscape on which people consequently settled, and may therefore have influenced the type, rate and extent of change caused by people. In other words, changes in the pre-colonisation environment may determine, or at least constrain, the consequent development of settlement and settlement impacts.

#### **Climate trajectories over the period of settlement**

Climate change occurring over the period of settlement that could affect people directly has been a common focus for research strategies seeking possible causal or contributory factors to change or collapse in human landscapes and societies (e.g. deMenocal 2001, Diamond 2005). Temporal links between climate change and cultural change over the period of Norse settlement have frequently been sought, e.g. correlations between Little Ice Age climate fluctuations and the desertion of the Greenland Norse colonies in the 15<sup>th</sup> century, and the large-scale abandonment of farmsteads in 11<sup>th</sup>-12<sup>th</sup> century Iceland (Þórarinnsson 1970, Sveinbjarnadóttir 1992). However, despite suggestions of temporal coincidences between cultural shifts and deterministic factors, chronologies are rarely robust enough to allow causal connections to be maintained. Furthermore, human-environment-climate interactions are complex and climate change is unlikely to be the single determining or dominating factor in Norse North Atlantic cultural development. Past populations can not be presumed to have been the “passive victims” of climate variation, and in any response by people to climate change, issues of perception, adaptation and adjustment require consideration, and may be crucial.

Two principal temperature shifts have been identified in proxy sources over the period of historically dated Norse settlement beginning around 800 AD. During the European Medieval period, an unusually mild and stable naturally forced climatic episode known as the Medieval

Warm Period (MWP) or Little Climatic Optimum has been recorded between c.700-1300 AD, which affected much of northern Europe (Hughes and Diaz 1994, Esper *et al* 2002). The MWP has been linked to Norse expansion and colonisation in the 9<sup>th</sup> century (Ogilvie 1991), following the suggestion that the relatively warm air and sea temperatures and stable climate may have encouraged Norse expansion. A warmer climate would have allowed navigation within northern areas previously prohibited by sea ice (Fagan 2000), and enabled the Norse to extend their farming practices to more environmentally marginal areas because of an increased number of growing days for hay, grass and crops such as barley.

Between the 14<sup>th</sup> century and mid-19<sup>th</sup> century, a significant North Atlantic climatic shift reversed the warm, stable climate of previous centuries, introducing conditions that were colder and wetter than previously, and more unpredictable. Known as the Little Ice Age (LIA), this period has been recognised in several palaeoenvironmental records, and across a wider spatial area than the MWP (Grove 1988, Mann *et al* 1998, Jones *et al* 1998, Bradley and Jones 1993, Hughes and Diaz 1994, Crowley and Lowery 2000, Lassen *et al* 2004). Proxy evidence reveals not only that average temperatures decreased, culminating in a period of prolonged cold between the 18<sup>th</sup>-19<sup>th</sup> centuries, but also that relatively short periods of harsh climate occurred periodically alongside an increase in extreme climatic events. Within these years, drift ice extended to the south, reaching the north coast of Iceland, and around the eastern side to Iceland's southern shore in exceptionally cold years (Fagan 2000, Ogilvie 1992). The impact of decreasing temperatures would have impacted the pastoral farming Norse populations by shortening the growing season and the productivity of fodder and grazing land, and diminishing the ability to feed stock, for example (Parry 1981). The distribution and migration of fish may also have been modified (Grove 1988), diminishing peoples reliance on fishing at a time when farming was becoming more difficult. Reduced temperatures and increases in sea ice in the North Atlantic would also have hindered trade and communication between the islands and the mainland.

### **Climate-people integration**

The actual effect of climatic shifts on a given social unit depends not just on temperature increases or decreases, but on the intensity, spacing and frequency of adverse climatic events (Abel 1980, Jordan 1996, Berkes *et al* 1998). In order to integrate climatic shifts with cultural scales of change, Dugmore *et al* (2007a), have evaluated proxy climate evidence for the period of Norse North Atlantic settlement utilising the cumulative deviations from the mean, calculated from the Greenland ice core storm frequency proxy (GISP2 Na<sup>+</sup>) and sea ice proxy (GISP2 chloride excess) (Meeker and Mayewski 2002). Not only are these indicators of more relevance to climatic changes in the Faroe Islands, because they track the polar front that affects the North Atlantic, rather than specific temperature changes that may

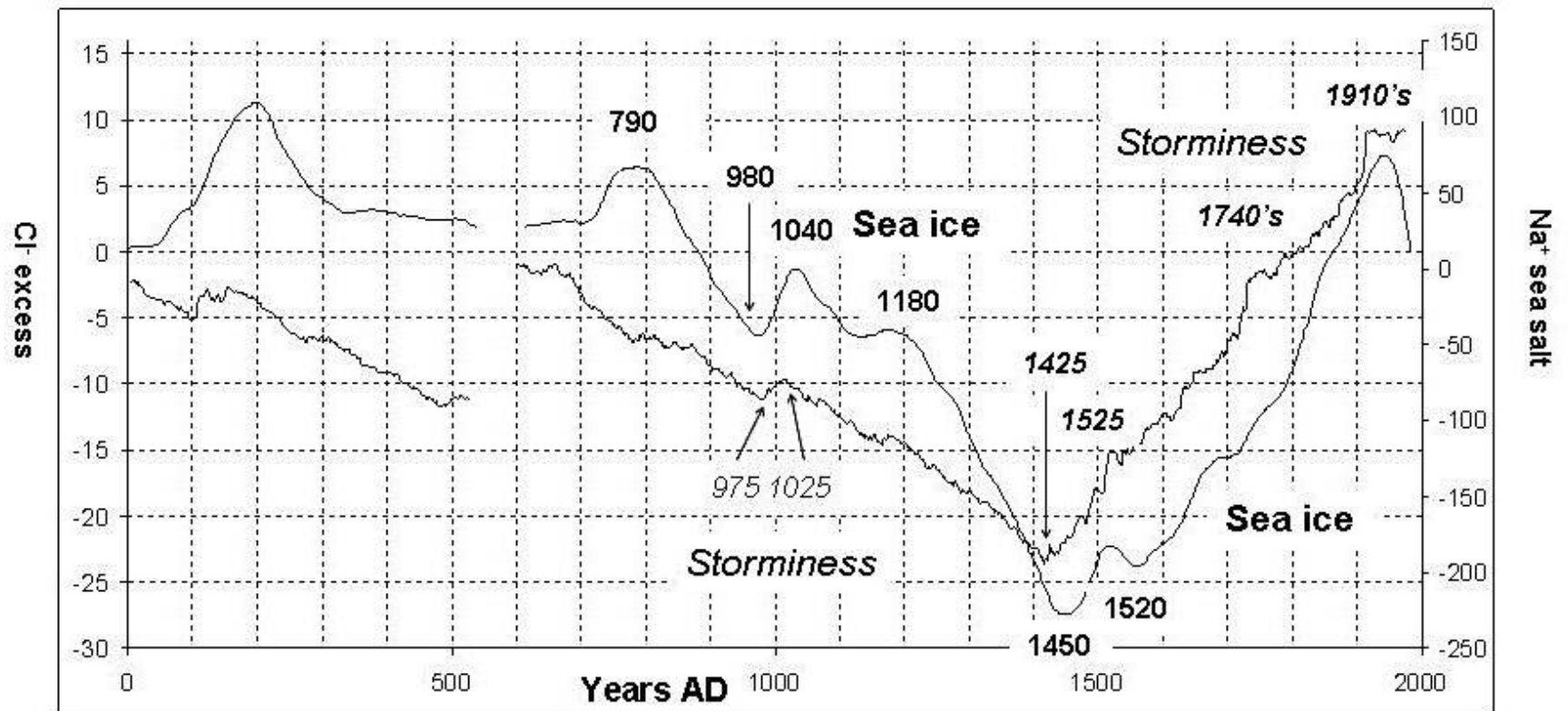
be more localised, but they are also more relevant to the context of human landscapes, settlement and responses than climate evaluations of deviations from the mean. The cumulative measure is appropriate because cultural memories, which are retained through personal experience, oral histories and written records, guide or influence human-interactions with the environment and are more significant when dealing with impacts on populations and long-term settlement.

The cumulative record identifies key shifts in the North Atlantic climate in 975 and 980 AD, 1180, 1425 and 1450, 1520 and 1525 AD (Dugmore *et al* 2007a) (Figure 4.4). Perhaps the most significant period is the turnover of the climate trajectory in 1425 AD, when the cumulative record of Na<sup>+</sup>, mirrored closely by the cumulative sea ice proxy, shows a sharp shift to deteriorating climate conditions, reversing the trend of warm, stable climate that had been established over the previous 200-400 years and encompassing the memories of several generations. The Norse had to anticipate year on year climate according to the climate of past experience and what was known through oral history, so immediately after colonisation of the islands, and for several generations after, the settlers would have adapted their agriculture and economy to the warm, but as far as they were concerned, stable or “normal”, pre-1425 conditions. A sudden turnover in the climate system in the 15<sup>th</sup> century that reversed the warming trend would not have been predictable and would have left the Norse unconscious of the overall trajectory of change.

Therefore, although it is possible for human populations to adjust to a consistent decrease in temperature, the variability of adverse events in the LIA might have made year by year climate changes difficult to predict and to take effective measures against. In this context it is important that although the literature has identified the 18<sup>th</sup> century as the coldest period of the LIA, the cumulative deviation measure gives most prominence to 15<sup>th</sup> century climate changes. Although colder, the 18<sup>th</sup> century occurs within a period of progressive cumulative change, which may have been easier to predict by human populations and possibly have been adapted to. So circumstances by which people make unsustainable demands on island environments may be explained in terms of either/both extreme events and their impacts, or shifts in long-term trajectories of change.

### **Climate and landforms in the Faroe Islands**

Detailed climate data for the Faroe Islands is limited to meteorological observations initiated in Tórshavn in 1867 and analyses of this climate data in relation to geomorphic activity (Humlum and Christiansen 1998a; 1998b), agricultural production (e.g. Guttesen 2001, Haahr 1996) and vegetation dynamics (e.g. Fosaa 2003, Fosaa *et al* 2004). In terms of human-environment research, climate data is important in order to analyse the climatic



**Figure 4.4:** Cumulative records of annual deviation from the long-term mean of the time series for proxy records of Greenland Sea/Davis Strait sea ice extent and North Atlantic storminess. The cumulative measure is appropriate, because it details changes in climate that would have been responded to by human populations, at a scale representative of cultural memories and personal experience. After Dugmore *et al* (2007a).

contribution to landscape change and changing soil cover, as in addition to people, climate is a significant driver of change. Therefore, in order to understand the human influence on landscape change, knowledge of the climate and its effects on vegetation and landforms is required. Humlum and Christiansen (1998a; 1998b) have identified a modern lower limit for periglacial activity within an altitudinal range of 250-450 m, corresponding to a mean annual air temperature (MAAT) of 5-3.5°C. During the cold intervals of the Little Ice Age, assuming a lowering of MAAT of 2-3°C (Lamb 1989), the lower limit for periglacial activity may have temporarily approached sea level in exposed regions (Humlum and Christiansen 1998b). Humlum and Christiansen (1998b) hypothesise that the number of growing degree days (GDD) and the frequency of freeze-thaw events, in particular, control the lower limit of modern periglacial activity. The presence or absence of a plant cover, which is partially dependent on temperature and GDDs, can control the development of small scale patterned ground (Ballantyne 1996). Periglaciation affects upland areas from 250-450 m, but is modified as a result of vegetation cover. Therefore, the circumstances under which climate can influence the altitudinal limits of periglaciation during the Little Ice Age, for example, is in turn influenced by the extent of vegetation cover. In the absence of grazing mammals, the signal expressed by landforms as a result of climate change is muted, because vegetation exerts a diminishing affect on periglacial processes, inhibiting the impact of climate change. With the additional impact of people and grazing mammals on vegetation, landscapes can be influenced to a greater degree by periglaciation.

With the limited climatic data available for the Faroes, climate modelling can be a useful tool in helping to understand potential temperature changes and impacts on vegetation and landforms (and periglacial limits). A climate model has been produced for the Faroe Islands based on a climate model for Iceland (Casely 2006, Casely and Dugmore in press) and utilising modern meteorological data from weather stations (Danish Meteorological Institute 2007) and specific field research (e.g. Humlum and Christiansen 1998b).

## **4.2. North Atlantic environmental context**

### **The Faroe Islands**

#### *Faroe Islands geography and environment*

The Faroe Islands lie in the North Atlantic between 61° 20' and 62° 24' N and 6° 15' and 7° 41' W, approximately halfway between Scotland 350 km to the south, and Iceland 450 km to the northwest. The archipelago consists of eighteen islands, all but one which have been inhabited, and some small islets, altogether covering 1397 square kilometres (refer to Figure

1.6). Most of the islands have an elongated form, and the islands and the sounds between them generally run in a NNW-SSE direction. The Faroe Islands are mountainous with extensive sea cliffs that provide a good habitat for birds, and the average height of the Faroes above sea level is 300 m, with most of the country lying at an elevation of between 300 m to 700 m. The highlands rise from 400 m to 600 m in the southern part of the islands to almost 900 m in the more mountainous northern islands. The majority of the country lies above an altitude suitable for cultivation, while lower altitudes are dominated by peat moorland. Only a small fraction of the islands has ever been cultivated and only 2.14 % of the land is utilised as arable today (CIA World Factbook 2007).

The Faroe Islands originate as the more mountainous areas of a submarine ridge formed by volcanic action in the Tertiary that connects Scotland with Iceland, Greenland and Svalbard. Successive sheets of lava were laid over one another at long intervals of time, with shallow beds of tuff, derived from volcanic ashes, deposited between them in the interim (Williamson 1948, Rasmussen and Noe-Nygaard 1970, Berthelsen *et al* 1984). The differential resistance to erosion of the lavas and tuffs has resulted in the characteristic “stepped” profile of the Faroese landscape. The exposed edges of the lava flows form rocky walls (*hamar*, *pl. hamrar*) (Figure 4.5), which alternate with grassy shelves, where less acidic tuff and basalt has been worn down to form a thin, relatively fertile covering of soil that offers well drained grazing land (Williamson 1948, Jóhansen 1985).

The cirques and fjords that typify much of the Faroe Islands have been formed by erosional processes during the last glaciation (Humlum 1996). Several local ice caps accumulated in the Faroes, covering the landscape to about 700 m in the north central part of the islands, with the tops of the mountains remaining ice free (Warming 1901-1908, Jørgensen and Rasmussen 1986). Conventional dating of moraine systems in the Faroes has not been successful and the date when the Faroe Islands became ice-free is unknown. On human time-scales, Holocene landscape processes, such as solifluction and frost shattering, are more important, especially in connection with feedbacks between vegetation and geomorphological processes, particularly at higher altitudes that might be used for sheep grazing. Over the Holocene, impacts of frost action and post-glacial erosion have been widespread and high plateaux are today characterised by block fields of frost-shattered stones and rocks. Steep slopes are characterised by irregular, unsorted accumulations of talus and scree with tongues of solifluction material typifying gentler slopes (Humlum 1996). River erosion is significant at lower altitudes, and in some places has been powerful enough to expose the underlying basalt bedrock, re-deposit glacial and sub-aerial debris cover and form gullies and channels (Humlum 1996). Although streams in the Faroes are small in size and cover only short distances, the narrow physiography of the islands and excessive rainfall equips even the small streams as powerful drivers of geomorphological change (Geikie



**Figure 4.5:** *Hamrar*, or basalt rock ledges/exposures, separated by grassy slopes formed by the breakdown of tuff.

1880).

#### *Faroe Islands biogeography*

The Faroese soils have originated from the weathered and eroded basalt bedrock and are fine and reddish brown in colour and strongly acid, with a mineral portion high in silt and low in clay-sized particles. Upland soils are more minerogenic due to the more rapid erosion at high altitudes where vegetation is limited (Højgaard *et al* 1989). Lowland soils are mostly organic, with the development of peaty soil aided by excessive moisture, low temperatures and a close covering of plants with interwoven roots, which hinders the access of air (Warming 1901-1908). Peat deposits can extend several hundred meters upslope, but are generally thin, less than 1-1.5 m. Prior to the onset of peat growth, in the early Holocene (10-9 ka BP), plant species such as *Betula nana* (birch) flourished under a more Arctic to Sub-arctic climate (Jóhansen 1985), but the onset of more oceanic conditions between 9-8 ka BP, led to the expansion of plant species including *Juniperus* (juniper) and *Salix* (willow) together with tall herb vegetation and grass heaths over the lowlands (Humlum and Christiansen 1998b). The accumulation of peat began around 8 ka BP and intensified between 5-2.5 ka BP as conditions became cooler and wetter, reducing the frequency of *Juniperus* and *Salix* (Humlum and Christiansen 1998b). The arrival of the Norse and grazing mammals in the 9<sup>th</sup> century initiated a general change in vegetation (Jóhansen 1985); shrub vegetation and tall herbs disappeared and cereals and weeds were introduced (Malmros 1990).

Tree growth in the Faroes is insignificant, partly as a combined result of relatively low summer temperatures, fog, rain, limited sunshine, strong winds and salty air, and partly as a result of the limited nature of biota due to glaciation and isolation (Cronk 1996, refer to Tables 3.1 and 3.2). Shrub cover is restricted to *Juniperus*, *Salix*, and dwarf shrubs including *Calluna vulgaris* (ling heather) and *Empetrum nigrum* (crowberry). The suggestion that woodland cover was more extensive immediately prior to settlement is, however, debated. Mahler (1991) and Jóhansen (1985) dismiss pollen in peat and lake-sediment sequences as a product of long-distance transport and suggest that prior to the arrival of people, the Faroes had little forest cover apart from willow, with birch probably being restricted to some sheltered areas away from salt spray. Hannon and Bradshaw (2000) alternatively suggest that *Juniperus*, *Betula* and *Salix* were more common prior to settlement, citing the discovery of macrofossil evidence of *Betula pubescens* at Eiðisvatn on Eysturoy dated to c.2300 BC (Højgaard *et al* 1989, Geikie 1880), and beneath the Viking site of Argisbrekka dated to between 2460 BC and 770 AD (Malmros 1990). If birch and juniper were once more abundant, it is queried as to what caused their subsequent decline. Højgaard *et al* (1989) suggest that birch might have persisted up until the timing of colonisation, implying that

settlement, particularly sheep grazing, led to its disappearance. Hannon *et al* (2001) assert that pollen records of primarily non-forested landscapes can be difficult to interpret, establishing through macrofossil evidence that *Betula*, *Salix* and *Juniperus* woodland was already degenerating into peatland and heathland prior to 9<sup>th</sup> century Norse settlement. Results from Gróthúsvatn on Sandoy also show that shrub woodland decreased in the late Holocene, as conditions became wetter, suggesting climate change as an alternative explanation to human intervention (Hannon *et al* 2001). It seems likely that prior to settlement, there were at least scattered woodland communities in favourable, protected sites, but that no forest dominated landscapes existed in the Faroe Islands as they did, for example, in Iceland (Hannon and Bradshaw 2000, Lawson *et al* 2005).

Most terrestrial fauna of the Faroe Islands has been introduced by humans, as prior to colonisation there were no indigenous terrestrial mammals as a result of the impact of glacial cycles, the isolation of the islands and the lack of natural habitats. Cattle, sheep, goats, pigs, horses and dogs were brought to the islands with the initial Norse settlers, while rats, mice and hares were introduced later. Like many remote islands, fauna in the Faroes is dominated by birds, predominantly sea birds, including puffins, guillemots, razorbills and gulls. Seabirds were utilised by the Norse for their meat, oil and feathers, with fowling playing an important part in Faroese subsistence and to some extent, economy. Marine mammals including pilot, bottlenose, fin and orca whales, dolphins, porpoises and non-migratory grey seals, are also common around the Faroes. Pilot whales have played a particularly valuable role in terms of Faroese subsistence. The first description of a Faroese *grindadráp* (pilot whale drive) dates back to 1584 AD (Bloch 1994, Schei and Moberg 2003), although the practice probably began much earlier (Joensen 1976). Seal oil was a valuable source of revenue for some Faroe Island communities. Fish and shellfish have been plentiful around the Faroes and although fishing did not become a commercially driven enterprise until the nineteenth century, fish has provided an additional subsistence food resource since Norse colonisation (Lawson *et al* 2005, Church *et al* 2005).

## **Iceland**

### *Icelandic geography and environment*

Iceland is located between latitude 63° 23' to 66° 32' N and longitude 13° 30' and 24° 32' W with Greenland lying 286 km to the northwest and Norway 950 km to the east. At 103,000 square kilometres, Iceland is the second largest island in Europe with a total land area nearly 75 times that of the Faroe Islands. Only 24 % of Iceland's land area is at an altitude less than 200 m and suitable for habitation (CIA world Factbook 2007). Over 50 % of the land is higher than 400 m, some of which is covered by large ice caps, with the remainder forming inland

deserts and mountain ranges. The inhabitable lowland areas are principally located along the coast and on a number of small plains and valley systems that stretch into the interior (Vésteinsson 2000).

Apart from the geologically older areas of Iceland in the east and northwest, where the stepped profile and deep fjords and bays that characterise much of the Faroes can be observed, the geology of Iceland contrasts with that of the Faroes as one of the youngest and most volcanically active landscapes in the world (Saemundsson 1979). This is a result of Iceland's position on the Mid-Atlantic Ridge, where the American and Eurasian continental plates diverge to produce a relatively high degree of volcanic and earthquake activity. Volcanic eruptions occur once in every five years, on average, and shape the environment and people not only through direct effects of their eruptions, but indirectly by depositing large quantities of tephra, which impacts the soil cover.

As well as impacts caused by volcanic action, Iceland's geomorphology is also heavily influenced by past and present glacial activity. The disintegration of the last inland Icelandic ice sheet began some time prior to 13 ka BP, followed by a standstill or even advance caused by a colder period around 9.7 ka BP (Ingólfson and Norddahl 1994), and termination of the ice sheet in the central highlands by around 7.8 ka BP (Kaldal and Víkingsson 1991). Since then, more limited glacial advances and retreats have continued to modify the Icelandic landscape. Eruptions of volcanoes that lie beneath glaciers are particularly destructive, causing *jökulhlaups* (large glacial outburst floods), which cause catastrophic environmental change. Permafrost activity, rock avalanche activity, landslides, tephra deposition and soil erosion are significant processes which have affected the late Holocene Icelandic landscape.

#### *Icelandic biogeography*

Soils in Iceland are predominantly silty andisols, although peat is present in some lowland areas. Most of Iceland's soil cover was formed on glacial deposits, with a large input from aeolian deposition. Today, aeolian soils in Iceland are rich in volcanic glass, derived from both primary and re-worked airfall tephra deposits and fines winnowed from sandur plains and proglacial areas (Einarsson 1991, Arnalds 1984; 2004, Arnalds *et al* 1987). This makes them light, friable and sensitive to disturbance and erosion by wind, water and people. Pre-*landnám* upland soils have developed in association with shallow soil profiles and generally lack thick tephra deposits (Dugmore 1987). These soils are more susceptible to erosion and reworking, especially on steep slopes. In comparison, lowland soils develop in more ecologically favourable zones and are more organic, contain thicker tephra layers and are more stable largely due to the existence of woodland scrub vegetation, which stabilises

thicker fallout deposits (Dugmore *et al* 2000). Prior to human colonisation, the soil was kept relatively stable by an extensive vegetation cover. *Betula* woodland began to spread initially around 9 ka BP as the climate became warmer and drier. Between 7-5 ka BP, mire vegetation, with increasing values of *Gramineae* and *Cyperaceae*, expanded, corresponding with a cooler and wetter climate, with birch trees colonising the peat landscape between 5-2.5 ka BP. At around 2.5 ka BP the mires expanded again as birch pollen declined (Einarsson 1968, Hallsdóttir 1987). Birch enjoyed a short-lived period of expansion prior to *landnám* (Hallsdóttir 1987), greeting the new colonisers with a largely forested lowland landscape with extensive vegetation cover in the interior (Ólafsdóttir and Guðmundsson 2002).

Unlike the Faroe Islands, where birch and juniper were probably confined to small stands, forest cover in pre-*landnám* Icelandic lowlands is thought to have been ubiquitous, with birch present at low elevations, and willow and other dwarf shrubs dominant up to an altitude of 300-400 m (Arnalds 1987). Evidence of a forest cover is suggested by remnants of former vegetation, written and historical sources, place-name evidence, palaeoecological evidence and modelling studies (Ashwell and Jackson 1970, Hallsdóttir 1987, Arnalds *et al* 1987, Ólafsdóttir *et al* 2001). An often repeated quote from Ari the Wise in *Íslendingabók* states that Iceland was “covered with forest between mountain and sea-shore” at the time of settlement. However, birch woodland has decreased since the arrival of people from an estimated 25 % to 1 % (Arnalds 1987) and was replaced by grass heaths, meadows and hayfields (Hallsdóttir 1987). Although this change is a rational response to the need to provide grazing land for the pastoralist subsistence base, not all evidence suggests that the decline in birch was primarily initiated by people. Ólafsdóttir *et al* (2001) propose that forest cover began to diminish from 3000 BP onwards, implicating changing climate as opposed to human factors as the primary agent of change, with human impact at *landnám* simply exacerbating an existing trajectory of change. Recent evidence alludes to a sustained, progressive pattern of clearance over centuries connected with the deliberate management and conservation of necessary woodland resources during Norse and early medieval periods (Dugmore *et al* 2006, Mairs *et al* 2006, Lawson *et al* 2005), as opposed to a uniformly widespread, rapid decline after *landnám* (Hallsdóttir 1987). The temporal and spatial patterns of deforestation are important both in terms of understanding the interactions between people and deforestation, and between the timing and significance of soil erosion that is caused in part by deforestation.

Prior to colonisation, the arctic fox and the polar bear were likely to be the only land mammals in Iceland, with all other mammals having been introduced by people, either knowingly or inadvertently. As in the Faroe Islands, early settlers introduced cattle, sheep, goats, horses, pigs and dogs. The lack of predators meant that from the beginning the

settlers could let their stock roam the highlands, although disputes about grazing are a common feature of later Saga Age literature. Birds are, and probably were, numerous and the marine fauna is exceptionally rich compared with northern Europe, with harbour and grey seals, whales such as the minke, and dolphins and porpoise. In contrast to the Faroe Islands, where sea bird colonies were an accessible resource to most farms and villages, the importance of bird colonies in Iceland would have been variable from settlement to settlement because of contrasting geographies and access. This may have been a stimulus to the early development of exchange networks, but also a potential source of conflict and competition. Aside from strandings, whales were also of less importance to Icelandic subsistence than in the Faroes. In the Faroe Islands, pilot whale migration occurs through the inter-island channels giving opportunities to the Faroe Islanders drive them into bays; in Iceland there is a lack of suitable bays for driving. Fish were however a critical resource; marine (especially cod) and freshwater fish (salmon, brown trout and arctic char) are abundant and were utilised by the settlers for subsistence and later, trade.

### 4.3 North Atlantic (Faroe Islands) human context: Overview

The histories of the Faroes, Iceland and Greenland are interconnected, but also have connections with rest of the Nordic world and north-west Europe. As a context for later discussions, the major events in Faroese history and some connections with the rest of Scandinavia (and Europe) from the settlement period to the beginning of the 18<sup>th</sup> century are summarised below (Young 1979, Schei and Moburg 2003);

**c.600-725:** Christian Gaels first go to the Faroe Islands?

**825:** Dicuil states that the Faroes (?) are uninhabited apart from sheep and sea birds.

**c.825:** Grímur Kamban is said to be the first Norse settler in the Faroes.

**c.885-890:** Further settlements of the Faroes under King Harald Hårfagre of Norway. Most of the settlers come from western Norway, but also many from Ireland and Scotland.

**c.900:** The Faroese *Althing* or parliament is assumed to be founded.

**c.999:** The Faroese *Althing* adopts Christianity.

**1026** - King Olaf II of Norway tries to impose Norwegian laws and taxes in the Faroes but fails.

**1035:** End of the Viking era in the Faroe Islands as Tróndur í Gøtu, the last Viking chieftain of the Faroes, dies. Leivur Øssursson becomes a Christian autocrat over the Faroes as feud under Norwegian government.

**c.1100:** The Faroe Islands become a diocese under the archbishopric of Hamburg-Bremen. The Faroese bishop has his seat in Kirkjubøur until 1538.

**c.1104:** The Faroes are transferred from the Archbishopric of Hamburg-Bremen to Lund.

**1152/53:** The Faroes are transferred to the archbishopric of Nidaros (today Trondheim).

**c.1200:** Slavery in the Faroes is abolished.

**1269:** Canon Erlend of Bergen becomes Bishop of the Faroes.

**1271:** A decree is enacted that extends the old *Gulating* law to the Faroes and from this time onwards the Faroese Alting changes from a legislative into a consultative body. The Decree also sets up a trade monopoly between Norway and the Faroes.

**1280:** The first known map (the Hereford map) mentions the Faroes which are called the "Farei".

**1294:** The Hanseatic League is forbidden to trade with the Faroes after which all Faroese commerce had to pass through Bergen, Norway.

**1298:** The Sheep Letter (*Seyðabrævið*) becomes law in the Faroe Islands. Slavery may have been reintroduced, for the sheep letter regulates, among other things, the exposure to slaves.

**1302:** The Hanseatics are again prohibited from trading with the Faroes.

**c.1303:** Bishop Erlend is forced to leave the Faroes and later dies in 1308.

**c.1349:** The plague reaches Europe including Norway and the Faroes. The plague kills between one and two thirds of the population of Norway. In the Faroes the effects of the plague are less well documented but is have thought to have wiped out entire Faroese settlements (Stumann-Hansen 2003).

**1350:** The Dog Letter (*Hundabrævið*) becomes law.

**1361:** The Hanseatic League acquires trading rights with the Faroes, as plague had severely impacted Norway's population.

**1397:** The Faroes come under Denmark with the Union of Denmark, Norway and Sweden, but continued to be ruled as a province of Norway.

**c.1400:** The *Althing* is renamed *Løgting*.

**c.1447:** Bishop Goswin of Iceland, tries to bring the Faroes into his diocese but does not succeed.

**c.1490:** Dutch tradesmen get the same privileges in the Faroe business as the Hanseatic traders.

**c.1500 onwards:** The Faroes are exposed to pirate raids from the British Isles and western France.

**c.1520:** Joachim Wullewever from Hamburg becomes baliff over the Faroes on behalf of King Christian II of Denmark.

**1524:** After going into exile, Christian II offers the Faroes and Iceland to Henry VIII of England as collateral for a loan which Henry denies.

**1538:** The reformation reaches the Faroe Islands.

**1710:** The Royal Trade Monopoly is founded.

**1720:** The Faroe Islands become a county of Denmark.

#### **4.4 North Atlantic human context: Colonisation**

##### **The Viking expansion**

The expansion of the Norse across the North Atlantic was the most extensive exploration of western European travellers during the Dark Age period, occurring at a time when elsewhere in north western Europe the population was probably in decline, coinciding with the fall of the western Roman Empire and a contraction of agriculture (Phillips 1988, McEvedy 1992).

There are a variety of explanations as to what caused the Norse expansion and consensus over the causes of expansion has changed over time (McGrail 1980, Haywood 1995, Karlsson 2000, Ólafsson 2000, Batey and Sheehan 2000).

In proceeding west, it is not certain whether the Faroes and Iceland were settled by accident, by ships being blown off course, or by a deliberate strategy of exploration in search of trade goods, made possible by following signs such as bird migration routes, or in pursuit of personal prestige. In the course of voyages to the north and west of Scotland and Ireland, ships were probably blown off course reaching as far as the Faroes and Iceland, and it is possible that the Vikings were already aware of the lands in the northwest prior to colonisation. Evidence that the islands were known is presented by *De mensura orbis terrae* (On measuring the earth), written by the Irish ecclesiastic Dcuil in around 825 AD, where islands located two days sailing north of Britain are described as separated by narrow stretches of water, bearing resemblance to the straits and islands of the Faroes. It is also stated that the latter were occupied by hermits from Ireland from around 725 AD, but were subsequently driven away by “Northmen” around 100 years later, abandoning the islands to sheep and seabirds (Tierney 1967).

#### **Pre-Norse colonisation of the Faroe Islands**

The Faroe Islands, lying only c.300 km beyond the Shetland Islands, were potentially within reach of sea-faring peoples from northwest Europe for centuries prior to the Viking Age and historically dated Norse *landnám*, and whether the Norse were the first settlers in the islands is debated. Table 4.1, for example, illustrates the timing of human impacts on other landscapes in the North Atlantic region, which by comparison, the Faroe Islands were settled surprisingly late. Christian Gaels as Irish monks or hermits, probably had both the means and the motivation to seek out these offshore islands, and their presence in the Faroes and Iceland has attracted speculation. As yet, no archaeological evidence for a Christian Gaelic settlement in the islands exists, although written sources and place names argue for their presence. Christian Gaelic settlers are referred to both by Dcuil and *Íslendingabók* (*Book of the Icelanders*). Place names have also been used to suggest a Christian Gaelic presence (Matras 1965), particularly those with the *papa*-element such as *Paparøkur* and *Papurshálsur* in the Faroes (Matras 1965) and *Papey*, *Papafjörður*, *Papafell* and others in Iceland (Eldjarn 1989, Buckland *et al* 1995, Sveinbjarnardóttir 2001). The earliest mention of *papa* place-names in the written sources is not, however, contemporary with the alleged presence of *papa* in the country, so it is possible that the Scandinavians who had settled elsewhere in the North Atlantic, such as Ireland and western Scotland, brought the place-names to the Faroes and Iceland in the Norse settlement period (Sveinbjarnardóttir 2001). Furthermore, in the Faroes, the locations connected with *papa* place names are generally in

inhospitable areas, situated many meters above sea level, on sheer cliffs facing the open North Atlantic, which has led some to question the theory of early Christian Gaelic settlements (Arge 1991).

<i>Region</i>	<i>First human impact</i>	<i>References</i>
Norway (North Cape)	c. 10000 BC	Bjerck 1995
Ireland	c. 8030 BC	Woodman 1985, Waddell 1998
Scotland	c. 8030 BC	Saville 1996, Edwards and Whittington 1997
Hebrides	c. 7000 BC	Edwards 1996, Fossitt 1996
Shetland	c. 6300 BC	Bennett <i>et al</i> 1992, Barclay 1997
Labrador	c. 4300 BC	Tuck 1975
Newfoundland	c. 3000-2000 BC	Tuck 1975
Greenland	c. 2500 BC	Grønnow <i>et al</i> 1983
<b>Faroe Islands</b>	<b>c. 500-700 AD</b>	Jóhansen 1985, Hannon and Bradshaw 2000
Iceland	c. 700-800 AD	Hallsdóttir 1987, Nordahl 1988, Hermanns-Auðardóttir 1989 - but cf. Crawford 1991, Kaland 1991, Mahler and Malmros 1991, Morris 1991, Sigurdsson 1991

**Table 4.1:** General dates for human impact on the landscapes of the North Atlantic region. Adapted from Hannon *et al* (2001).

In the Faroe Islands, there are “fields” with raised parallel ridges of stone and earth which are traditionally connected and popularly assumed to represent traces of pre-Norse settlement (Brandt and Guttesen 1981, Jóhansen 1979, Arge 1991, Edwards *et al* 2005b). There may be up to twelve “cultivated field” sites across the Faroe Islands, characteristically found on steep (up to 60°), inaccessible slopes less than 100 m above sea level, facing to the south, east or west. Aside from cultivation, the fields may have been used for a variety of functions over time, such as turf stripping, but their location in distinctive topographic settings argues for a common function. It is also possible that rather than representing core areas of Christian Gaelic settlement, the fields represent peripheral remnants of a once more widespread Norse settlement. Their antiquity is, however, uncertain and dating the fields has been problematic. Jóhansen (1979) discovered evidence for oats, and later, barley cultivation at one of the “fields” on Mykines, radiocarbon dated to 600 AD, although this date has been applied with caution, as a result of the difficulties involved in sampling (Arge 1991, Buckland *et al* 1998). In terms of this research, however, what crucially matters is not the

timing or origins of the first settlers, but the timing of the first significant environmental impact and whether this is contemporaneous with early settlement or begins later (cf. controversies in New Zealand and Easter Island).

### **Norse *landnám* in the Faroes**

Evidence for the Norse colonisation of the Faroes and Iceland or *landnám* (Old Norse meaning “land-taking”) comes from both documentary and palaeoenvironmental evidence (Arge 1991; 1993, Debes 1993). The principle literary work on the Norse history of the Faroe Islands is *Færeyinga Saga* (The Faroese Saga), a collection of various texts compiled from the Icelandic Sagas. *Færeyinga Saga* was composed in the 13<sup>th</sup> century, but describes events following settlement in both the Faroes and Norway, focusing on the struggle for power among chiefs and events that are connected with the introduction of Christianity to the islands, rather than the settlement itself (Arge 1991). Grímur Kamban is described as the first Viking settler, arriving c.800 AD, although it is generally considered that Grímur, like many other colonists, did not arrive in the Faroes directly from Norway but came via the Hebrides, Ireland or the Isle of Man. *Landnám* has traditionally been dated by historical records to c.825 AD in the Faroe Islands and a 9<sup>th</sup> century date for the Faroese *landnám* has been confirmed by archaeological research (Hansen 1991). Accounts of initial settlement in Iceland are more comprehensive; *Landnamabók* (*The Book of Settlements*), is an Icelandic account of the country’s colonisation written around the 12<sup>th</sup> century and describes the arrival of the first Scandinavian visitors and settlers on Iceland.

In the Faroes, human colonisation has also been identified in palaeoenvironmental records from several islands, based on the appearance of cultivated crops and reductions in birch and other tree pollen (Jóhansen 1971; 1975; 1982; 1985, Hannon *et al* 1998, Hannon and Bradshaw 2000), plant macrofossils (Bennike *et al* 1998), insects (Buckland 1990, Buckland and Dinnin 1998), increases in minerogenic inputs (Hannon *et al* 2001, Hannon and Bradshaw 2000) and multi-proxy studies (Buckland *et al* 1998, Hannon *et al* 1998; 2001) (Figure 4.6). Although there is a variance in dates from the palaeoenvironmental research, there is evidence to suggest that human impact occurred at least two centuries earlier than the historically accepted date of 825 AD. Early palynological studies from Tjørnuvík in northern Streymoy suggest a possible early *landnám* beginning c.600 AD (Jóhansen 1985) and later research has since confirmed these ideas (Hannon *et al* 1998, Hannon and Bradshaw 2000). Recent research from Hov on the island of Suðuroy, estimates a relatively consistent presence of cereal type pollen grains and an expansion of microscopic charcoal from c.680 AD (Edwards *et al* 2005a), and Hannon *et al* (2005) have estimated the appearance of charcoal and plant macrofossils to c.570 AD. As this evidence for a human presence comes from sites across the Faroes, and is geographically extensive, it seems

probable that human-interactions on a small scale had begun by at least the 6<sup>th</sup> century onwards. The nature and timing of settlement in the Faroe Islands is considered in Figure 4.6 along with the dating of other palaeoenvironmental data.

#### 4.5 North Atlantic human context: Long-term settlement and adaptation

##### Norse “cultural capital”

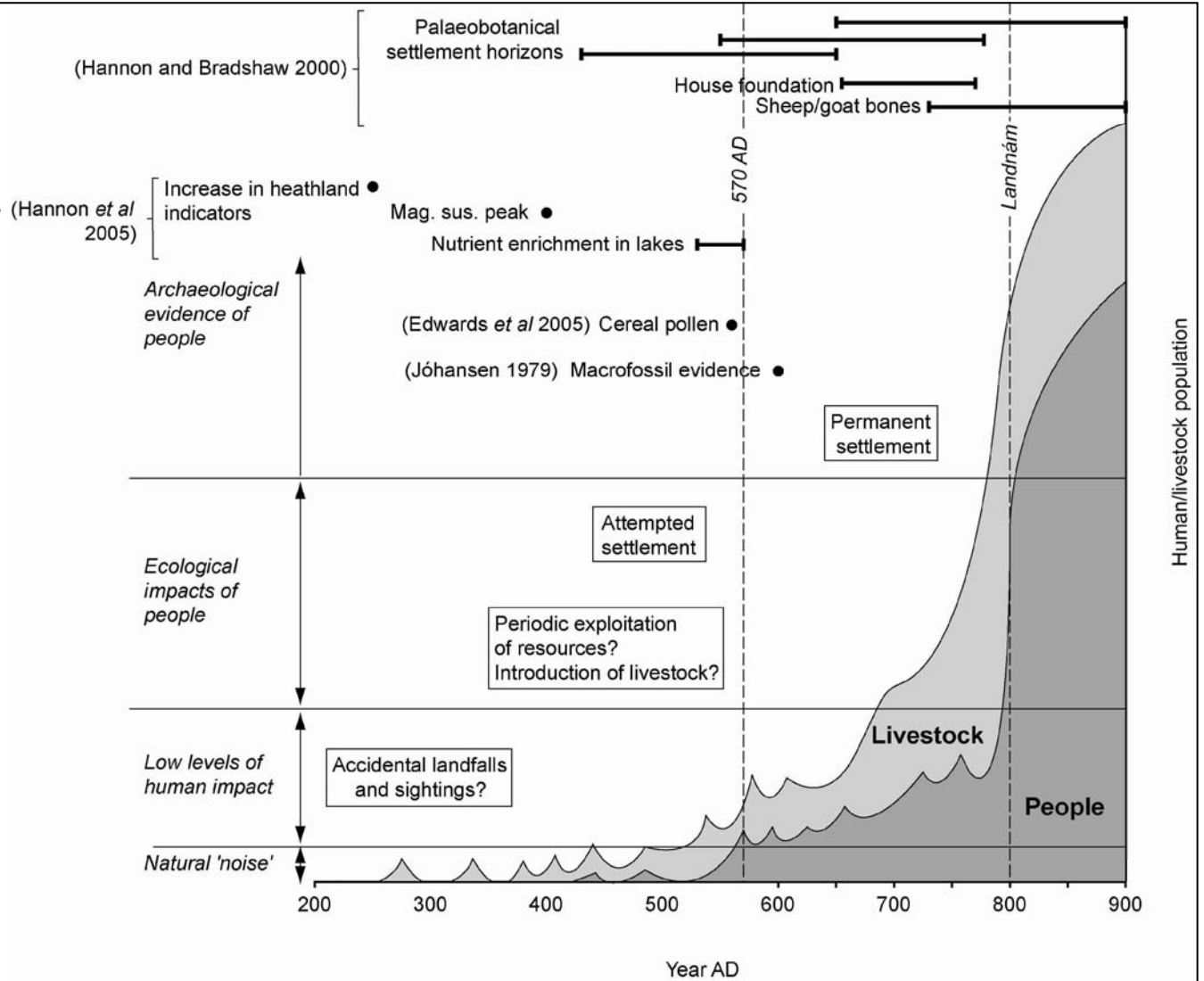
When immigrants colonise a new homeland, the lifestyle they establish there, usually integrates features of the lifestyle that they practiced in their homeland. This has been described variously as a “transported landscape”, “portmanteau biota” and “cultural capital”, and incorporates the knowledge, beliefs, subsistence methods and social organisation accumulated in the homeland (Diamond 2005, Amorosi 1991, Thorsteinsson 1991). The transportation of known capital is especially important for settlers occupying land that is either originally uninhabited, e.g. the Faroes and Iceland, or else inhabited by people with whom the new colonists have little contact, e.g. Greenland. The Norse settlers in the Faroes and Iceland had no possibility of learning anything from indigenous people who had adapted to the environment over time. Instead, the societies that the Norse created on the North Atlantic islands were modelled on mainland Norse Late Iron Age society, incorporating the Iron Age Norse principles of agriculture, iron production, class structure and religion. On arrival, the Norse would have been especially attracted to the grassland and forest landscapes which resembled their homelands, and where their accumulated knowledge of subsistence pastoral farming could be practised. Perhaps because they comprised a mixed cultural group of Norse, slaves and exiles, the Norse may have gone out of their way to re-create their own myths of the idealised west Norwegian lifestyle.

Landscapes covered by birch forest would have been attractive, as birch was a particularly important commodity, which became a well-controlled asset as woodland began to decline, e.g. in Iceland (Mairs *et al* 2006, Dugmore *et al* 2006). Wood was required not only for building, cooking and heating purposes, but was crucial to make charcoal to create iron from low-grade bog ore for creating and maintaining the sharp edges on the tools needed to cut fodder. In the Faroes, there is limited evidence of iron-working and due to the lack of woodland, the use of peat was widespread and used for both cooking and heating purposes.

In a Norse pastoral farming economy, the mix of livestock preferred by Late Iron Age Norwegian chiefs included predominantly cows (~50 %) and pigs (~25 %), with fewer sheep and goats (~20 % caprines [undifferentiated sheep and goats]), horses (5 %) and a small number of ducks, geese and dogs (Vésteinsson *et al* 2002). Cows were the most favoured

**Figure 4.6:** A model of human occupation for the Faroes, combined with dating of published palaeoecological evidence. Note that spot dates are approximate.

Four possible phases of pre-Norse settlement are proposed. *i) Accidental landfalls and sightings* when people became aware of the islands, but no occupation resulted. *ii) Periodic exploitation of resources-Introduction of livestock*. I.e. short-lived visits to exploit natural resources such as birds and marine mammals. During this phase new species may have been introduced, as, for example, part of a deliberate provisioning strategy. Livestock impacts could therefore develop in the absence of people. *iii) Attempted settlement*. A possible phase of temporary or unsuccessful settlement that could have seen impacts spread between islands. This phase could also encompass deliberate preparation phases of livestock introduction that proceeded successful permanent settlement. *iv) Permanent settlement*. Permanent occupation involving cultivation and significant landscape modification by a substantial human population (hundreds rather than dozens of people).



animal commodity, both for beef and as prized status symbols although pigs were also highly esteemed. Sheep were kept for wool, milk and mutton, and goats also provided milk. Horses were kept for meat as well as for riding and as draft animals. Limited barley was grown and formed the most common grain, although wheat, oats and rye could be grown in certain favourable areas along with vegetables such as cabbage, onions, peas and beans (Kaland and Martens 2000). Archaeofaunal evidence from the Faroes, Iceland and Greenland (Church *et al* 2005, McGovern 2000) illustrates that although cattle are favoured in the early years of settlement, they decline relative to the proportion of caprines one or two centuries later, and although pigs are favoured initially, as they both breed rapidly and are used to uproot trees and clear areas for grazing, they are phased out soon after settlement.

Cows, which were highly prized by the Norse, required over-wintering in byres and needed to be fed large quantities of hay and other fodder. Sheep could remain outdoors all year in the Faroes and in milder coastal areas in Iceland, but elsewhere in Iceland and in Greenland they also required some winter fodder. Fodder acquisition was therefore of crucial importance on the Norse farm, so the colonists would have sought occupation sites most suitable to fodder cultivation. In Iceland, wetland meadows made good settlement locations as they produced sedges and grasses that made good fodder and were free from birch forest at the time of settlement (Vésteinsson *et al* 2002). In the Faroes, good fodder producing land was restricted, although the need for it was probably less; because of the longer length of growing season compared to Iceland and Greenland, because sheep and goats could be over-wintered outside, and because of the utilisation of other sources of food besides domesticated animals.

Farm produced food was supplemented by wild food resources in the early years of settlement, which would have provided settlers with a much needed resource while livestock numbers were being built up. In the Faroes this included sea birds, bird eggs, fresh and saltwater fish and probably whales; in Iceland, initially walrus, seals, fresh and saltwater fish, some sea birds, bird eggs and berries; in Greenland, caribou, harbour and the migratory harp and hooded seals, small mammals such as hares, sea birds, ptarmigans, swans, eider ducks and mussels. Although remains of fresh and saltwater fish are abundant in the Faroes and Iceland, and would have been available to the Greenlanders in abundant supply, fish bones account for less than 0.1 % of animal bones recovered at Greenland Norse archaeological sites, compared to between 50 % and 95 % at most sites in Iceland and north Norway (McGovern 1983).

#### **Faroese “cultural capital” developments**

A critical aspect of the traditional Faroese subsistence economy in particular, not just in the early period of settlement, was that it was highly diversified with wild foods, or pseudo-infinite resources. According to archaeofaunal evidence, birds formed a proportionately high percentage of food consumed in the Faroes (Church *et al* 2005). Although the initially high percentage of bird bones had parallels with that of sites in Iceland (McGovern *et al* 2001), after the initial settlement, birds provided only a minor supplement to fish and domestic mammals. In contrast, at Undir Junkarinsfløtti on Sandoy, there is evidence of a sustained use of wild bird colonies, especially puffins, suggesting that the Faroese remained dependent on bird resources far longer and to a greater degree than any of the other Viking Age settlers of the North Atlantic islands (Church *et al* 2005). Pig keeping also remained active in the Faroes until at least 200 years after settlement, long after pig bones had disappeared from archaeofaunal records in Iceland and Greenland (Church *et al* 2005). The importance of pig-keeping to the Faroese is also attested to by the existence of some fifty place-names in the Faroes referring to the practice (Arge *et al* 2005) (Figure 4.7). Pigs would have required extensive feeding and can be destructive of birch woodland and other vegetation, which is probably why they disappeared early from Iceland and Greenland; after being used initially to clear land for grazing, they were no longer needed. It is not known how they would have been kept and fed in the Faroes, but the input of labour required for pig-keeping might have been more readily available in the Faroe Islands.

#### **Faroese settlement patterns in a North Atlantic context**

On arrival in the Faroes, Iceland and Greenland, the Norse settlers would have sought out locations that allowed the transferral of their “cultural capital”, such as lowland and/or wetland areas suitable for growing or acquiring fodder, large outfield areas with south facing slopes for growing additional fodder and for sheep grazing, access to abundant fresh water, reasonable access to coastal resources and close proximity to fuel resources such as birch forests or peat resources.

Lowland areas suitable for cultivation are relatively scarce in the Faroes but exist predominantly along the coasts and mainly in the bays where the original farms were established (Arge *et al* 2005). Most settlements occupy a location with both convenient access to the sea and marine resources, and access to lowland sites suitable for animal husbandry and cereal cultivation. There are some villages which are an exception to this, such as Gásadalur on the island of Vágoy, which is not easily accessed from the sea. These settlements may represent an expansion of settlement after the initial favoured coastal sites had been taken (Arge *et al* 2005). A small number of farms have also existed which were more than 2 km from the sea, although many of these were former shieling sites exploiting productive summer pastures, prior to the extensive development of grazing lands or outfield areas.

Figure 4.7a

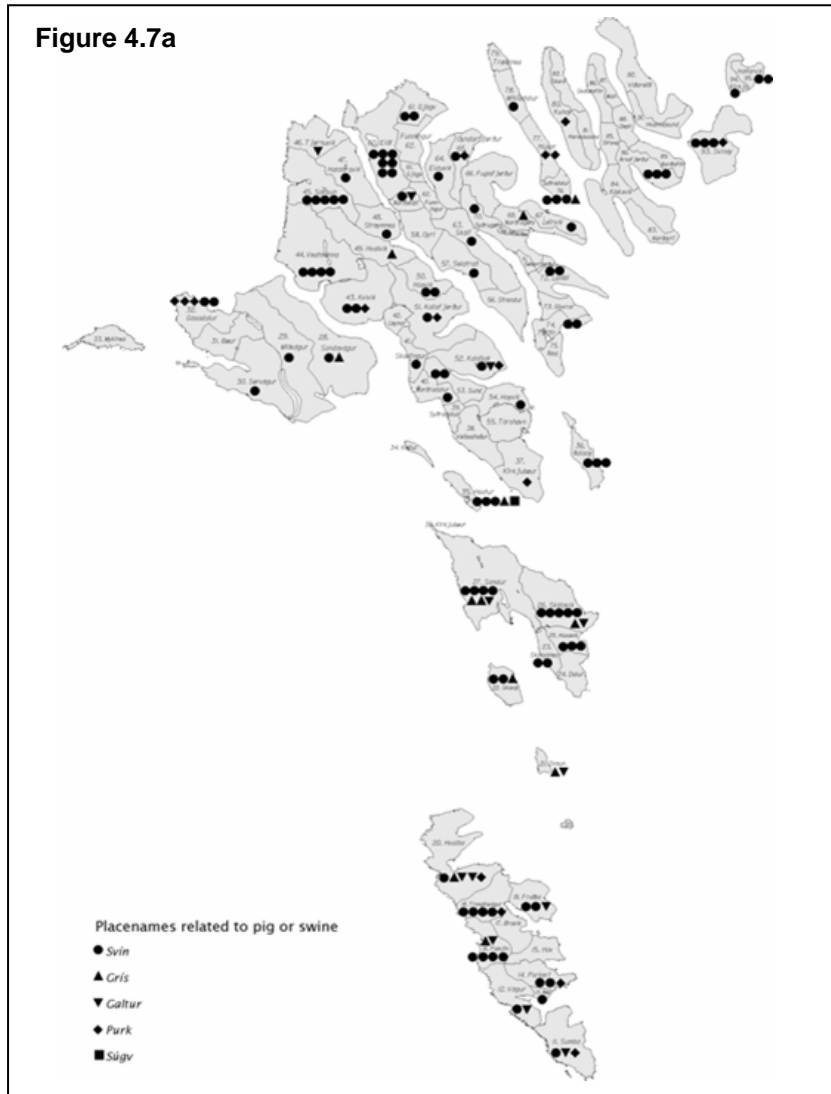


Figure 4.7b

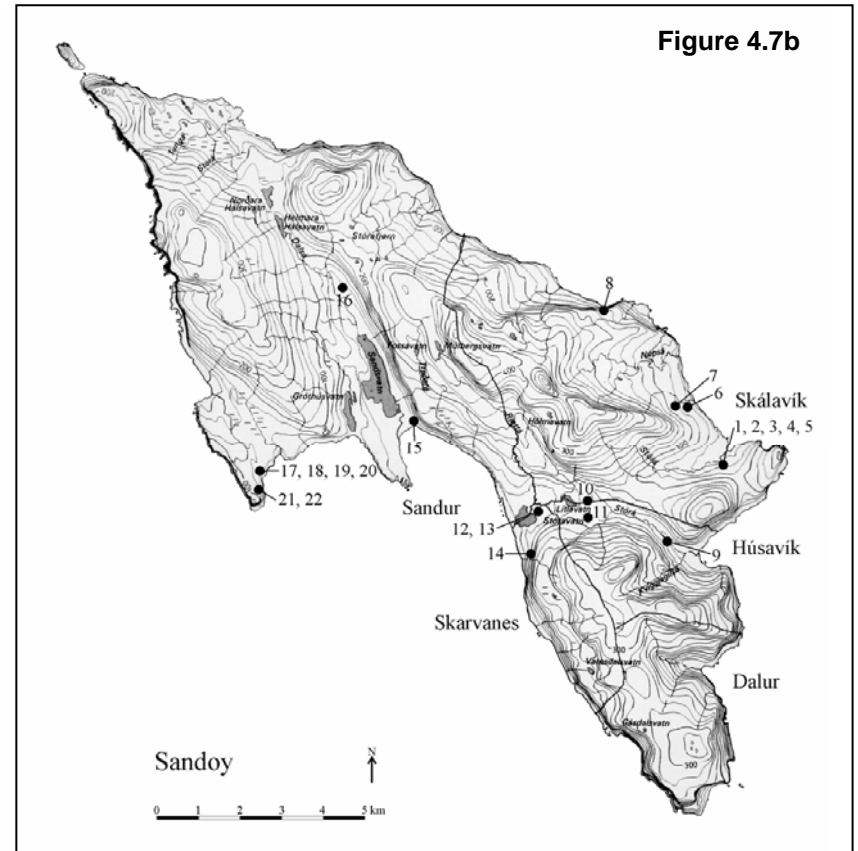


Figure 4.7a (left): The location of place-names related to pigs or swine in the Faroe Islands. After Arge *et al* (2005).

Figure 4.7b (right): The location of place-names related to pigs or swine on the island of Sandoy, Faroe Islands. After Arge *et al* (2005).

beyond the coastal infield areas from around the 11<sup>th</sup>-12<sup>th</sup> centuries (Edwards 2005). As only a small land area of the Faroes is suitable for settlement and cultivation, settlements are unlikely to have changed much since colonisation. This may also be a factor in explaining why a lack of archaeological remains have been found from the earlier settlements, as many earlier farmsteads have probably been built over or re-used.

The Faroese live in *bygdir*, or settlements, whose form may have changed little since the Viking Age, which is supported by the appearance of many still occupied sites in documents and written sources, demonstrating a notable continuity of settlement (Figure 4.8). After the initial establishment of several large farms, secondary settlements may have been established as tenancies inside the larger farms, forming the basis for larger divisions. The establishment of *bygdir* as separate farms continued during the early Middle Ages and it was only after this that a number of new farms were established in isolated spots (Thorsteinsson 1991). The Faroese settlement pattern, characterised by villages that developed soon after initial settlement, contrasts with settlement patterns in Iceland and Greenland, where towns and villages only developed in the 20<sup>th</sup> century. In Iceland, for example, subsistence based farms were more independent, isolated and widely scattered, with the distance between two farmsteads determined by the fodder producing capabilities of the intervening tracts of land (Vésteinsson 2000). The majority of settlements were located near the coast where boats could be landed, and in some sheltered inland valley systems.

### **Faroese farming systems in a North Atlantic context**

The Faroese farming system probably originates from the 11<sup>th</sup> or 12<sup>th</sup> century and is outlined by *Seyðabrevið* or the “Sheep Letter” of 1298, the first medieval law code concerning the Faroe Islands, which has more or less remained in effect to the present day. The farming system in use since at least 1298 can be described as an infield-outfield system, similar to that established in Western Norway in the early Iron Age and which is substantiated in most of the Norse colonised areas (Øye 2005). The infields, (*bøur*), were walled or fenced from the farm to prevent trampling by cattle and were intensively cultivated, while the outfields (*hagi*) were extensively used, primarily as grazing pasture, but also to grow additional fodder and to gather resources such as peat.

The farming system used prior to 1298 has not been unequivocally established, but place-name (Matras 1956) and archaeological evidence (Dahl 1970a; Mahler 1990; 1991; 1996; 1998) suggests that an older decentralised farming system might have been in use, known as the shieling system, which was also widely practiced in Norway and Scotland. The shieling system was probably superseded by the instigation of the infield-outfield system and establishment of property rights as detailed by *Seyðabrevið*, by which time shielings are not



**Figure 4.8:** Inferred locations of Norse settlements in the Faroe Islands based on archaeological and historical evidence. After Arge *et al* (2005).

mentioned. Summer farms or shielings (*ærgi*) existed in higher altitude and inland areas of the Faroes, allowing the exploitation of more remote pastures. Details of the nine shielings suspected in the Faroe Islands are presented in Table 4.2. In a shieling economy, inhabitants from permanent farms herd their cattle and sheep to more remote pastures for certain seasons of the year, allowing livestock to be removed from the main farm early in the spring to avoid summer exploitation of the coming winter fodder. Related activities such as the milking of cows, sheep and goats, processing and preparation of dairy products, collection of additional winter fodder and winter fuel, peat cutting, charcoal and iron production, fishing and wool working may also be carried out at some shielings sites, particularly in Iceland and Greenland, but probably less so in the Faroe Islands.

The shieling economy in the Faroes appears to have evolved differently compared to those of Iceland and Greenland, which are more closely aligned with the Norwegian shieling system. In the Faroes, distances between the shieling and the main farm are very short, within 4-5 km, and there is little variation in vegetation between the home farm and the shieling (Arge 2006). In addition, while the average altitude of Faroese shielings is approximately 75 m (Mahler 1993), shielings in Iceland, Greenland and Norway are frequently located above 200 m. The shieling system in the Faroes has therefore been implemented and adapted to the local topography, indigenous cultural influences and internal economic development. The decline in the shieling system in the Faroes may have been for similarly regionally relevant reasons, such as a shift in the economy, driven by increased trade that placed more emphasis on sheep rearing and wool production as opposed to cattle (Mahler 1998). Alternatively, a low number of livestock relative to rangeland carrying capacity may also explain the demise of the shieling system in the Faroes by the 13<sup>th</sup> century. Model evidence suggests there was sufficient biomass for the number of livestock likely to have been utilising the rangeland areas, in which case the shieling areas would have become less important (Thompson *et al* 2005). Additionally, a population decrease or shift in economy could have led to a decline in the labour available to operate a shieling system. This may have been the case in Iceland where documentary records suggest that a shortage of labour often led to the discontinuation of shieling practices (Sveinbjarnardóttir 1990). In Iceland, as in Norway and Greenland, shielings were located in inland areas, which permitted access to pastures at a considerable distance from the home farm, and allowed exploitation of a wide spectrum of ecological variation, with the distribution of resources dictating the choice of shieling location (Keller 1989, Sveinbjarnardóttir 1990). In Iceland and Greenland, the distribution of shielings may have been adapted to a differentiated economic strategy, where the distribution of different types of shielings was well adjusted to the distribution of resources in different areas (Keller 1989).

Location	Number of ruins (number of divisions visible)	Type of ærgir	Location in supposed catchment area	Water supply	Accessibility	Communication by boat	Distance overland from supposed farm (km)	Location of presumed head farm	Altitude (m)
Argisbrekka, Eiði	>17	Complex/simple	Central	Ample and steady	Easy	By fresh water	3.1	Eiði	130-136
Argisá, Skúvoy	>1	Simple	Central	Ample and steady	Easy	No	1.8	Skúvoy	180
Argisgjógv, Selatrað	>2	Simple	Central	Medium	Easy	By sea	1.6	Selatrað	40-60
Ergidalur, Hov	>2 (2)	Simple	Periphery	Ample and steady	Easy	?	3.7	Hov	180
Ergibyrgi, Sumba	>5	Simple	Periphery	Unknown	Medium	No	2.4	Vikabyrgi	30-50
Argisá, Havnabøur	>1 (5)	Complex	Central	Ample and steady	Easy/ Difficult	By sea	2.3/ 3.6	Oyndafjøður/ Fuglafjøður	15-20
Argisfossar, Kvívík	>1 (2)	Complex	Central	Ample and steady	Medium	By fresh water	4.7	Kvívík	80
Kvíngadalur, Klaksvík	>4 (2-3)	Complex	Central	Ample and steady	Difficult	By sea	4.0	Gerðar	20-30
Í Hópinum Norðoyrar	>2 (2)	Complex	Periphery	Unknown	Medium	By sea	3.0	Norðoyrar	10
Borðoyavík Klaksvík	>1 (2)	Complex	Periphery	Unknown	Medium	No	4.5	Uppsalar	60
Borðoyavík Klaksvík	>1 (3)	Complex	Central	Unknown	Medium	No	4.1	Uppsalar	60

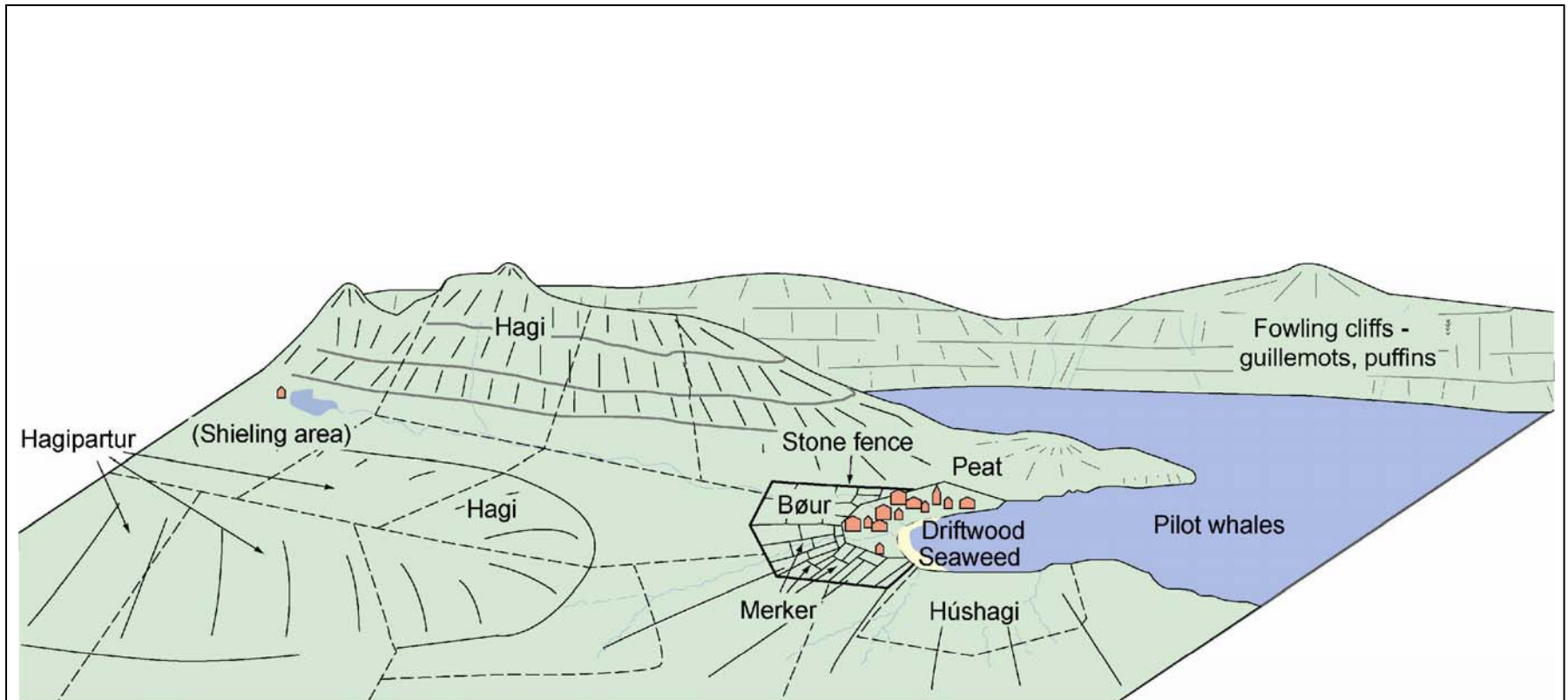
**Table 4.2:** Ærgir (shieling) sites and presumed ærgir sites surveyed during 1989. Adapted from Mahler (1993).

### Land and resource ownership in the Faroe Islands in a North Atlantic context

A Faroese village or *bygd* consists of a number of houses standing on *almeningur* (land which is free and common property). Around the houses lays the *bøur* (infield), demarcated from the *hagi* (outfield) by a stone fence (Figure 4.9). In the Faroe Islands, land ownership is regulated within this infield-outfield system by the traditional land measurement system of *markatal*, outlined in *Seyðabrevið*, whereby the *markatal* is not a fixed area of land, but acts as an indication of production value. Although a few villages have undivided *hagi* or outfields, in most villages it is divided into a number of *hagapartur*, or outfield parts. The main resources of the *hagi* are the property of the community (as opposed to the individual) and are fairly distributed to each farmer according to his degree of ownership of the *bøur*, which is divided into as many as 92 units called *mørk* (pl. *merkur*). In contemporary villages each unit is subdivided into minor lots, each lot of which owns part of a *hagapartur* (Nørrevang 1979). The lot is cultivated by its owner, while the *hagapartur* are tended by all owners in common. Each farmer owns certain sheep and feeds them through the winter, although one farmer's sheep can roam anywhere in the village. In the summer, sheep graze in jointly owned and demarcated sections of the *hagi*. The shepherds elect a *seyðamaður* (sheepman) whose leadership is rotated and who acts as the primary caretaker of the sheep and of fencing for their area (Gaffin 1996). As well as the sheep output from the *hagi*, summer grazing in the *húshagi* (the lower altitude outfields), geese ownership, and a percentage share of other resources, such as peat (*torv*), fowling cliffs, pilot whales (*grind*), driftwood and seaweed are also community owned. The *markatal* system of ownership therefore contrasts with the *hreppur* or commune system that characterises settlement and farming in Iceland. In north Iceland especially, pastures were private property, belonging to individual farmsteads or churches, while in south Iceland, although pastures were often communally owned, individual sheep were still the property of individual farms. Additional resources were held privately by particular farms as opposed to being property of the community.

### 4.6 Human impacts and environmental change in the North Atlantic islands

As with documented human impact in the Pacific islands, there is evidence to suggest that human impacts in the North Atlantic were widespread, and in some cases catastrophic. The causes of human impact in the North Atlantic are similar to those affecting remote Pacific islands, principally in relation to impacts of deforestation and the introduction of domestic mammals which either instigates or enhances soil erosion and landscape degradation. Research has been carried out with regards to soil erosion in Iceland (Þórarinnsson 1961, Haraldsson 1981, Dugmore and Erskine 1994, Dugmore *et al* 2000) and cultural collapse in



**Figure 4.9:** A simplified representation of the geographical distribution of resources and system of land ownership in the Faroe Islands. *Merker* are subdivided into 'lots' with each lot cultivated by the owner. *Hagipartur* are tended by owners in common and a percentage share of peat, driftwood, seaweed, pilot whales and fowling cliffs are communally owned. The shieling area is part of the shieling system that probably preceded the *bour-hagi* system.

Greenland (Jacobsen 1987; 1989, Jacobsen and Jakobsen 1986, Jakobsen 1989, Fredskild *et al* 1988). In Iceland, the evidence for widespread soil instability associated with the arrival of people is relatively comprehensive and convincing, with research aided by the application of tephrochronology and the existence of the *landnám* tephra layer (Þórarinnsson 1961, Runólfson 1978, Þórarinnsson 1981, Haraldsson 1981, Dugmore and Erskine 1994, Dugmore *et al* 2000). In south Iceland, it has been demonstrated that the rate of sediment accumulation over the settlement period increased by more than an order of magnitude (Arnalds 1987). It has been estimated that between 60 % and 90 % of the surface soil cover was stripped from the Eyjafjallahreppur area of south Iceland by 1985 (Dugmore and Buckland 1991). The massive extent of soil erosion was most likely caused by a combination of deforestation (Hallsdóttir 1987) and impacts of grazing animals (Einarsson 1963), although as with some Pacific island research, the observed environmental impacts have also been attributed to natural climatic changes (Ólafsdóttir and Júlíusson 2000, Ólafsdóttir and Guðmunsson 2002). In Greenland, a record of sedimentation in a lake core from near the chieftain's seat, Brattahlíð, in the Eastern settlement, illustrates a threefold increase in sedimentation rates over the period of Norse settlement, which ceased suddenly after the farm was abandoned (Krogh 1982). This has prompted suggestions that the impacts people had on vegetation and that the resulting soil erosion, in combination with other factors, may have been considerable enough to result in cultural collapse (Jacobsen 1987; 1989, Jacobsen and Jakobsen 1986, Jakobsen 1989, Fredskild *et al* 1988).

Only limited research of human impact has been carried out in the Faroes (e.g. Hannon *et al* 1998, Hannon and Bradshaw 2000, Hannon *et al* 2001, Wastegård *et al* 2003). Recent research on Holocene landscape change in the Faroe Islands has predominantly focussed on either a palaeoecological approach that has sought to assess the impact of people on landscape, or on a geomorphological approach that has considered to a lesser degree the role of people in those landscape changes. Yet there has been no attempt to consolidate the results from these apparently diverse studies. Detailed geomorphological research that has been carried out, particularly in relation to past and present periglacial processes and landforms, and associated climatic controls (Humlum and Christiansen 1998a; 1998b), the geomorphology of highland aeolian deposits (Christiansen 1998) and relict rock glaciers and climatic implications (Humlum 1996) tends to underplay the influence of people on the Holocene landscape of the Faroes. Palaeoecologically orientated research has focussed more explicitly on the impact of human settlement in the late Holocene (Hannon *et al* 2001; 2005, Hannon and Bradshaw 2000) and this research does record significant anthropogenic impact on vegetation. The results from the two research approaches might therefore appear to be at odds with each other, even though consistent links between vegetation and geomorphic controls would be expected because of the interconnected relationship between periglacial activity, vegetation disturbance and soil erosion. Data from geomorphic and

palaeoecological research may, however, appear inconsistent if the research approaches are operating on different temporal and spatial scales and therefore identifying subtly distinct landscape changes. In order to resolve this apparent incompatibility between results, a suitable approach, methodology, and field site selection is required, which is the focus of the following chapter.

### **Chapter summary**

This chapter has provided a geographical and historical context to the research that follows, in terms of both the natural environment and climate, and the development of North Atlantic island colonisation and settlement. Concepts introduced above will be re-evaluated in the discussion in chapters 7 and 8. Research regarding human impact on the environment in the Faroe Islands appears to be both contradictory and limited and therefore human-environment interactions in the wider North Atlantic provided the conceptual and methodological framework for this thesis.

The following chapter details the selection of the specific field sites from which data was recorded and outlines the methodological framework used to direct the collection of data.

## Chapter 5

### Methodological framework and data collection

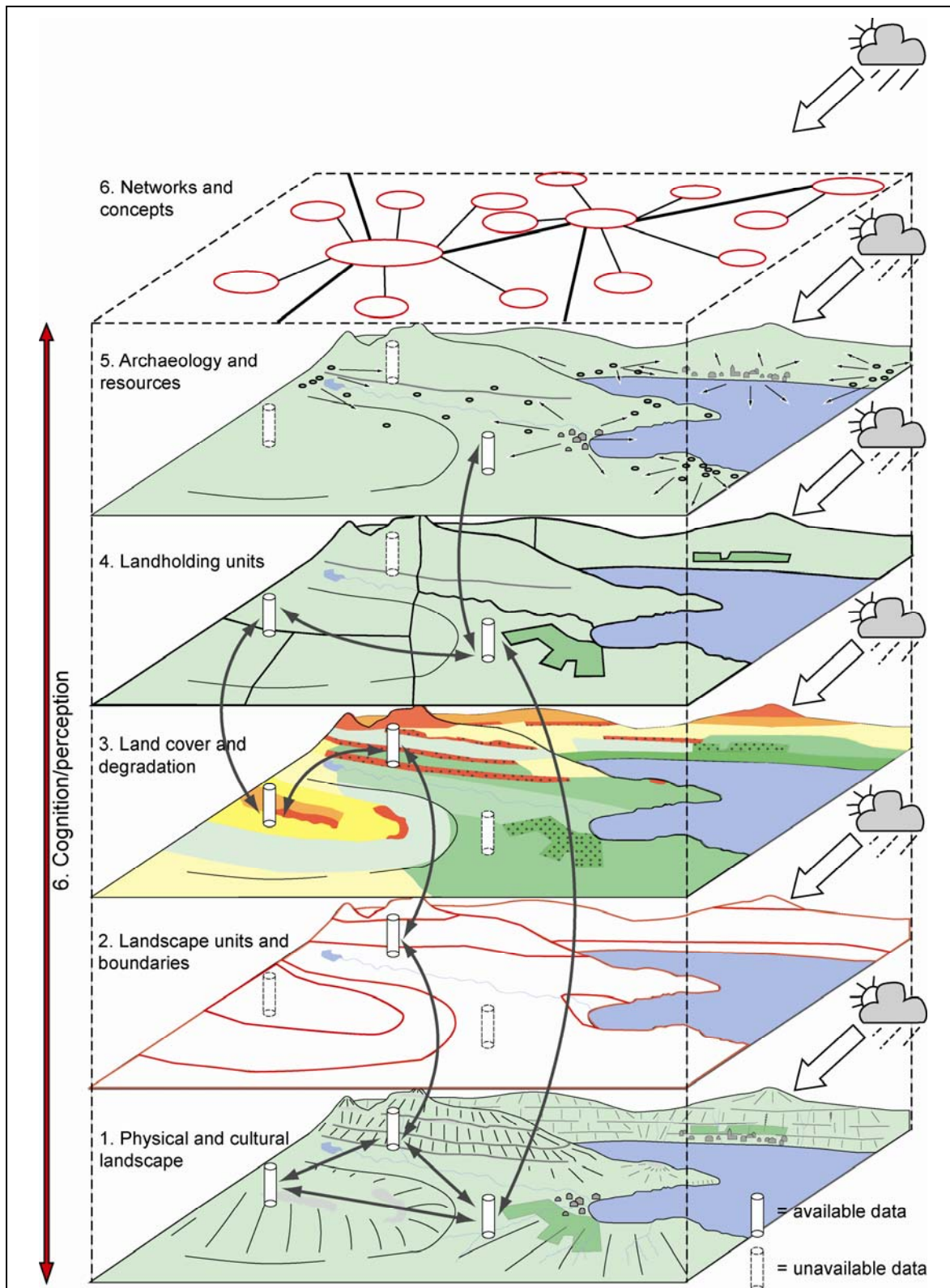
#### Introduction

This chapter begins with an outline of the methodological framework used to direct the collection of data. The implementation of a variety of methodologies was a crucial part of achieving the objective of developing a scale-matched approach, where data from different disciplines can be integrated. Initially, Figure 5.1 is described to illustrate how the results from different approaches used in the thesis may be integrated, and how these contrasting data sets may be used to assess a variety of key questions. Individual methodologies are then described separately as spatial (landscape mapping and archaeological survey), conceptual (interviews) and temporal (stratigraphic profiles and chronology) methods. The selection of the field sites is also discussed.

#### Methodological framework

The focus of the approach and methodology is at a landscape-scale. Landscape can be viewed as both natural, influenced by geology, impacts of climate and geomorphological processes, and as cultural, as influenced by its archaeology, settlements, resource exploitation and human activity (Figure 5.1). The surface landscape and underlying soft sediment reflects the integration of a combination of these anthropogenic and natural influences and impacts, and thus landscape can be used as a common unit of analysis in a wide range of disciplinary fields, e.g. geomorphology, ecology, archaeology, anthropology. A focus on landscape change allows the incorporation of both quantitative and qualitative information at a scale applicable to most human-environment interactions (Crumley 2000). In order to begin to disentangle these different influences, a wide range of methodologies, targeting a wide range of data sets, needs to be applied, with landscape as a focus. The data sets that illustrate evidence regarding the physical and cultural landscape are considered in this chapter as component parts, although results arising from the data collection need to be considered within an integrated framework if an adequate understanding of human-environmental interactions is to be achieved.

Landscape-scale morphological units and their corresponding boundaries (Figure 5.1: 2) represent one specific dataset, from which boundaries, limits and thresholds can be identified in the environment. For example, changes in landscape unit boundaries are important in relation to the identification of key environmental thresholds including periglaciation limits, slope stability and soil erosion, which can be assessed. At a more

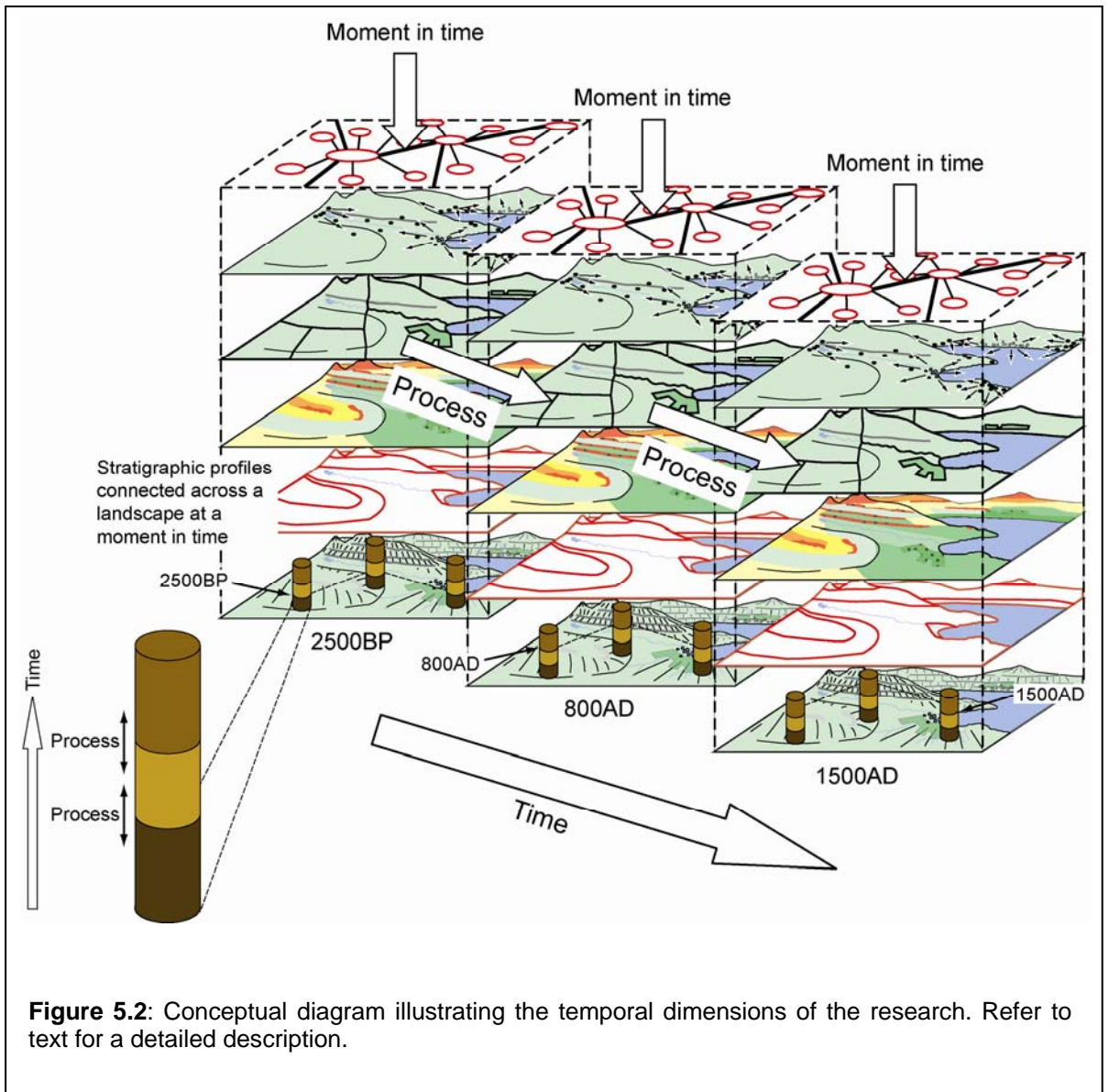


**Figure 5.1:** Conceptual diagram illustrating the integration of methods used in the research. Available/unavailable data refers to the unavailability of data across the landscape at a specific level of investigation. The diagram highlights that even when data is missing from specific areas at a particular level, by adopting a landscape-scaled approach to several methodologies, different data in diverse areas of the landscape can be connected. See text for detailed description of diagram.

detailed scale, and relating to more subtle effects of human impact, land cover classification based on the percentage of landscape cover across a landscape (Figure 5.1: 3), was an additional method, used to identify key environmental thresholds, and accumulated impact, particularly regarding soil erosion. Landscape units and land cover extent therefore represent the accumulation of a combination of natural and anthropogenic induced impacts up to the present day. A challenge when analysing this data is to be able to determine the timing of significant landscape events, in order to understand their causal factors. It is useful to disentangle those landscape features that were formed prior to the arrival of people, from those that may have been influenced by people. Also, early human impact as people were still adjusting to their new environment, may be different from later impacts that illustrate the degree to which the Norse adapted (or not) to environmental, climatic and cultural conditions over the longer term.

While landscape units and land cover extent establish key environmental boundaries, landholding units or farm boundaries (Figure 5.1: 4) define fundamental cultural boundaries between different landholdings, settlements or farms. This is important in terms of questions of land management, and critically, operates at a scale comparable to that of landscape units and land cover classifications. Archaeological survey data operates at a different, but complementary scale, and can indicate sites of cultural activity and concentrations of resource exploitation, such as that relating to peat cutting, drainage or shieling activity (Figure 5.1: 5). The identification of sites where human activity is concentrated can be mapped against geomorphological details. Archaeological and historical data (gained from oral interviews as well as written sources) also provide information regarding cultural thresholds, such as the changes in cultural activities or subsistence methods practiced by the settlers. These various facets of the cultural and natural landscape are bound together by a cognitive framework, viewed in terms of perceptual networks rather than necessarily in terms of the physical landscape (Figure 5.1: 6). Cognitive frameworks are the most difficult aspect of landscape to understand because unlike anthropogenic activities or climatic impact, they do not manifest themselves as physical evidence in the landscape record. Interviews were conducted with present day Faroese farmers who are knowledgeable of traditional farming methods and whose familiarity with oral histories goes back several generations. However, knowledge and oral histories are limited in temporal scale to a few generations previous, and as the interview data represents the farmers' own perceptions or opinions of the past, they are influenced by peripheral factors.

All aspects of the physical and conceptual landscape described by Figure 5.1 are affected by a temporal dimension. The form of the physical landscape changes over time, as do perceptions of that landscape and its natural resources. Figure 5.2 illustrates the temporal dimensions of this research. Comparison between boundaries of similar soil contexts across



several stratigraphic profiles at different locations in the landscape represent “moments in time”, which may be synchronous or time-transgressive. Processes between those times are represented by the development of sediment contexts. Stratigraphic profiles therefore allow processes of change such as the onset of significant erosion or episodes of landscape stability to be identified and tracked across a catchment and island-wide scale. Understanding the reasons and mechanisms of landscape change requires both accurate and precise dating.

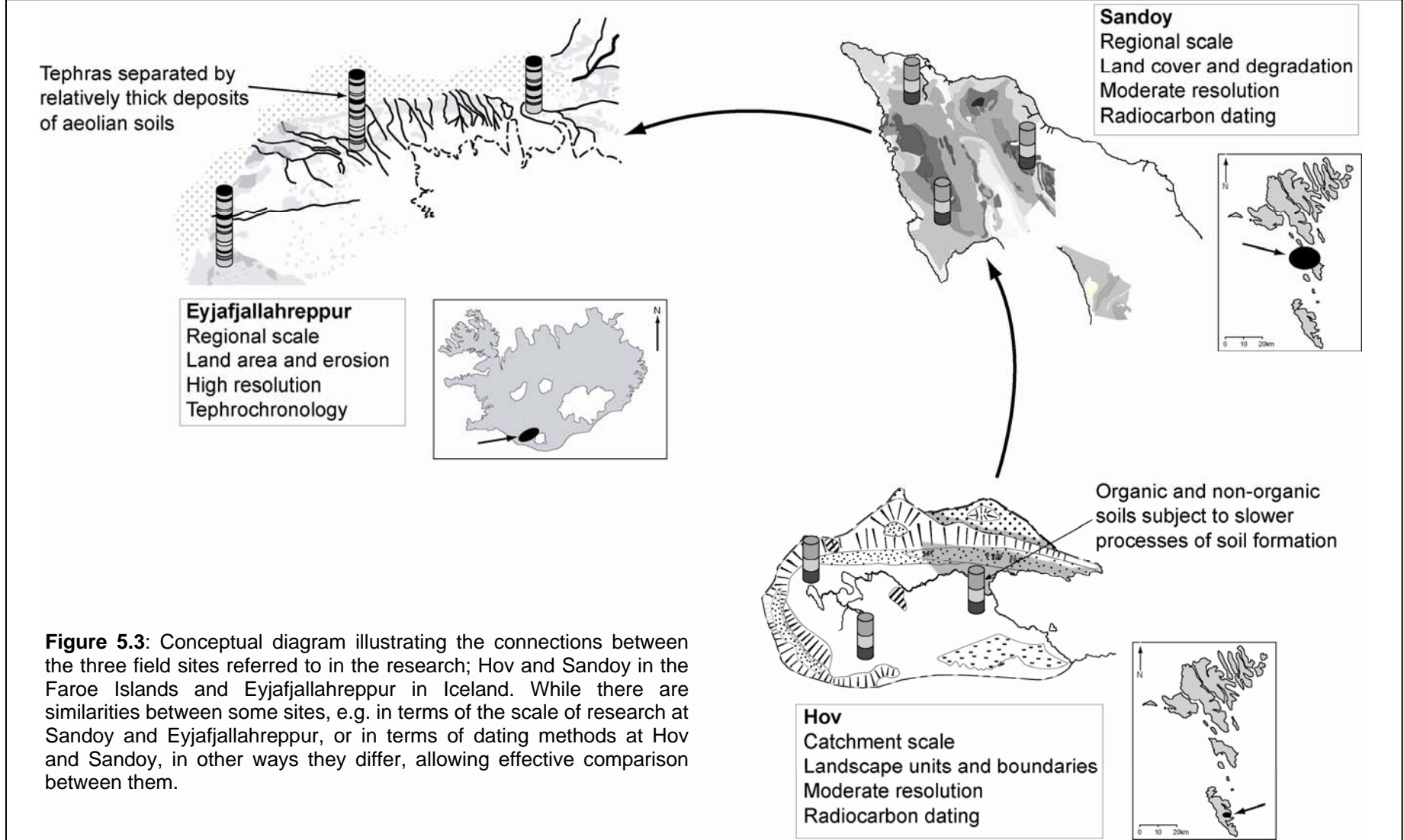
Ideally, the diverse data sets described above would be easily combined and spatially comparable, but records are rarely complete so it is important to combine complementary data sets and consider many sites across many spatial scales. This involved investigation of stratigraphic profiles at scales of transects, catchments, settlements, regions and islands. Figure 5.3 illustrates the overall spatial context of the field sites and how they connect. The field sites themselves are described below.

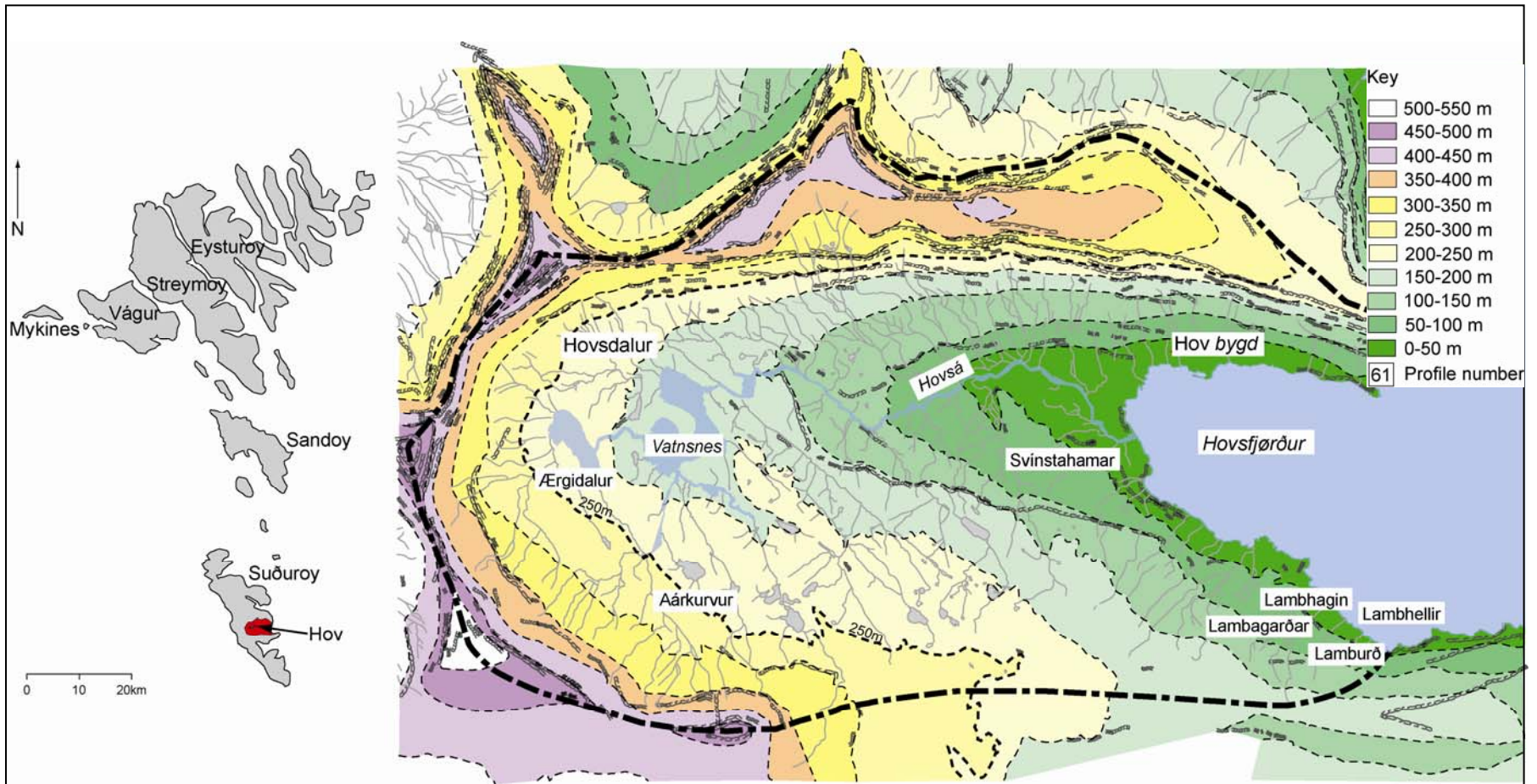
### **Field site selection**

#### *Hov and Sandoy, the Faroe Islands*

Initial research was carried out at Hov, a settlement on the east coast of the most southern island in the Faroese archipelago of Suðuroy (Figures 5.4 and 5.5). For this research, the term “Hov” is used to represent the hydrological catchment of the Hovsá (Hov River), which incorporates the village of Hov and outfield areas belonging to both Hov and the settlement of Porkeri to the south. The Hov catchment area is an ideal site for testing hypotheses of human impact and environmental change because it embodies a microcosm of the archetypal Faroese landscape. The spatial scale of the catchment is manageable in terms of data collection, is physically well constrained by the surrounding topography, and is also of a scale applicable to both cultural and environment changes.

Mountains in the west, up to 574 m in altitude, form a steep-sided cirque valley that defines and constrains the catchment. In the west of the catchment, and extending for several kilometres, is a scoured out area characterised by lakes and rivers, which has formed a characteristic outfield of open heath for grazing, and provision of peat that was utilised for fuel and construction. The settlement (*bygd*) of Hov lies to the east and is bounded by slopes up to 424 m to the north and by the bay of Hovsfjørður to the south. Hov *bygd* itself is situated on a south facing slope composed of deep sediment that has proved relatively productive for cultivation. The sheltered bay of Hovsfjørður, south of the village, provides a suitable location for boat landings and convenient access to marine resources. On the south side of the bay, directly across from Hov, is a well vegetated coastal strip and low altitude





**Figure 5.4:** Relief map of the Hov catchment with place-names mentioned in the thesis.

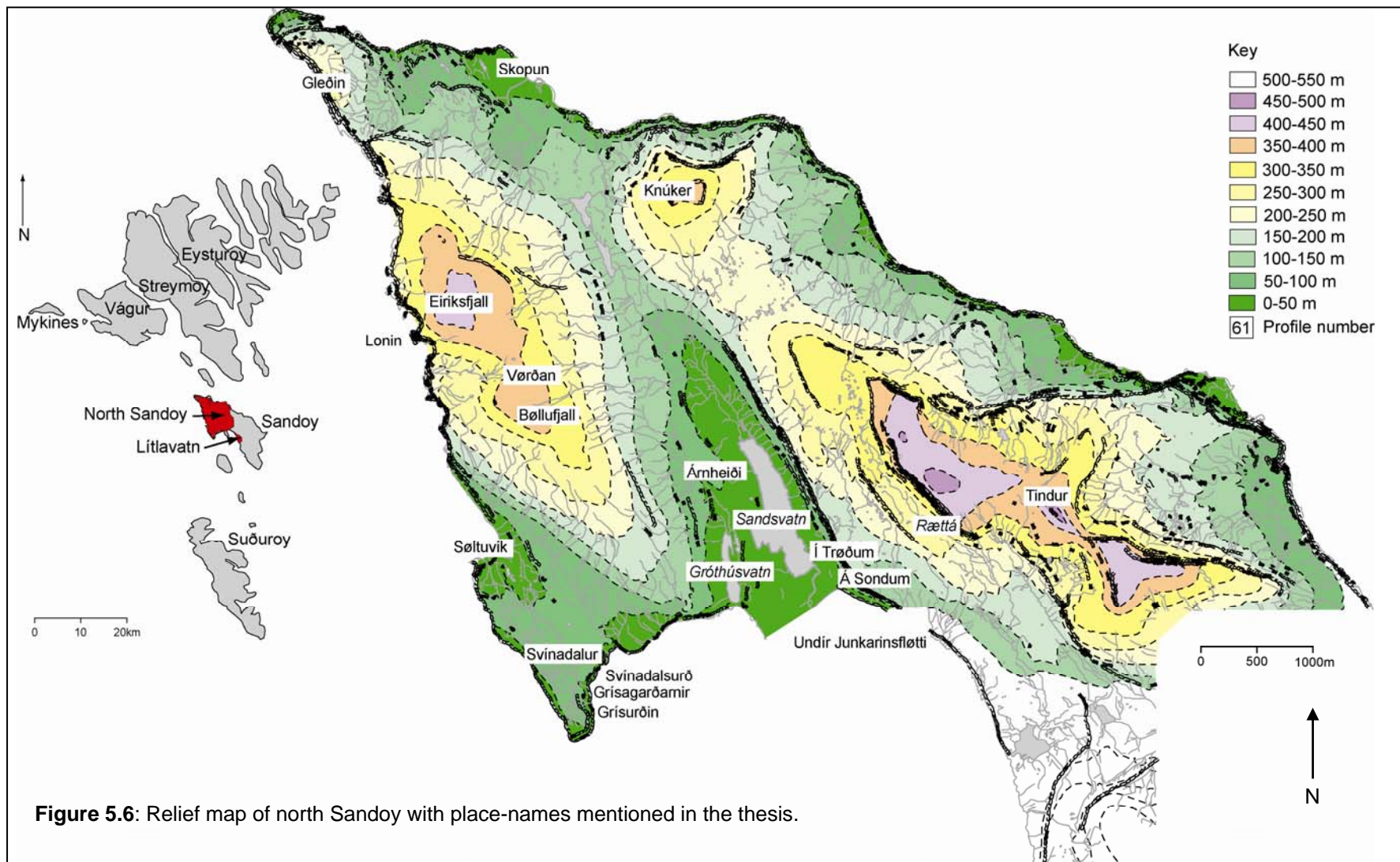


**Figure 5.5a** (above): Hov catchment and *bygd* looking west to Hovsdalur.  
**Figure 5.5b** (below): Hov catchment looking east to Hovsfjørður.

peat landscape, characterised by a high density of archaeological structures. The Hov landscape, therefore, contains records of a spectrum of human and environmental impacts, which can be tested in terms of the development of vegetation, soils, peat, slopes, river systems and archaeology. An additional reason for selecting Hov was that according to *Færeyinga Saga* (the Faroese Saga), Hov was one of the first settlements to be established in the Faroe Islands. In addition to the original farm, which is thought to be located upslope of the present day settlement, there are several farm names within the village and an inland summer shieling site that also testify to early Norse settlement. Evidence of both early and significant human impacts would therefore be assumed to be discernible within the landscape.

The Sandoy field site (Figures 5.6 and 5.7) targeted a larger geographical area than that of Hov in order to represent a wider spectrum of spatial scales. North Sandoy is extensive enough to identify a significant regional environmental signal, but constrained enough to enable comprehensive analyses of human interaction, and also providing a more substantial area to re-assess the initial hypotheses developed from environmental data collection at Hov. Sandoy is the second largest of the southern islands of the Faroes and is distinctive within the archipelago, not only for its sand dune system which gives the island its name, but also because of its relatively subdued topography and extent of land suitable for cultivation. Although a mountain ridge runs down the centre of the island and the west coast and west-facing hillsides are generally rugged with high cliffs, two major valleys that run from Sandur northwards to Skopun and eastwards to Húsavík (refer to Figure 5.6) have been scoured smooth by ice and give the island an overall more gentle topographic form. Within the valleys, a number of small lakes have developed, and extensive areas of blanket peat would have supplied the settlers with a source of fuel and building material.

The most prominent, and once the largest *bygd* on the island, is Sandur, which is believed to have been settled early and is probably the site of a farm mentioned in *Færeyinga Saga*. Excavations are ongoing at one of the primary holdings and the corresponding radiocarbon dates are currently some of the earliest in the Faroes (Lawson *et al* 2005). The Sandur infields are located on the isthmus between the lakes Sandsvatn and Gróthúsvatn and provide an extensive area for hay growing for winter fodder that is relatively well drained because of the sandy soil. Sandsvatn is a long shallow lake, rich in trout, and attracts a wide range of migrating birds and geese. The cliffs on the west coast offer considerable breeding opportunities for sea birds, particularly puffins and guillemots. Another characteristic of Sandoy is the relative abundance of pig-related place names, of which 22 have been identified (Arge *pers. comm.*), which combined with results from the ongoing archaeological excavations, demonstrates the use of pigs on the islands for centuries after initial settlement.



**Figure 5.6:** Relief map of north Sandoy with place-names mentioned in the thesis.



**Figure 5.7a** (above): Looking east across Gróthúsvatn and Sandsvatn to the Í Trøðum farms.

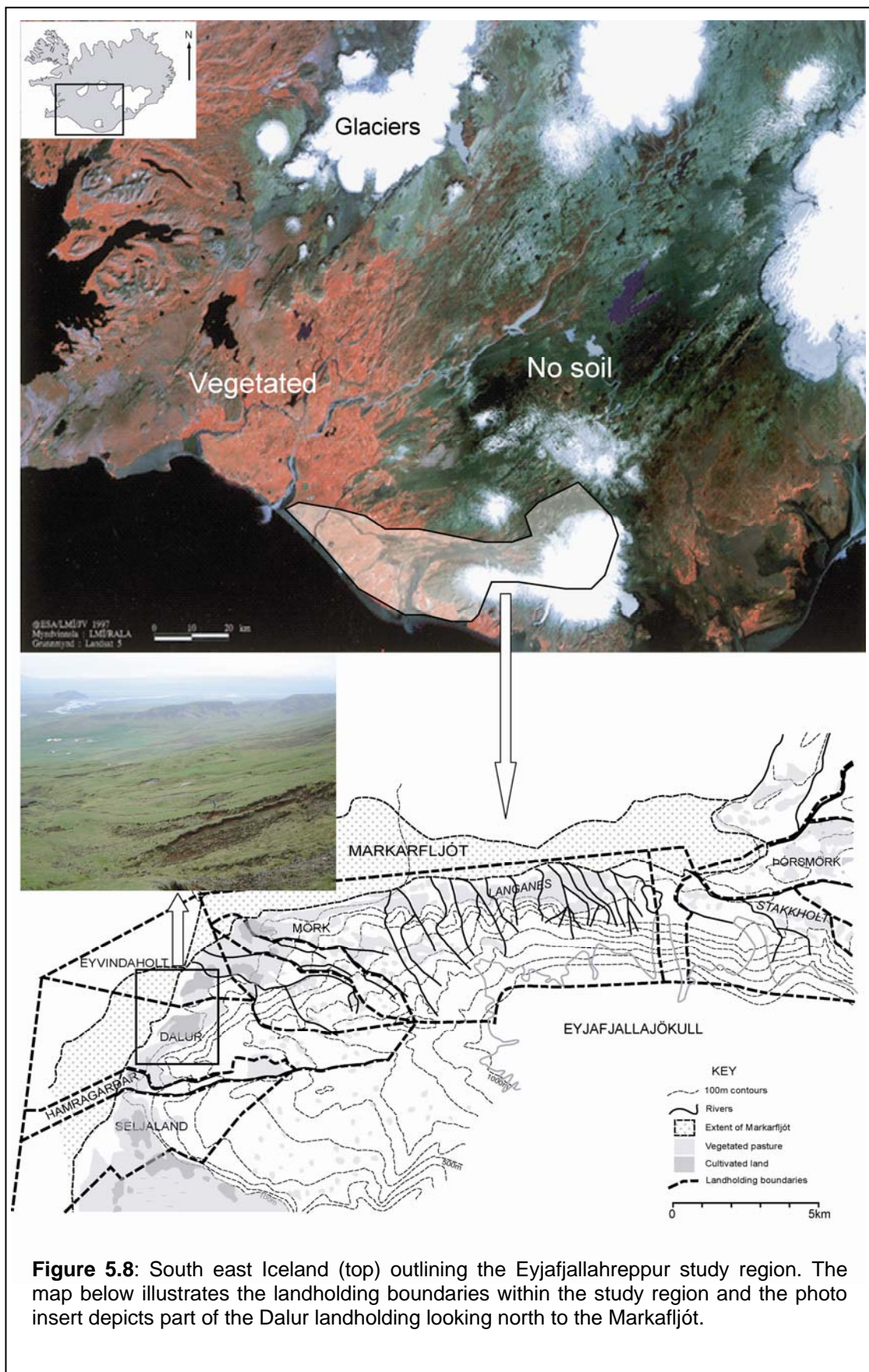
**Figure 5.7b** (below): Looking west from Knúker towards Eiriksfall.

In view of these characteristics and recent investigations, it is assumed that Sandoy was colonised relatively early in the Norse settlement period, by a significant number of settlers, and was therefore subjected to a wide range of human impacts. It is also assumed that human impacts display a stronger and more recognisable signal in the landscape records from Sandoy than is, for example, apparent in the landscape record of the northern islands. Many of the northern islands have steeper gradients and higher altitudes and, therefore, natural processes may dominate even where human impact has been significant.

#### *Eyjafjallahreppur, Iceland*

Eyjafjallahreppur is a region located in the south of Iceland and encompasses the valley to the north and the sandur plain to the south of Eyjafjallajökull (Figure 5.8). Although the hreppur (district) extends along the south coast sandur, the field area comprised only the strip of land between Eyjafjallajökull to the south and the Markarfljót to the north. On the slopes between these margins, nearly 40 farms, both settled and abandoned, and the continuous settlement of some farms since the early days of settlement, testifies to the utilisation of the landscape by people for a significant period of time. Although the present-day farm infields and their environs are well vegetated, and the inland area of Þórsmörk is forested by birch and willow, extensive upland areas are degraded, having suffered from increased soil erosion since human settlement. The extensive erosion of upland soils has led to the deposition of thick aeolian sediments in the lowlands, which are divided by layers of tephra that mark the instant in time at which the volcano erupted. This area of Iceland has a particularly well-established tephrochronology and most identifiable historical tephra layers in the region have been dated (Þórarinnsson 1944; 1967; 1981, Larsen 1981; 1982; 1984, Dugmore 1987; 1989, Dugmore *et al* 2000, Larsen *et al* 1999). The combination of rapid soil accumulation and continuous volcanism in the area throughout the historic period, has resulted in the formation of high resolution soil stratigraphic profiles, which can be utilised in testing hypotheses of human-environment processes and interactions. These contrast with processes of soil formation in the Faroe Islands, which have been less rapid and have formed shallower profiles (refer to Figure 5.3). The lower resolution soil stratigraphies from the Faroe Islands, therefore, make historical mechanisms of landscape change and human impacts more challenging to identify in comparison to south Iceland, where high resolution records and more precise chronological data are available. Although some micro-tephras have been identified in Faroese soils, the identification and significance of these are hard to determine and the Faroese profiles lack the chronological precision provided by tephrochronology in Iceland (Dugmore and Newton 1998).

#### **Spatial methods**



**Figure 5.8:** South east Iceland (top) outlining the Eyjafjallahreppur study region. The map below illustrates the landholding boundaries within the study region and the photo insert depicts part of the Dalur landholding looking north to the Markaflljót.

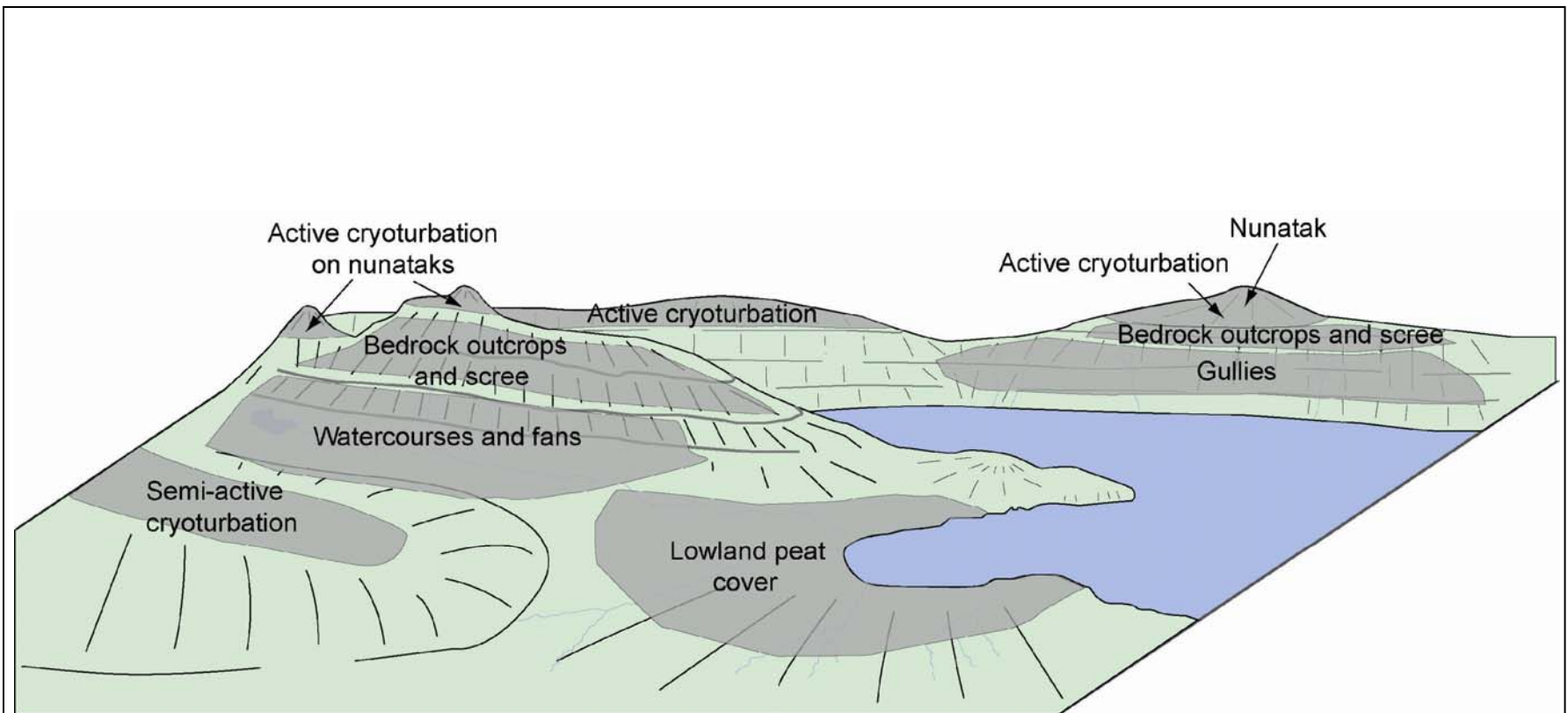
*Landscape mapping*

Identification of landscape-scale morphological units, and mapping of the extent of landscape surface degradation, was carried out at Hov and Sandoy respectively, with the aim of defining boundaries, limits and thresholds within the environment, and understanding how these have changed through time. The aim of the landscape mapping was firstly to assess to what degree landforms, and the boundaries between them, have changed since colonisation (thus indicating the extent of human impact), or to assess whether the landscape seen today is essentially similar to that which existed prior to settlement. It is important to investigate if the present landscape has been predominantly influenced by processes occurring prior to settlement or by geomorphological changes that were initiated by human activity.

Landscape mapping can also be directly compared with other data sets, such as stratigraphic profile records, archaeological survey data and interviews. For example, degraded landscape surfaces can be compared with periods of increased mineralization and erosion observed in the underlying stratigraphy, and by dating the unit transition in the profiles, dating for the onset of erosion might also be proposed. Selected profiles were sampled at high elevations on the threshold of degraded and vegetated land (as determined from the landscape mapping) to secure dating of these major destabilisation events. Comparisons between degraded areas on Sandoy and in Hov, and patterns of human settlement and known areas of resource use as determined from archaeological survey and interviews, can also be made, in order to determine to what extent there is a correlation between human activity and soil surface degradation.

Mapping of both landscape units and surface degradation was based initially on the interpretation of aerial photographs and topographic maps. Desk-based work was supported by extensive ground surveys of Hov and north Sandoy that utilised GPS. A multi-stage approach was adopted for the mapping; stage 1 (Hov) utilised geomorphic mapping of landscape units combined with selective stratigraphic analyses. Stage 2 developed this approach on Sandoy and switched emphasis to detailed stratigraphic studies and land cover classifications relating to the more subtle effects of human impact, which were found not to be affecting fundamental landform units. Stage 3 involved a return to Hov to reassess the geomorphology and add the same land cover classifications used in stage 2. Archaeological studies were nested within the geomorphic mapping exercise.

In stage 1 (Hov), 8 categories were assigned to landscape units, ranging from nunatak areas with active cryoturbation, bedcrop outcrops, scree slopes of deep sediment and lowland peat cover. Figure 5.9 illustrates the identification of landscape units in a characteristic catchment



**Figure 5.9:** A typical Faroese landscape divided into “landscape units” that were used to define boundaries when mapping the Hov catchment.

that were used to define boundaries when mapping the Hov catchment. Key areas of geomorphological interest were comprehensively recorded and illustrated by more detailed recording and mapping. Key features identified and mapped included a series of box gullies on slopes on close proximity to Hov *bygd*, post-settlement gullying in peat on north facing slopes south of Hovsfjørður, the development of a high altitude inactive fan in Hovsdalur and a lower altitude active fan and river system further down the Hovsá valley.

For stage 2 and 3 (north Sandoy and Hov), levels of surface degradation were classified into 11 categories, ranging from completely degraded (0 %), to completely vegetated (100 %), according to the estimated extent of surface vegetation and soil cover. The mapping of these surface degradation categories makes it clear to identify, for example, degraded areas which may not be explained by a climate-altitude relationship.

#### *Archaeological survey*

In order to integrate the analyses of stratigraphic profiles and landscape mapping of the outfield area with evidence of land and resource use, archaeological field surveys were carried out at the two Faroese field sites of Hov and north Sandoy. Archaeological and palaeobotanic excavations have been conducted in and around infield sites, which has yielded insights into the life and farming practices of the first settlers (Stummann Hansen 1990, Dahl 1970b, Matras 2005, Arge 2001, Church *et al* 2005). There has, however, been a lack of systematic surveys of the outfields, and at present, very little, or nothing at all is known about the traces and remains of the Faroese cultural landscape (Arge 2006). While the current record of structures in the infield have been selectively destroyed or are obscured by near continuous settlement and agricultural activity, the outfields have a rich archaeology that remains visible in the surface landscape. Physical remains in the outfield are abundant, but ironically, due to this abundance have been considered insignificant. However, when their spatial patterns are analysed, they may clarify economic and social elements in a period where few other contributory sources to our knowledge exist (Arge 2006). The aim of the archaeological surveys in this research was to address the spatial patterns of archaeological structures within the landscape, and to assess possible functions and forms of anthropogenic activities through the outfield archaeology. In particular, specific locations or nodes of activity were identified where particular anthropogenic activities must have been prolific.

The field survey was conducted at the same spatial resolution as the environmental fieldwork, allowing comparisons to be made between areas of more or less intensive human activity and areas of heavily degraded or vegetated land. The hypothesis was that a positive spatial correlation between degradation and structure density would indicate a dominance of

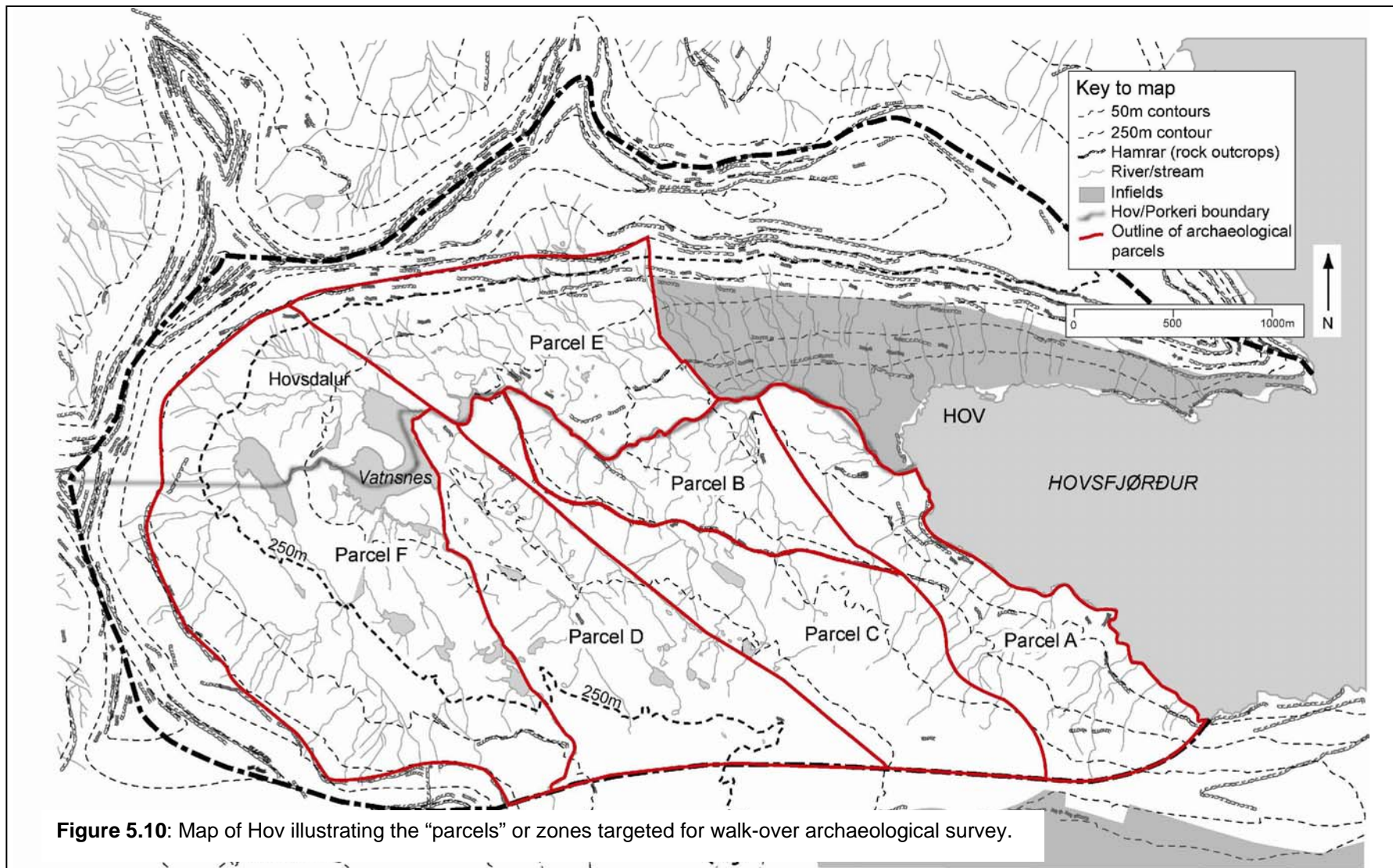
human impact, while a negative spatial correlation between degradation and structure density might imply that people had chosen the environmentally best sites on arrival. This would infer that human impact was negligible and that degradation was predominantly caused by natural impacts (refer to Table 1.1, hypothesis 4). Locations of anthropogenic activity, inferred by the location of archaeological remains, were also compared with information on the location of more recent anthropogenic activity according to interviewees from Sandoy.

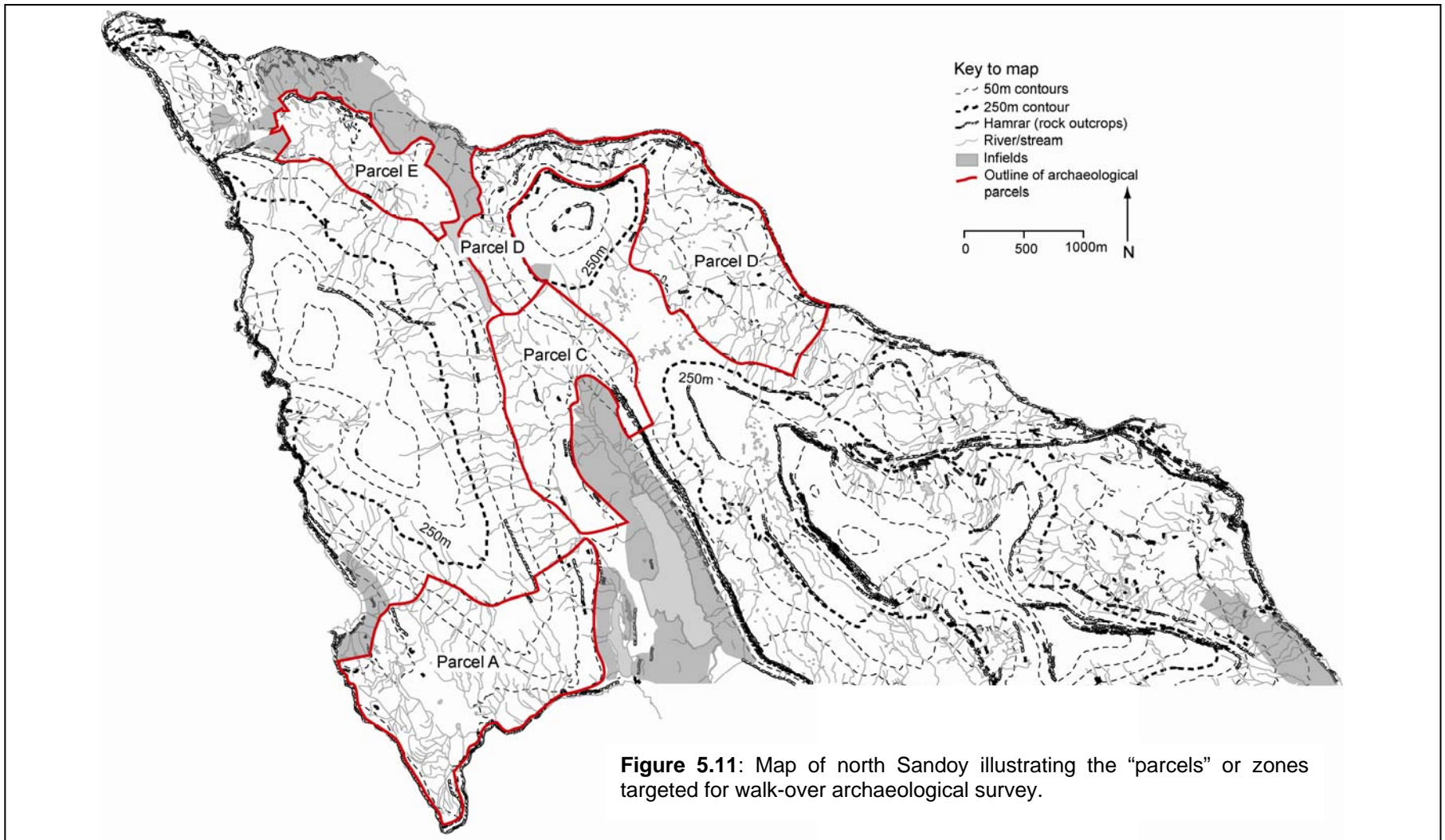
The locations and spatial pattern of the archaeological structures at Hov acted as a preliminary study prior to a more extensive survey of three archaeologically rich areas (zones) in north Sandoy. In addition, a general survey over the entire north Sandoy region was carried out to gauge areas of archaeological concentration and ensure representivity of the surveyed areas. For each zone, an initial desk-based survey was carried out, with the defined area split into “parcels” on the basis of the proposed density of archaeological remains as gathered initially from the maps (Figures 5.10 and 5.11) (some, but not all, features, such as sheep folds and shelters are located on Faroese 1:20,000 topographic maps). The parcels were walked over in detail and locations of the observed structures were recorded either directly onto the map (in Hov) or using a GPS (in Sandoy). Using a monument form (e.g. Figure 5.12), the structure and its environmental context were photographed and sketched, and the structures were classified in the field according to size, orientation, form, building structure and material, possible purpose, current condition and environmental context.

#### *Settlement and landholding data*

The reconstruction of Viking Age settlement patterns has been carried out by Arge *et al* (2005) based on archaeological and documentary evidence, which provides an interesting comparison to modern day settlement patterns (refer to Figure 4.13). Settlement pattern data may be compared, or incorporated, with information acquired from the interviews and the natural landscape data sets, as these other sources of data may assist in understanding the development of Faroese settlement patterns. Settlement patterns in the Faroe Islands are different from those in Iceland and Greenland, so a key question is whether settlement patterns in the Faroes developed in response to the local topography or because different subsistence practices evolved on each of the North Atlantic islands that demanded a different settlement arrangement.

Data concerning the distribution of landholdings is also valuable in order to make cultural scale analyses of environmental change. Landholding units are comparable at a landscape-





MONUMENT FORM		
PROJECT: Sandoy Arc 2005		DATE:
TEAM: KAM		WEATHER:
PARCEL NO/ZONE:	MONUMENT NUMBER:	
COMPONENTS:		
MAP SHEET:	PHOTOS:	
MONUMENT	DIMENSIONS	
SOURCE:	LENGTH - INNER:	
NGR/GPS:	LENGTH - OUTER:	
CLASS:	WIDTH/DIAMETER - INNER:	
NATURE:	WIDTH/DIAMETER - OUTER:	
FORM:	HEIGHT/DEPTH:	
CONDITION:	ASPECT:	
LAND COVER:	SLOPE ANGLE:	
LAND USE:	ELEVATION:	
	ORIENTATION:	
PERIOD:		
DESCRIPTION:		
WALLS:		
STONE SIZE/SHAPE:		
PHASES OF ACTIVITY:		
LONG AXIS ORIENTATION:		
DOORWAY ORIENTATION AND POSITION:		
EXPOSED/SHELTERED:		
ENVIRONMENTAL RELATIONSHIPS:		
VEGETATION:		
LEVEL OF DEGRADATION:		
GRAZING QUALITY:		
PROXIMITY TO WATER:		
PROXIMITY TO BUILDING MATERIALS:		
LICHEN PRESCENCE:		

**Figure 5.12:** Sample monument form used for Hov and Sandoy archaeological surveys.

scale resolution, and can be used to test the extent to which landscape change is a result of anthropogenic or climatic factors. For example, if the landscape record (in terms of the extent of erosion) differs between landholdings in a single region, the impact of management decisions made by individual landholdings are probably dominant. If landscape changes are regionally similar, and are unconstrained by landholding boundaries, climatic effects or more widespread anthropogenic activities are likely to be the dominant cause of erosion. The inheritance of current landholding boundaries on Sandoy is not fully understood, so the application of landholding data was less important in the Faroes than in southern Iceland, where landholding boundaries are known to have a long history (Sveinbjarnardóttir *et al* 2006) and can, therefore, be incorporated and compared directly with the physical landscape data.

## Conceptual methods

### *Interview process*

Semi-structured interviews were conducted with selected farmers from Sandoy with the aim of relating the data collected from archaeological surveys (i.e. evidence of past human activity) and the palaeoenvironmental records to the current knowledge and practices of local populations who have lived in and managed such environments, and have knowledge of the practices of previous generations. Local perspectives on subsistence practices, social interactions and values can provide vital insights into the recent past, as local knowledge is passed down through oral histories and past experience, and because there has been a temporal continuity in farming practices and conservativeness of values in the Faroe Islands. Farmers also have a wealth of spatially localised knowledge, for example, concerning locations of previously used peat banks, and the ownership of specific areas of cliffs used for bird catching by individual farms.

The number of interviews was limited to four, but represents a significant proportion of the active farming population of Sandur (the main centre of agriculture on the island). The interviewees were carefully selected so that they were of the older generation. In particular, the oldest had childhood memories back to the Second World War, giving an insight into farming practices from the mid 20<sup>th</sup> century and before. There was a combination of both active farmers and people with both a personal experience of farming and wider perspective of agriculture. Crucially, rather than adopting a more extensive but less detailed approach, each interview was in depth, and together have produced more than 20,000 words from the two English language discussions alone. The conversations were wide ranging, covering all aspects of farming. Data is reproduced in full in Appendix B, because there is a notable lack of information in the English language, and unfortunately first hand knowledge is dying out in

the Faroe Islands. It was notable by the third or fourth interview that diminishing returns were being encountered and a very similar picture was emerging with limited additional information. The specific objectives of the interviews were:

- (i) To compare past and present resource use and resource “value” with archaeological and environmental data.
- (ii) To compare past and present settlement patterns and community structures with that of other North Atlantic settlement patterns.
- (iii) To compare perceived and actual land quality and erosion and how these qualities are measured.
- (iv) To establish the environmental/climatic criteria that most impact farmers in the Faroe Islands.

The interviews consisted of open-ended questions arranged around a framework of topics which are presented in Appendix B and include the exploitation of resources, particularly peat, birds, fish and whale, resource ownership, community and social structures, settlement location, affects of erosion and affects of climate on agriculture. Some specific questions were also asked to elicit locally based information particular to Sandur, such as where the best peat banks or nearest bird cliffs were to be found, as such information is difficult to procure from the existing literature. Although the framework set out in Appendix B was initially referred to, queries were not followed in a strict order, and in a number of cases it was appropriate to deviate from the suggested questions.

Four in depth interviews were conducted with farmers from Sandur, each lasting up to two hours. Two of the respondents are from long-standing farming families from Sandur and are actively farming today. One respondent had retired from active farming (the farming now having passed to his son) and a fourth respondent, although from a farming family on Sandoy, no longer actively farms, but works within the agricultural sphere and has access to local and regional information based on oral family histories. Two interviews were conducted in English as the respondents were fluent English speakers, while the two remaining interviews were conducted primarily in Faroese and interpreted with the help of Faroese archaeologist, Símun Arge, who was present throughout. Audio recordings were made of each interview to assist in analyses. Detailed notes arranged around specific categories were made from the audio recordings of the interviews conducted in Faroese, while the two interviews conducted in English were transcribed in order to minimise the amount of questionable inference involved in the interviews. Interview data was analysed based on the method of “grounded theorising” (e.g. Glaser and Strauss 1967, Strauss and Corbin 1990), whereby analytical categories were developed arising from the initial framework of the data and from the data itself. Segments of data were then gathered together from different parts

of the interview that were relevant to a certain category, and all the items of data that have been assigned to a category were compared and contrasted in order to clarify the meaning and relations among categories.

As the interviews, in general, did not concern controversial or sensitive material, the major issue was the problem of accurate translations between Faroese and English. Material was inevitably lost during translation of the Faroese interviews, both in questioning and answering. To compensate for this, material from transcribed interviews was cross-checked with notes made from the translated interviews. Although the quality of the translated data was inevitably less, the principal loss was the quantity of data.

## **Temporal methods**

### *Stratigraphic sections*

In the Faroe Islands, many proxy records which could be used to gather data on landscape change, are either absent or comparatively desensitised in terms of their response to climate and cultural forcing. For example, significant measurable changes in the biota of the Faroe Islands are limited as the landscape lacked significant woodland cover prior to settlement and has been essentially dominated by grass and heath (Hannon and Bradshaw 2000, Lawson *et al* 2005). Therefore, impacts of human colonisation may be expressed by only comparatively limited changes in the vegetation record, which needs to be complemented by additional or alternative records. In this instance, geomorphological changes may be relevant because they respond to environmental and anthropogenic signals over a range of temporal and spatial scales (Humlum and Christiansen 1998a; 1998b). Changes in the form of the surface landscape through time, as represented in the stratigraphic section, record a fundamental environmental change, such as the crossing of a critical threshold within the landscape. Although specific profiles may be representative of site-specific changes, the majority of profiles identify change at local scales, although by comparing several profiles across a catchment, region or island, and between islands, a regional picture of landscape change can be accumulated.

A study of the soft sediment stratigraphy, overlying either bedrock or glacial/fluvioglacial sediments, was used to identify periods of landscape stability and major geomorphological change, which together with a reliable dating framework, can be used to reconstruct the Holocene environmental history of the southern Faroes. A total of 86 stratigraphic sections were recorded, 32 from Hov in the east of Suðuroy, with the remaining 54 located across a larger geographical area in the north of Sandoy. Various locations were targeted to represent a wide range of geomorphic situations; fluvial and non-fluvial settings, at various stages on

slopes of various aspects, and at high altitudes on mountain plateaux in places where soil was remaining. Several profiles were recorded along specific topographical transects covering altitudes between 0-350 m, above which little soil cover remains. The transects allowed changes in lithostratigraphic units to be traced through time, under the assumption that impact begins at high altitudes and migrates downhill to affect more stable geomorphic areas. Profiles recorded at altitudes above the lower threshold of periglacial activity (~250 m) may be especially sensitive to anthropogenic and climatic change and are less likely to be contaminated than sediments in lower altitude profiles where re-worked material may be re-deposited.

Stratigraphic sections were recorded from excavations of naturally eroding faces and fluvial channel exposures as well as from the faces of artificial ditches and road cuttings. Stratigraphies therefore covered a wide range of environments allowing sediment units to be traced across the landscape, and allowing profiles illustrating more site-specific changes to be identified. Profiles were recorded across a minimum horizontal exposure of 50 cm to ensure accuracy, and at many localities additional profiles were consulted to ensure the recorded exposures were representative. Detailed notes and sketches of each profile's location and slope catchment within the landscape were made. This permitted an assessment of how the record in each profile was representative of landscape change in a particular area, e.g. KAM 19-21 contains evidence from activity on the slopes directly above up to the watershed. Detailed notes and sketches of individual sediment profiles were also made to record the colour, texture, composition and form of soil units. At specific sites, stratigraphic sequences were sampled using monolith boxes secured into the face of the exposure, measuring between 25 cm and 50 cm in length. Sets of monoliths provided a longer sequence on deeper profiles. All cores were re-examined and re-recorded under laboratory conditions and sub-sampled down to 1 cm contiguous intervals. Loss-on-ignition and dry-bulk density analyses were conducted as part of this research, in order to ascertain how the organic content of the soil stratigraphies changed through time and to establish the optimal depth for subsequent dating of samples using AMS radiocarbon dating. Magnetic susceptibility, tephra analyses, pollen analyses and detailed soil micro-morphological work, incorporating total nitrogen, total carbon, total phosphorous and particle size measurements, were conducted by others as part of the wider "landscapes circum *landnám*" research project, but were not directly relevant to the themes of geomorphological change explained here.

#### *Radiocarbon chronology*

A critical aspect of reconstructing an environmental framework, with which to integrate cultural data and processes, is the establishment of a chronology that is relevant to human

timescales. A high resolution sediment record and a precise and accurate chronology are desirable, without which the identification of causal factors is ambiguous. This is particularly so when analysing the causes of landscape change as, for example, a geomorphic event must occur *after* the natural or anthropogenic event that is implied to have caused it. Although radiocarbon dates may be precise enough to suggest coincidence between two events, they are rarely precise enough to prove causality between those events. Dating the anthropogenic record is further complicated in the Faroe Islands because the timing of human settlement is not known beyond the traditional date of 825 AD (Arge 1991). In southern Iceland, on the other hand, a rigorous and well-established tephrochronology fulfils the criteria of precision and accuracy, and rapidly accumulating soils have provided a high resolution chronology. Within a Bayesian framework, tephrochronology has also been used along with sediment accumulation rates and multiple radiocarbon dates to secure a date on charcoal pits to an accuracy and precision of less than 20 calendar years (Church in press; *pers. comm.*)

Due to difficulties in applying tephrochronological methods to the Faroe Islands material, chronological control was achieved using topographic and stratigraphic relationships combined with radiocarbon dating. In order to provide a robust chronological framework across the southern Faroe Islands, a total of 52 AMS radiocarbon dates were acquired from 19 stratigraphic profiles, with a minimum of two dates from any single profile. Specific stratigraphic sections were targeted for dating with the aim of bracketing major sediment changes in the stratigraphy, for example, to date the timing of transition from a stable peat unit to a clast rich or sandy silt unit. Radiocarbon dating is also dependent on the availability of suitable organic material, although this did not cause any problems in the Faroes where peat is ubiquitous, and where many units consist of up to 98 % organic material. By targeting obvious unit transitions in the profile, which could be traced through the region, the timing of initiation of major geomorphic changes could be compared both within and between the southern Faroe Islands. Dating on profiles at Hov was performed in April 2004, with dating on profiles from Sandoy performed in January 2006. Additional dates on the Hov profiles were secured in 2006, which allowed for the resolution of existing incompatible dates at Hov and to test the robustness of the dating chronology. Peat samples of 1 cm<sup>3</sup> were subjected to acid and alkali washes and were dated from the humic fraction (with the humin fraction additionally dated for KAM28 samples). AMS radiocarbon dates were measured and calculated by Gordon Cook at the SUERC, East Kilbride. Calibration to calendar years was performed to 2  $\sigma$  using Calib 5.0.2 (Stuiver *et al* 2005), using the highest probability value with dates rounded to the nearest ten years.

The accuracy of the radiocarbon chronology was assured by corresponding radiocarbon dates acquired from equivalent unit transitions across both islands, from multiple dates on

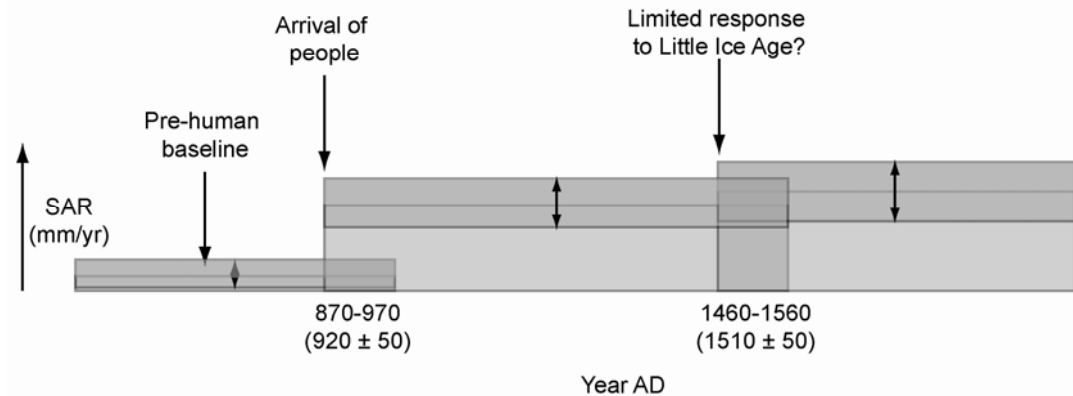
cores, and through comparison with stratigraphical relationships. However, the application of radiocarbon dating is limited by the precision and resolution of the technique on human timescales. The precision of the calibrated radiocarbon dates varies, and the range on a single date differs between 50 and 200 calendar years, which make it more problematic to understand decadal scale anthropogenic change. Figure 5.13 demonstrates a major drawback of using a radiocarbon chronology to make interpretations of landscape and cultural history. The example used in Figure 5.13 represents the average sediment accumulation rates (SARs) of 22 sediment profiles in the Mörk landholdings in the Eyjafjallahreppur region of south Iceland, and illustrates the differing interpretations that might be made of these SARs when utilising a radiocarbon chronology (A) and a tephrochronology (B). Detailed information regarding, for example, the settlement period and associated erosion between 871 AD and 1341 AD, and a decrease in erosion after 1341 AD indicating landscape stabilisation, is lost when relying on a radiocarbon dating chronology. This presents a challenge when considering detailed palaeoenvironmental trajectories at the time of *landnám* and over long-term trajectories of settlement (Dugmore *et al* 2000).

Additionally in the Faroes, the resolution of the sediment stratigraphies is reduced as soil profiles are general shallow, whereas in Iceland, andisol accumulation has been rapid since settlement, resulting in deep profiles and high resolution records. Re-working of sediments and incorporation of old carbon was also an issue when dating down slope and low altitude profiles, so the majority of samples were collected from higher altitude sites. Other drawbacks when using radiocarbon chronologies relate to both the technique itself (Olsson 1982; 1986), and the presence of radiocarbon plateaux in the 5<sup>th</sup> and 6<sup>th</sup> centuries and the latter centuries of the first millennium, which restricts the precision of dates over the crucial settlement period (Dugmore *at al* 2000, Hannon *et al* 2001).

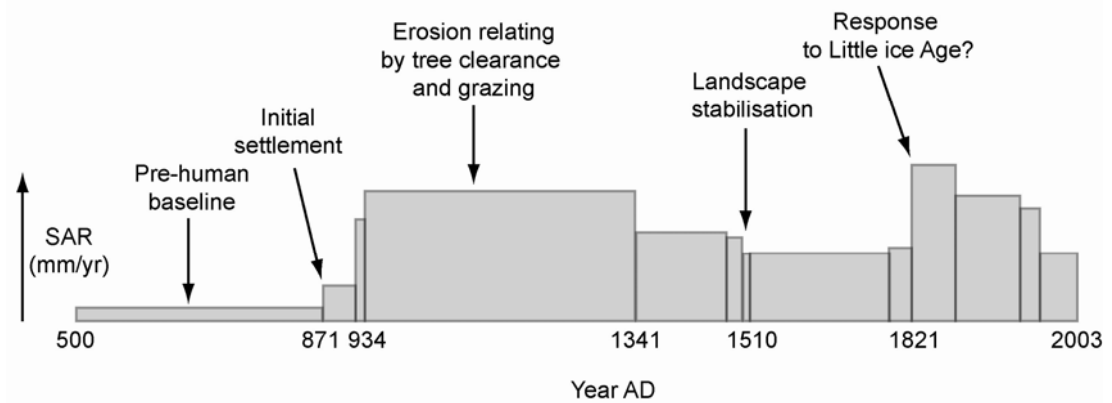
### Chapter summary

This chapter began by outlining a methodological framework from which to better understand the integration of scale-matched methods in historical ecology based research. Additional conceptual frameworks explored the relationship between these methods over time and space. Secondly, the field site locations in both the Faroe Islands and Iceland were described and justified. The methods and processes of data collection from those field sites was then discussed relating to the individual collection of landscape mapping, archaeological survey, semi-structured interview and stratigraphic data. Finally, the advantages and disadvantages of a radiocarbon chronology, used to understand and date the Faroe Island landscape record, were evaluated.

A: Sediment accumulation rates and an interpretation of landscape history utilising a radiocarbon dating chronology



B: Sediment accumulation rates and an interpretation of landscape history utilising a tephrochronology



**Figure 5.13:** Figure illustrating the possible interpretations of human and landscape history within the landholdings of Mörk in the Eyjafjallahreppur region of south Iceland. Figure A illustrates possible interpretations that may be made if relying on a radiocarbon chronology and assuming 2 dates down the profile. Figure B illustrates possible interpretations that may be made by utilising tephrochronological dating. The higher resolution of the latter suggests a more complex landscape and cultural history of Mörk than is suggested by the record using radiocarbon dating.

The following chapter presents the collected data, which is organised in a similar arrangement to that of the methods described above.

## Chapter 6

### Data presentation

#### Introduction

Data collected from the methodologies outlined in chapter 5 and in Figure 5.1 are presented here separately, according to the method of collection, in order to make reference to the data as straightforward as possible. Spatial data is presented initially, specifically landscape unit evidence for Hov, inclusive of maps, tables, figures and photos, followed by data relating to land cover classifications in Sandoy. The presentation of cultural data includes archaeological survey data, maps and descriptions of archaeological structures. An overview of interview data, arranged thematically, is then presented with full transcripts and notes of the original interviews in Appendix B. Temporal and stratigraphical data is presented as annotated sedimentary profiles, descriptions of transects and associated radiocarbon chronologies. A summary review of original Icelandic data on which Icelandic comparisons were based concludes this chapter (and additional original Icelandic data is presented in Appendix C).

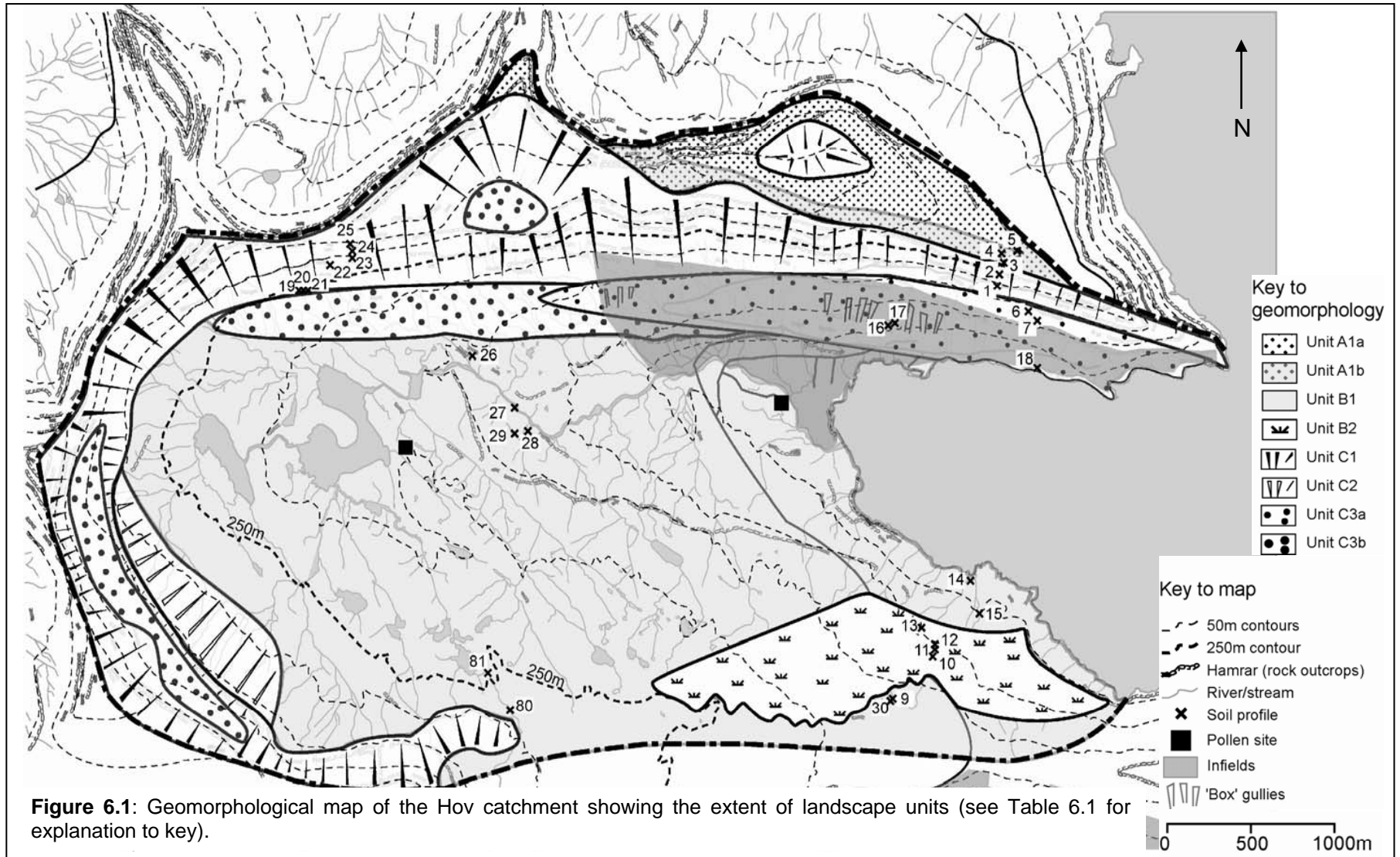
#### 6.1. Presentation of spatial data

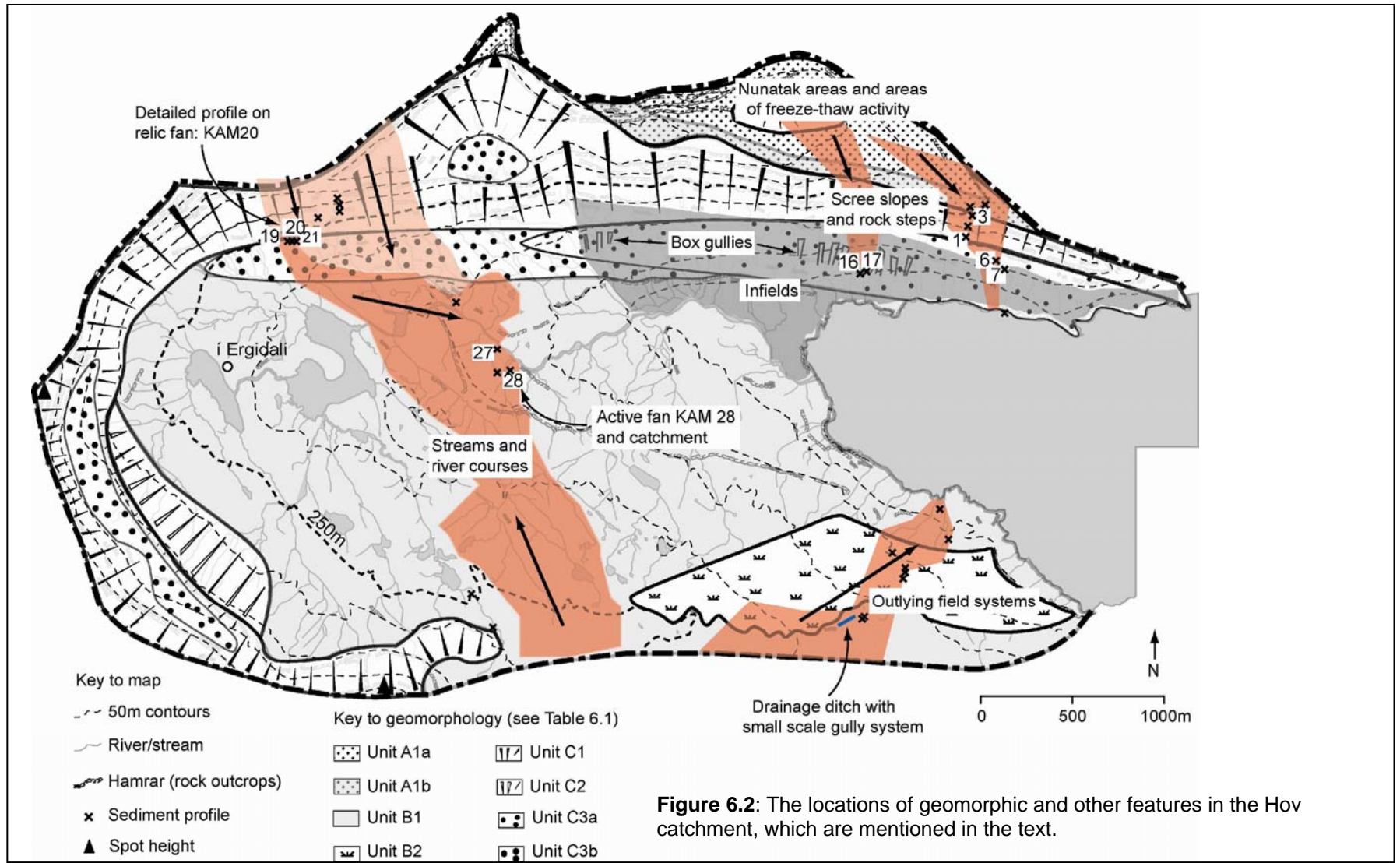
##### Hov: landscape units and geomorphic features

For stage 1 of the landscape mapping, which utilised geomorphic mapping of landscape units at Hov, a map was constructed demonstrating the geomorphology of the region at a catchment-wide scale (Figure 6.1). Four major landscape units were identified including nunataks and areas of active or semi-active cryoturbation, peat dominated cover, soil or scree covered slopes and infields with improved soils. Each unit was subdivided into additional categories with more detailed descriptions (Table 6.1). Within this wider-catchment overview, specific relevant geomorphic features were identified and are discussed in more detail below following a general summary. Locations of specific geomorphic features along with other features mentioned later in the text are illustrated by Figure 6.2.

##### *General summary of Hov geomorphology*

In summary, the Hov catchment consists of steep-sided south and east facing headwalls, where basalt outcrops and buttresses (*hamrar*) alternate with steep slopes dominated by clast rich talus or sandy entisols. As these slopes become less steep, the sediment cover





**Figure 6.2:** The locations of geomorphic and other features in the Hov catchment, which are mentioned in the text.

<b>Altitude</b>	<b>Bedrock area exposed</b>	<b>Regional slope angles (spatial scales of 100-1000m)</b>	<b>Local relative relief (spatial scales of 10-100m)</b>	<b>Dominant surface sediments and features</b>	<b>Map code</b>	<b>Comments</b>
>250m	Limited (<10%)	Low (<1:10)	Low (<5m)	Clast rich diamictons; sandy Entisols/ Histosols Periglacial processes active (cryoturbation)	A1a	Nunatak areas-cryoturbation active with little vegetation
>250m	Limited (<10%)	Low (<1:10)	Low (<5m)	Clast rich diamictons; sandy Entisols/ Histosols Periglacial processes semi-active/fossil	A1b	Nunatak areas-cryoturbation semi active with some soil and vegetation
<250m	Significant (10-50%)	Low to Moderate (up to 1:5)	Low-High (<50m)	Histosols plus frequent watercourses/ lakes/ponds; ribbons of alluvium and some fans	B1	Ridge/basin topography
<250m	Limited (<10%)	Low (<1:10)	Low (<5m)	Histosols covering >75% of surface, some gullies	B2a	Lowland peat cover
<250m	Limited (<10%)	Low (<1:10)	Low (<5m)	Patchy histosols/ exposed diamicton/bedrock; ribbons of alluvium and some fans	B2b	Eroding peat cover
0-600m	Significant-dominant (10-75%)	Steep (1:10 to 1:1/vertical)	High (<50m)	Abundant free-faces. Clast-rich talus (gravels-boulders) and sandy Entisols	C1	Bedrock outcrops plus scree
0-600m	Limited (<10%)	Steep (1:10 to 1:1)	Low (<5m)	Clast-rich talus and sandy Entisols	C2	Semi vegetated diamicton/scree few bedrock outcrops
0-600m	Limited (<10%)	Steep (1:10 to 1:1)	Low (<5m)	Sandy Entisols/ Histosols overlying deep (.5m diamictons) Dry 'box' gullies present	C3a	Soil covered slopes over deep sediment
0-600m	Limited (<10%)	Steep (1:10 to 1:1)	Low (<5m)	Shallow sandy Entisols/ Histosols generally overlying bedrock; frequent watercourses; ribbons of alluvium and some fans	C3b	Soil/peat covered slopes
<250m	Limited (<10%)	Low-Moderate (<1:5)	Low (<5m)	Infields with improved soils	D	Homefields

**Table 6.1:** Key and detailed description for the Hov catchment landscape unit mapping (Figure 6.1).

deepens and talus is replaced by soil, which is generally well vegetated. At lower altitudes, such as the where the infields have developed and where the village of Hov now sits, the depth of sediment is more considerable, a factor which has aided the formation of characteristic gullies. The valley bottom and lower hill slopes are dominated by ridge and basin topography and a network of watercourses, strips of alluvium and some fans. Some areas are more eroded than others and are characterised by un-vegetated patches and loose gravels where soilfluction is semi-active. Inland, below the eastern headwall, relatively deep peat deposits were observed, which have been affected by considerable erosion and gullying (refer to Figure 6.9f). An extensive, well-vegetated lowland peat cover characterises the landscape in the south of the catchment, although with limited erosion. Water courses of various scales, from small ephemeral streams to perennial rivers, feature across all landscape units and are associated with some limited areas of fluvial deposition and fan formation. With regards to landscape stability over time, scree slopes and fan surfaces are comparatively stable today and are characterised by lichen and vegetation cover, and an absence of evidence for movement. Fluvial systems show limited evidence for aggradation, although there is evidence of past periods of considerable instability, whereby major gullies were formed and surfaces eroded.

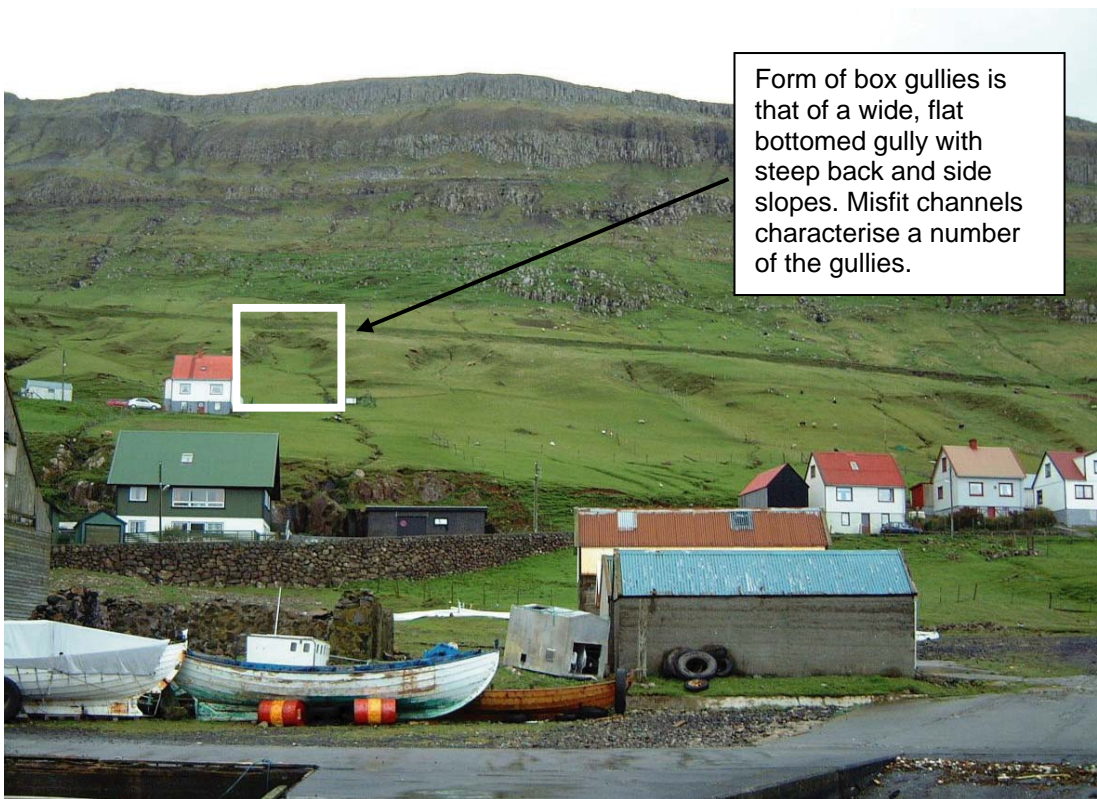
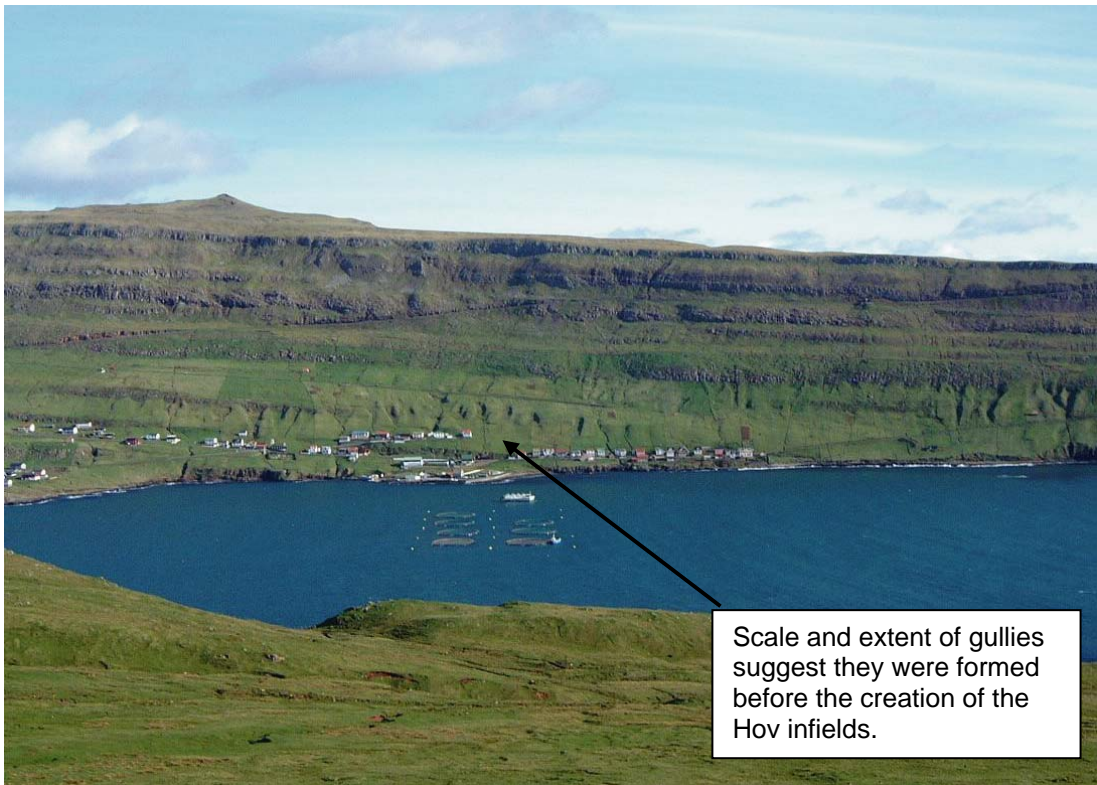
#### *Summary outline of specific geomorphic features*

##### *Box-type gullies*

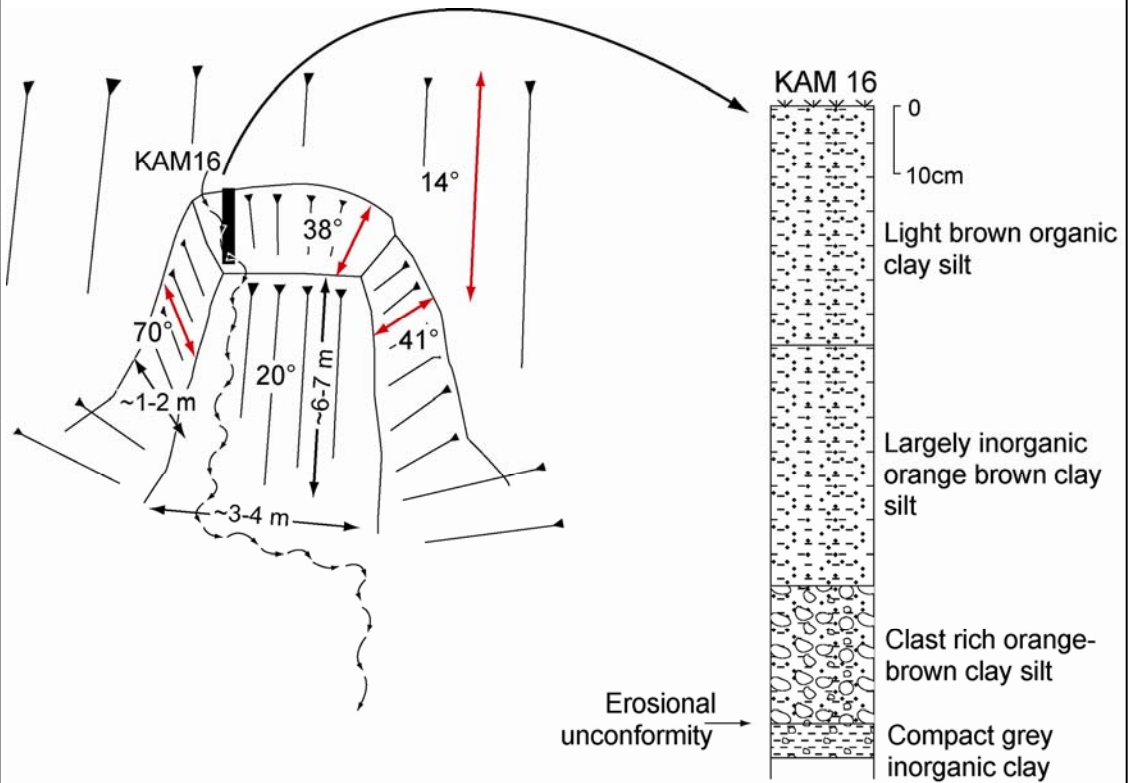
A series of several wide, steep-sided and flat-bottomed gullies have formed in deep unconsolidated sediment on the south facing slopes of the Hov catchment between 50-70 m (Figure 6.3a and 6.3b). One series of gullies is visible directly above the village, and a second series is visible above and to the east of the village. The gullies measure approximately 3-4 m in width, 6-7 m in length and 1-2 m in depth. The deepest gullies occur above the settlement and are steep sided with slopes averaging around 40°, but reaching a maximum of 70°. An exposure cut into the slope of one of the gullies (KAM16), records an inorganic clay unit at the base of the profile, overlain by an orange-brown clay silt sediment unit dominated by gravels at its base. A top unit of brown organic clay silt is consistent with the top silt unit of other sediment profiles in the area. Interpretation of the gully development and geomorphological implications is discussed in chapter 7.

##### *Small scale gullying*

In the south of the catchment at the boundary of the lowland peat unit (refer to Figure 6.1 for location), a series of small gullies have formed on otherwise relatively well-vegetated grazing land. A drainage ditch cross-cuts the gullies, the base of which has been radiocarbon dated



**Figure 6.3a:** Photos at various scales (also see Figure 6.3b) illustrate a series of major box gullies that have formed in deep unconsolidated sediment above the modern day *bygd* or village of Hov, Suðuroy.



**Figure 6.3b:** Photo of Hov box gully (also see Figure 6.3a) with detailed figure and associated stratigraphy. The peat context seen elsewhere in soil profiles in the Hov catchment is absent, indicating that it was probably eroded during a period of landscape destabilisation.

to  $1120 \pm 35$  yr BP (858-996 AD) (GU-11661). A detailed geomorphic map (Figure 6.4) was made of the immediate area, specifically to record the form of the channels and their relationship with the anthropogenic ditch, as a way of relatively dating the development of the natural channels to pre or post-*landnám*. Although the majority of the gullies have developed following the ditch cutting, i.e. after settlement, the surface is relatively stable today.

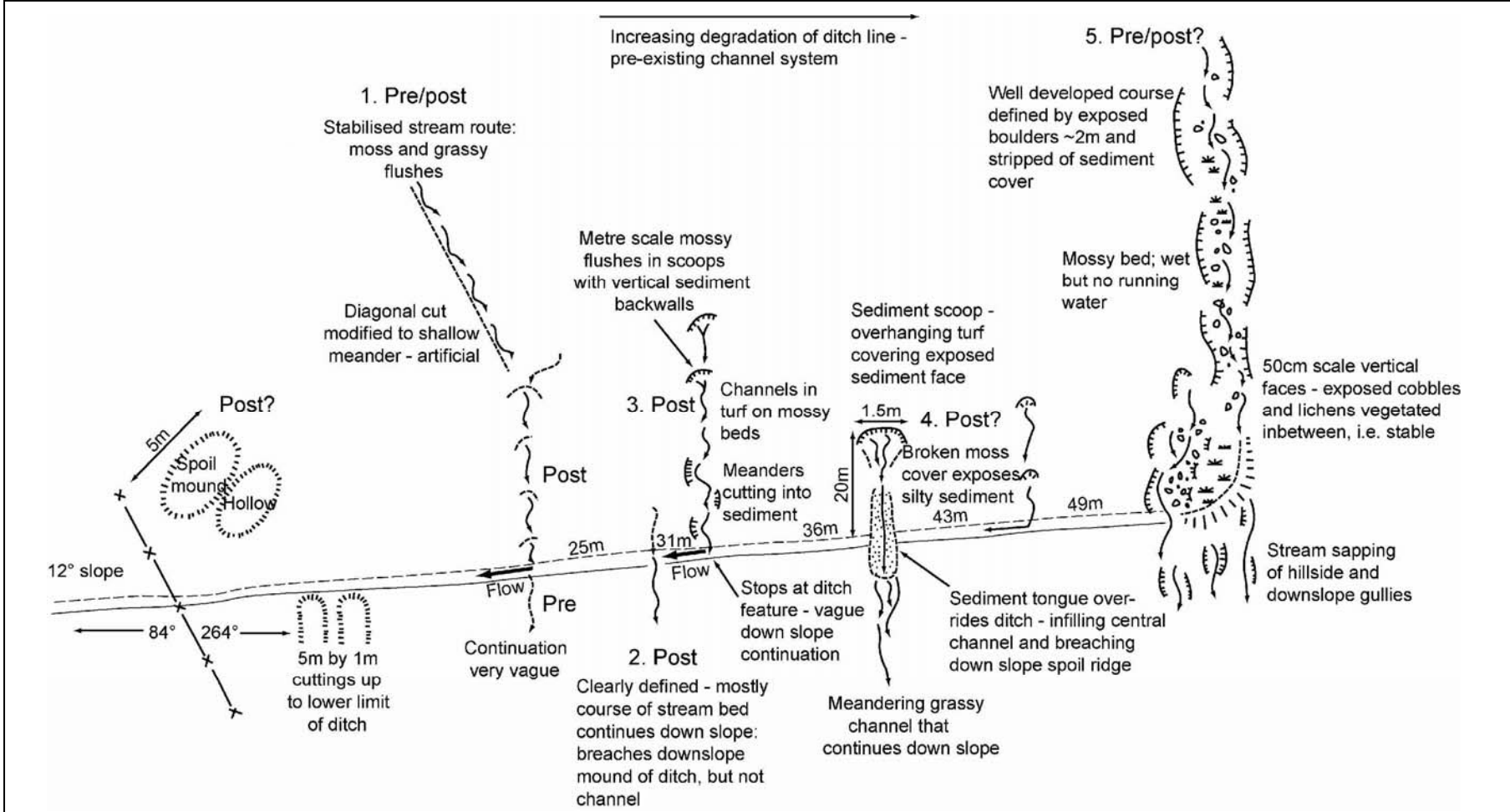
#### *Inactive fan*

There was little evidence of large fans in the Hov area, although an inactive fan on south facing slopes in Hovsdalur was recorded in detail (Figures 6.5a and 6.5b). Three sediment stratigraphies were recorded from an extensive exposure cutting across most of a major debris fan, which presented an effective cross-sectional view of the feature. The stratigraphy of the KAM20 profile is described below in more detail but notably between the mid-6<sup>th</sup> to mid-7<sup>th</sup> century and the late 8<sup>th</sup> to 9<sup>th</sup> century, KAM20 records the deposition of an extensive gravel unit, which can be related to upland disturbance at this time. Later fan activity appears to have been limited, an observation which is reinforced from other sites, indicating that large areas of modern fans have stable surfaces.

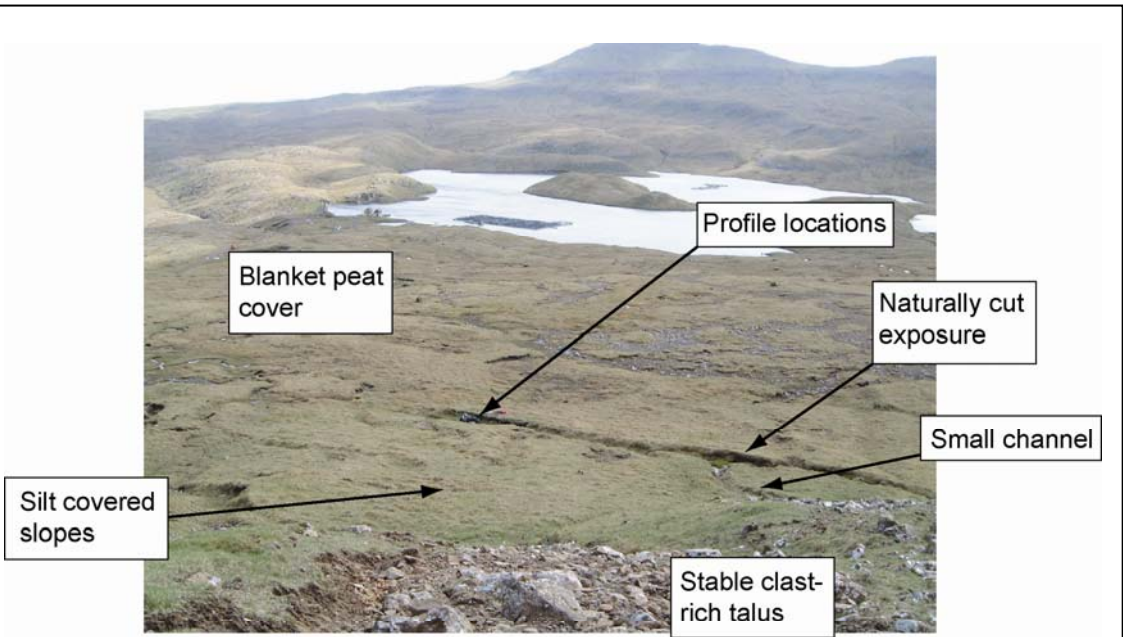
#### *Active fans and river systems*

In a lowland area of the Hov catchment, a small active fan on a tributary stream joining the Hovsá, was observed (Figure 6.6). The profile on the fan records aggrading bands of sands and gravels prior to  $c.2755 \pm 35$  yr BP (980-920 BC), after which an organic layer of macro-fossil rich sediment was buried by the rapid emplacement of silts above. The infilling event ends  $c.1540 \pm 35$  yr BP (430-600 AD), after which a 70 cm thick silty peat has aggraded.

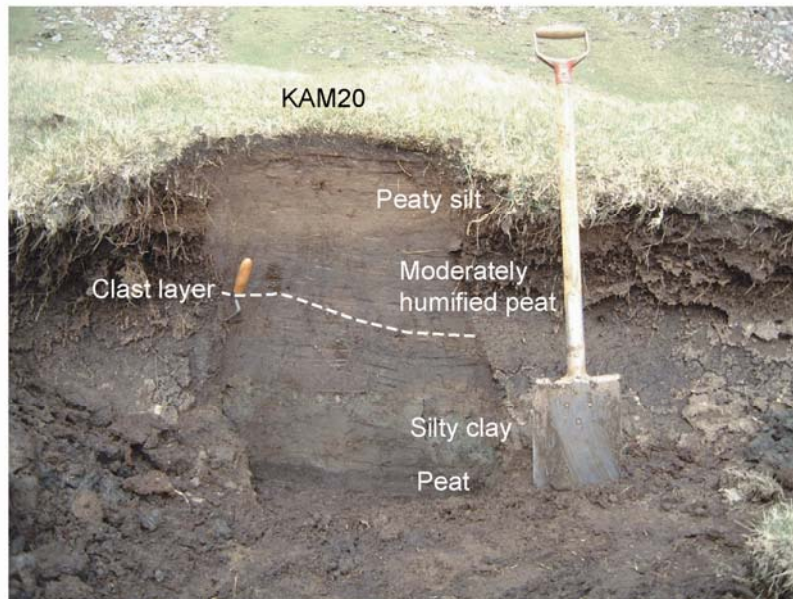
River systems are good indicators of changes affecting the wide-scale landscape catchment and the Rættá system on Sandoy is characteristic of others in both Hov and Sandoy. The location of this feature is presented in Figure 6.7 as are other specific geomorphological and archaeological features on Sandoy mentioned later in text. The limited evidence for aggradation along the channel margins suggests either that sediment has been transported through the system or that there has been limited creation and transport of material to be moved. The low-energy meandering river is suggestive of low sediment transport supporting the assertion that recent erosion in the wider catchment has been relatively limited. Suggested alternate processes of development of the river system are illustrated by Figure 6.8.



**Figure 6.4:** An artificial ditch, cross-cut by natural channels and located on the North facing slopes above Hov, illustrates an example of the interaction between archaeology and geomorphology. By analysing the form of the channels and whether they cross-cut the ditch or not, the natural channels can be dated to pre- or post-*landnám*. Note the figure is not drawn to scale - individual measurements between gullies are presented in the figure.

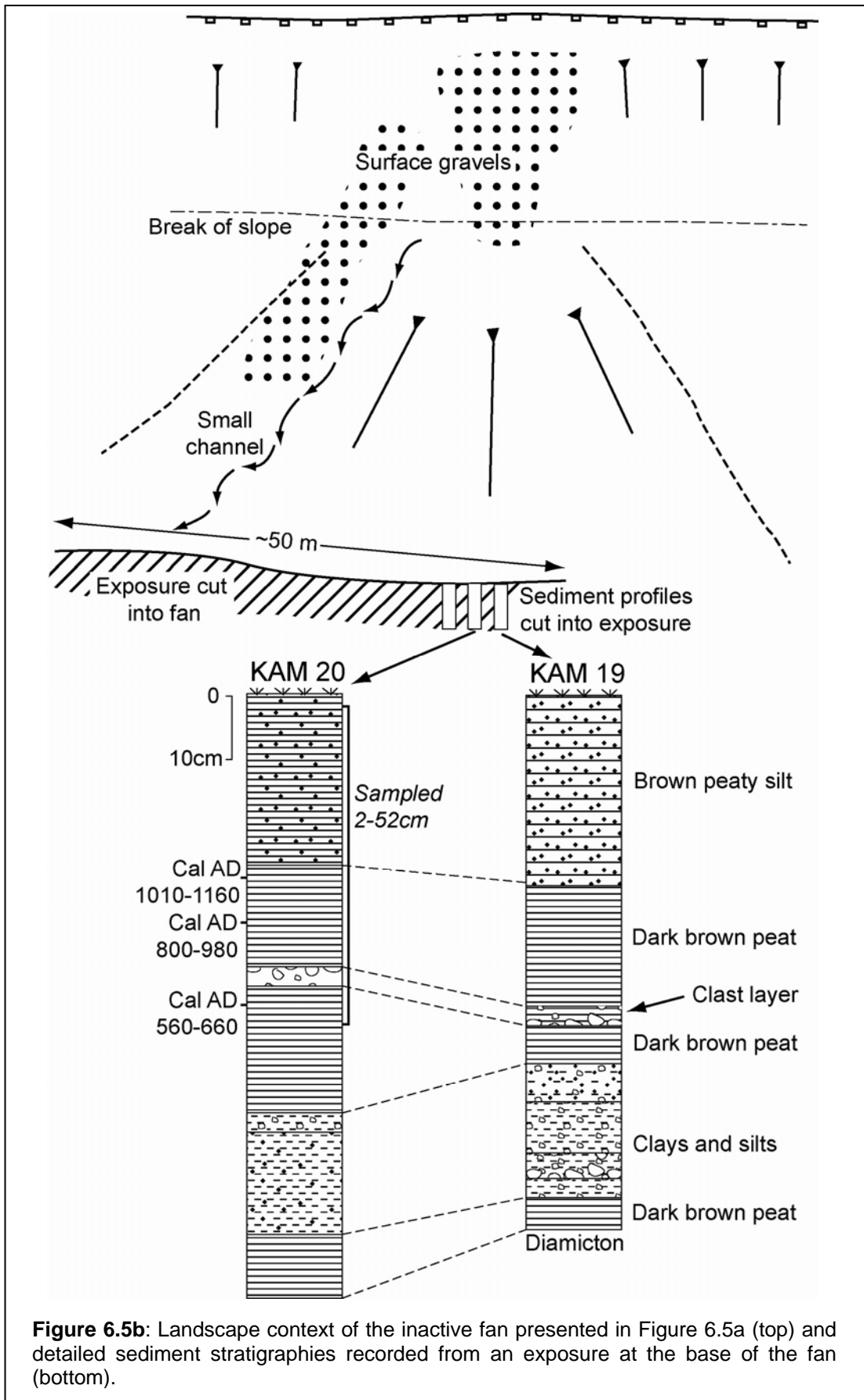


1

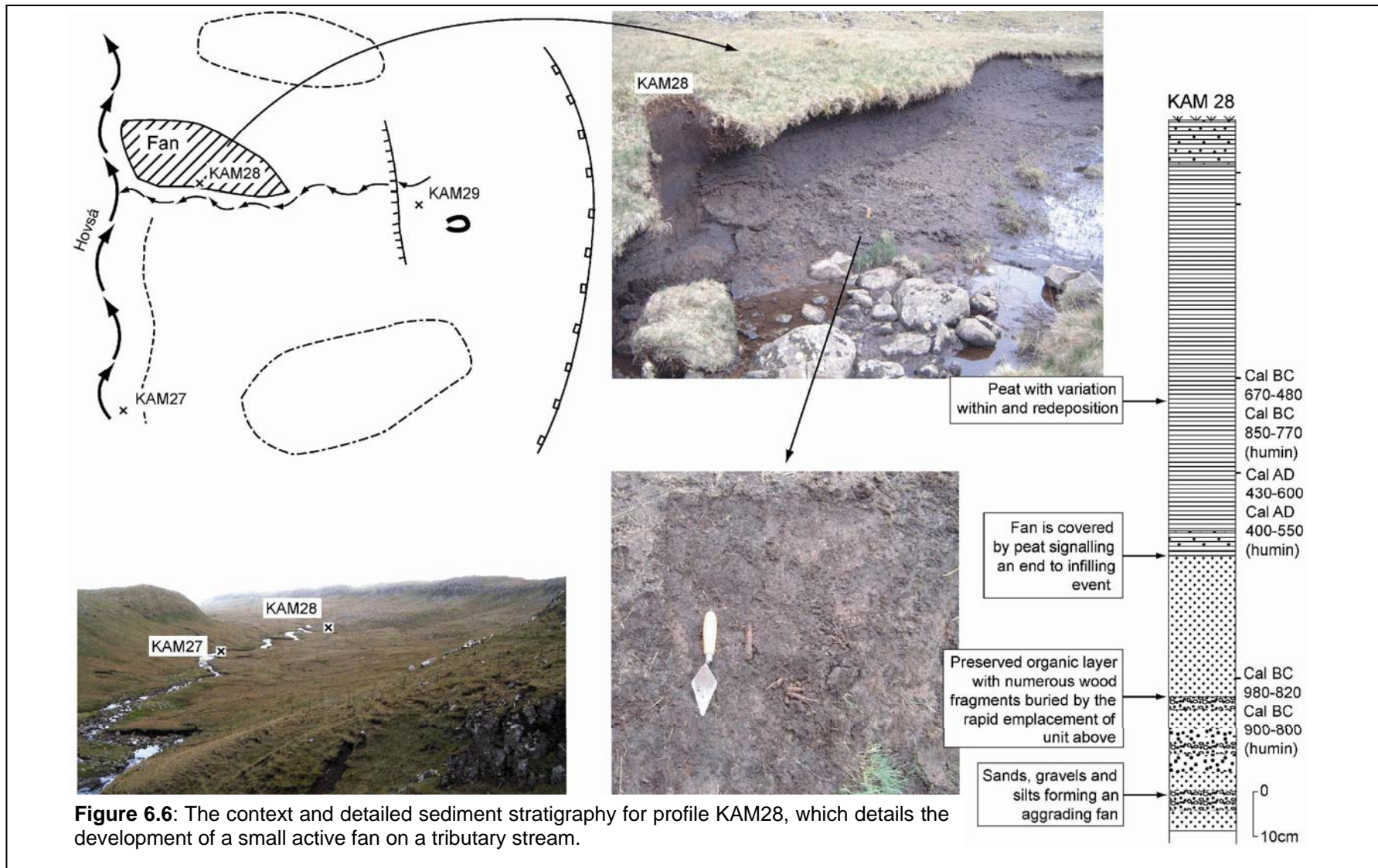


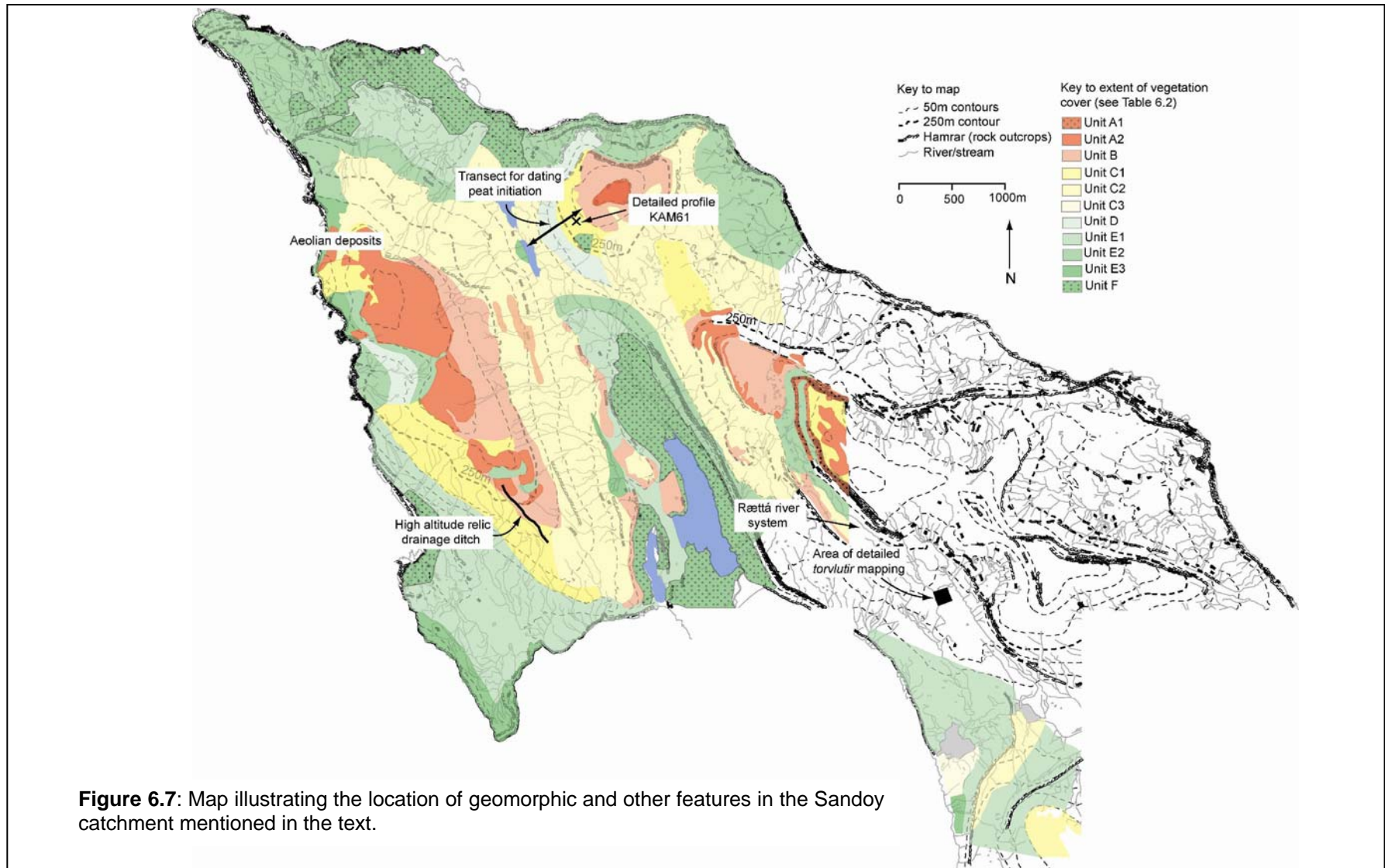
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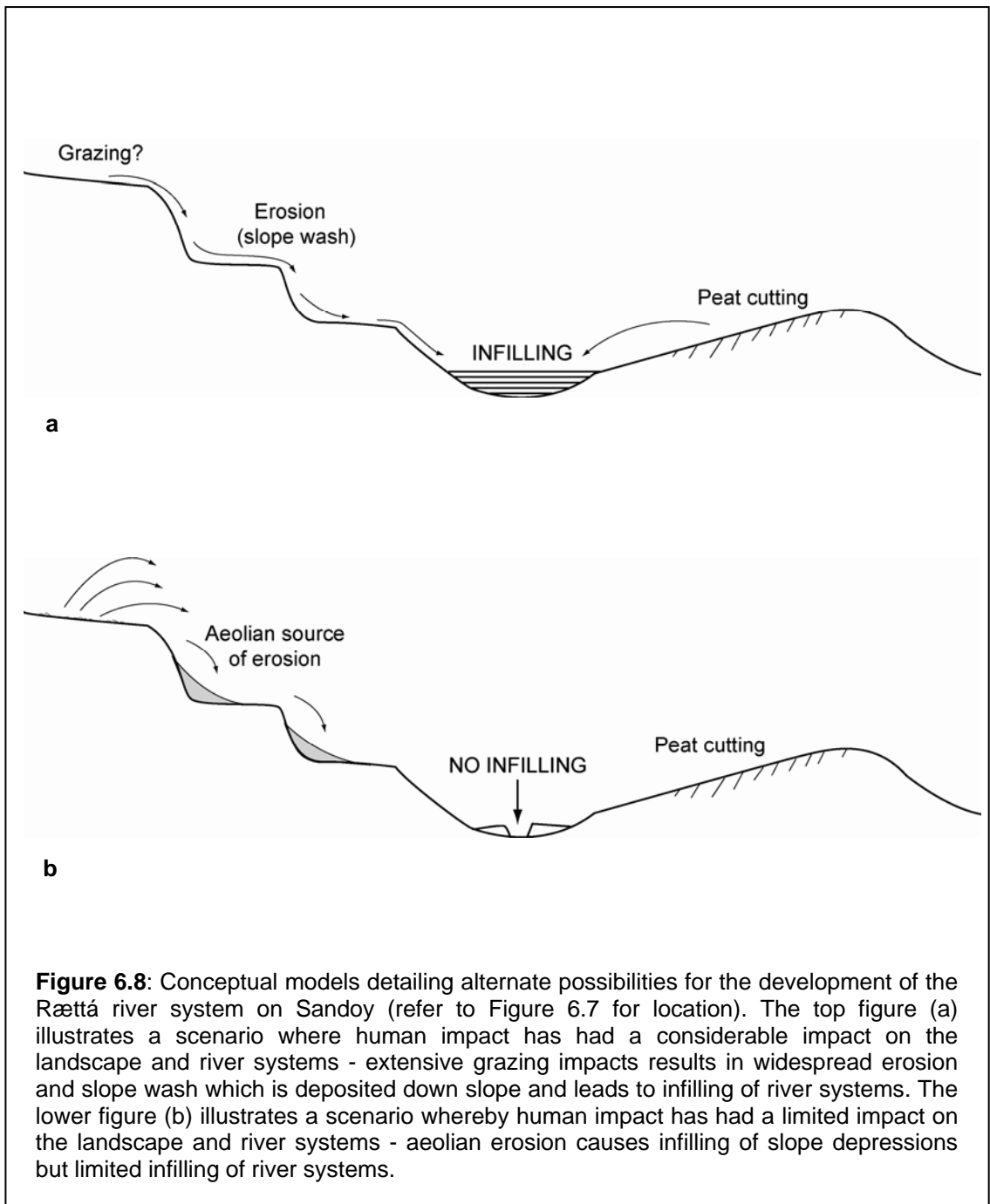
**Figure 6.5a:** An exposure of an inactive fan in the Hovsdalur region. Photo 1 (top) looks down slope to the exposure on the fan. Photo 2 (bottom) presents the KAM20 stratigraphic profile on the exposure that records the fan history (see Figure 6.5b for details of the sediment stratigraphy).



**Figure 6.5b:** Landscape context of the inactive fan presented in Figure 6.5a (top) and detailed sediment stratigraphies recorded from an exposure at the base of the fan (bottom).



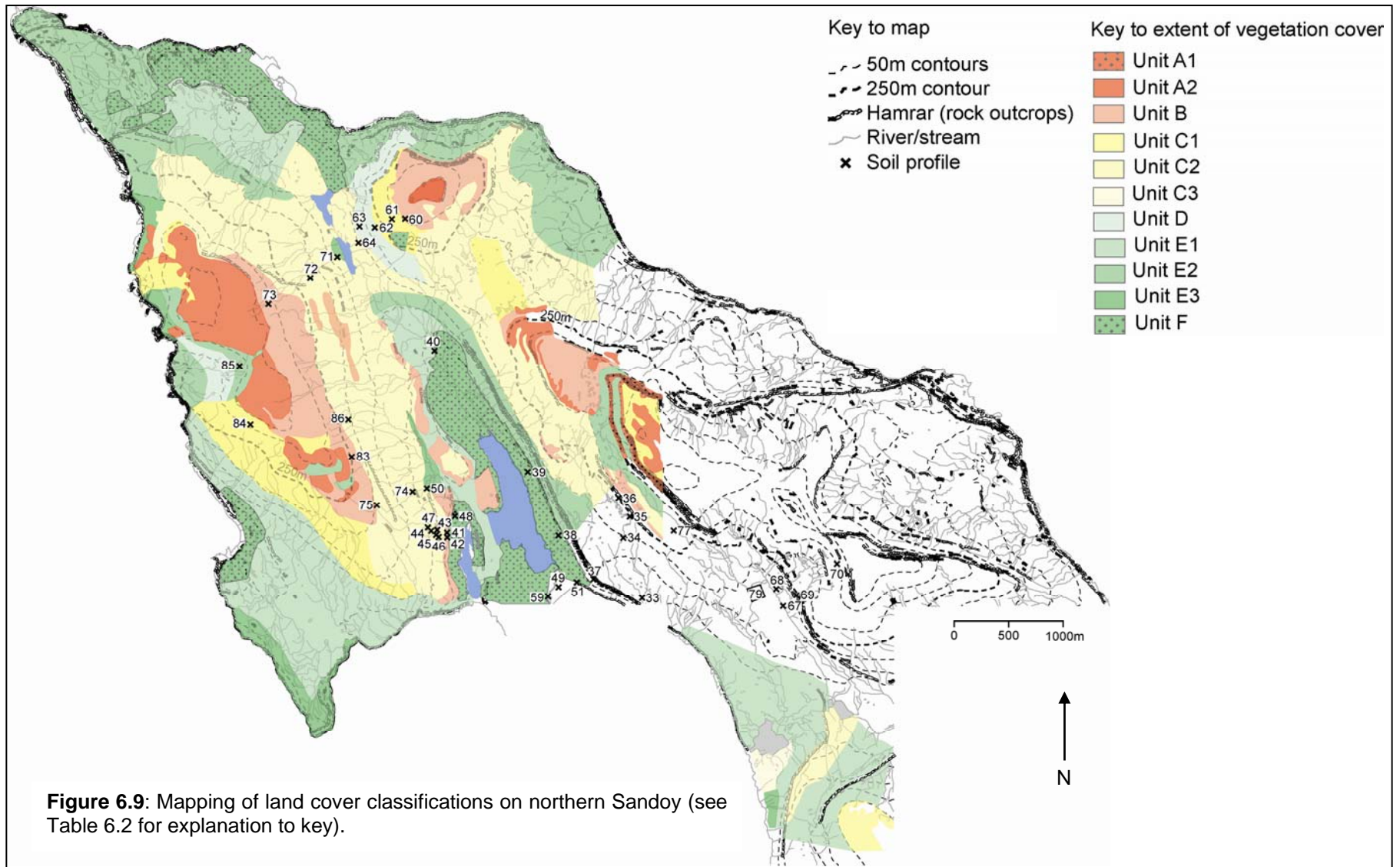















**Sandoy: extent of land degradation***General summary of landscape-scaled degradation patterns*

Stages 2 and 3 of the landscape mapping, were developed from stage 1 (which focussed on the geomorphic mapping of landscape units) to analyse land cover classification relating to the more subtle affects of human impact. A map detailing land cover classifications for north Sandoy is illustrated by Figure 6.9. Five major categories qualitatively classify the vegetation as “very limited”, “limited”, “significant”, “dominant” and “very dominant”. These categories were further divided into a total of 11 subcategories according to the slope angle of the localised landscape surface and dominant surface features. A detailed explanation of subcategories is presented in Table 6.2, and photographic examples of the 11 subcategories are presented in Figures 6.10a-k. This approach was also applied to Hov, with a map detailing land cover classifications for Hov illustrated by Figure 6.11. In summary, areas in excess of 250 to 300 m altitudes are generally degraded with very limited vegetation cover (less than 10 %), as altitude effectively determines the climatic limits to periglacial processes, which are a cause of the breaking up of landscape surfaces. Non-altitudinal related differences also emerge from the mapping results. Plateaux and areas of very gentle sloping topography are generally more degraded than steeper, better drained slopes, which are surprisingly well vegetated, even at altitudes of between 300 and 350 m (Figure 6.12). The plateau to the south of Eiriksfjall on the western side of North Sandoy is severely degraded, for example. East facing slopes in Sandoy are also more eroded and have less vegetation cover at lower altitudes than west facing slopes which are steeper with rock outcrops. The most well vegetated region aside from improved infields is the promontory to the west of Sandur *bygd* and south of the Søltuvík road, in an area which also displays considerable evidence of anthropogenic activity. In contrast, at a similar altitude (100 m or less), in areas to the west of Sandsvatn and Gróthúsvatn lakes, specific locations were observed which were almost entirely degraded, the suggested causes of which are discussed in chapter 7.

At the north west point of a mountainous plateau in west Sandoy, completely degraded land exists immediately adjacent to well vegetated areas. This might be a fragment of an aeolian deposit which are known to occur elsewhere in the Faroes and must to some degree have accumulated during former more extensive periods of wind activity than at present (Christiansen 1998). The Sandoy aeolian deposits, illustrated in Figure 6.13 (refer to Figure 6.7 for location), have accumulated on west facing slopes above a vertical 300 m cliff and may be the remnants of formerly more continuous sheets indicating that some erosion or re-working has occurred, and probably still continues, on a small scale.



Altitude	Vegetation cover	Slope angles (spatial scales of 100-1000m)	Dominant surface sediments and features	Map code	Comments
0-600m	Very limited (<10%)	Steep (1:10-1:1/vertical)	Abundant <i>hamrar</i> (free-faces), clast rich talus (boulders and gravels) and sandy entisols	 A1	Bedrock outcrops and scree
>250m	Very limited (<10%)	Low (<1:10)	Clast-rich diamictons. Periglacial processes active (cryoturbation)	 A2	Active cryoturbation, little vegetation, degraded
>250m?	Limited (10-30%)	Low (<1:10)	Clast-rich diamictons, talus; sandy entisols/histosols. Periglacial processes semi-active	 B	Cryoturbation semi-active with some soil and vegetation
0-600m?	Significant (40-60%)	Low-moderate (up to 1:5)	Clast-rich diamictons; sandy entisols/histosols; periglacial processes semi-active and relic	 C1	Cryoturbation semi-active on large patches (>5m) between vegetated areas
0-600m?	Significant (40-60%)	Low-moderate (up to 1:5)	Significant talus (boulders and gravels); relic and semi-active periglacial processes; sandy entisols/histosols	 C2	Talus and small scale (<5m) relic cryoturbated patches
<350m	Significant (40-60%)	Low (<1:10)	Periglacial processes semi-active and relic; histosols; extensive gullying and pooling, peat haggling	 C3	Eroded peat with extensive gullying and peat haggling
0-600m	Dominant (50-80%)	Moderate to steep (1:10-1:1)	Shallow/sandy entisols/histosols generally overlying bedrock; frequent watercourses; ribbons of alluvium and some fans	 D	Soil/peat covered slopes (more degraded than E2)
<250m	Very dominant (80-100%)	Low (<1:10)	Histosols covering >75% of surface, some gullies	 E1	Lowland peat cover
0-600m	Very dominant (80-100%)	Moderate-steep (1:10-1:1)	Shallow/sandy entisols/histosols generally overlying bedrock; frequent watercourses; ribbons of alluvium and some fans	 E2	Soil/peat covered slopes
0-600m	Very dominant (90-100%)	Moderate-steep (1:10-1:1)	Sandy entisols/histosols overlying deep (5m) diamictons. Dry 'box gullies' present (Hov)	 E3	Soil covered slopes over deep sediment
<250m	Very dominant (90-100%)	Low-moderate	Improved sandy entisols/histosols	 F	(Manured) infield

**Table 6.2:** Key and detailed description for categories defined on the Sandoy and Hov land cover classification maps (Figures 6.9 and 6.11).



**Figure 6.10a; Unit A1:** Example of land cover classification category A1, with reference to Figure 6.9 and Table 6.2.



**Figure 6.10b; Unit A2:** Example of land cover classification category A2, with reference to Figure 6.9 and Table 6.2.



**Figure 6.10c; Unit B:** Example of land cover classification category B, with reference to Figure 6.9 and Table 6.2.



**Figure 6.10d; Unit C1:** Example of land cover classification category C1, with reference to Figure 6.9 and Table 6.2.



**Figure 6.10e; Unit C2:** Example of land cover classification category C2, with reference to Figure 6.9 and Table 6.2.



**Figure 6.10f; Unit C3:** Example of land cover classification category C3, with reference to Figure 6.9 and Table 6.2.



**Figure 6.10g; Unit D:** Example of land cover classification category D, with reference to Figure 6.9 and Table 6.2.



**Figure 6.10h; Unit E1:** Example of land cover classification category E1, with reference to Figure 6.9 and Table 6.2.



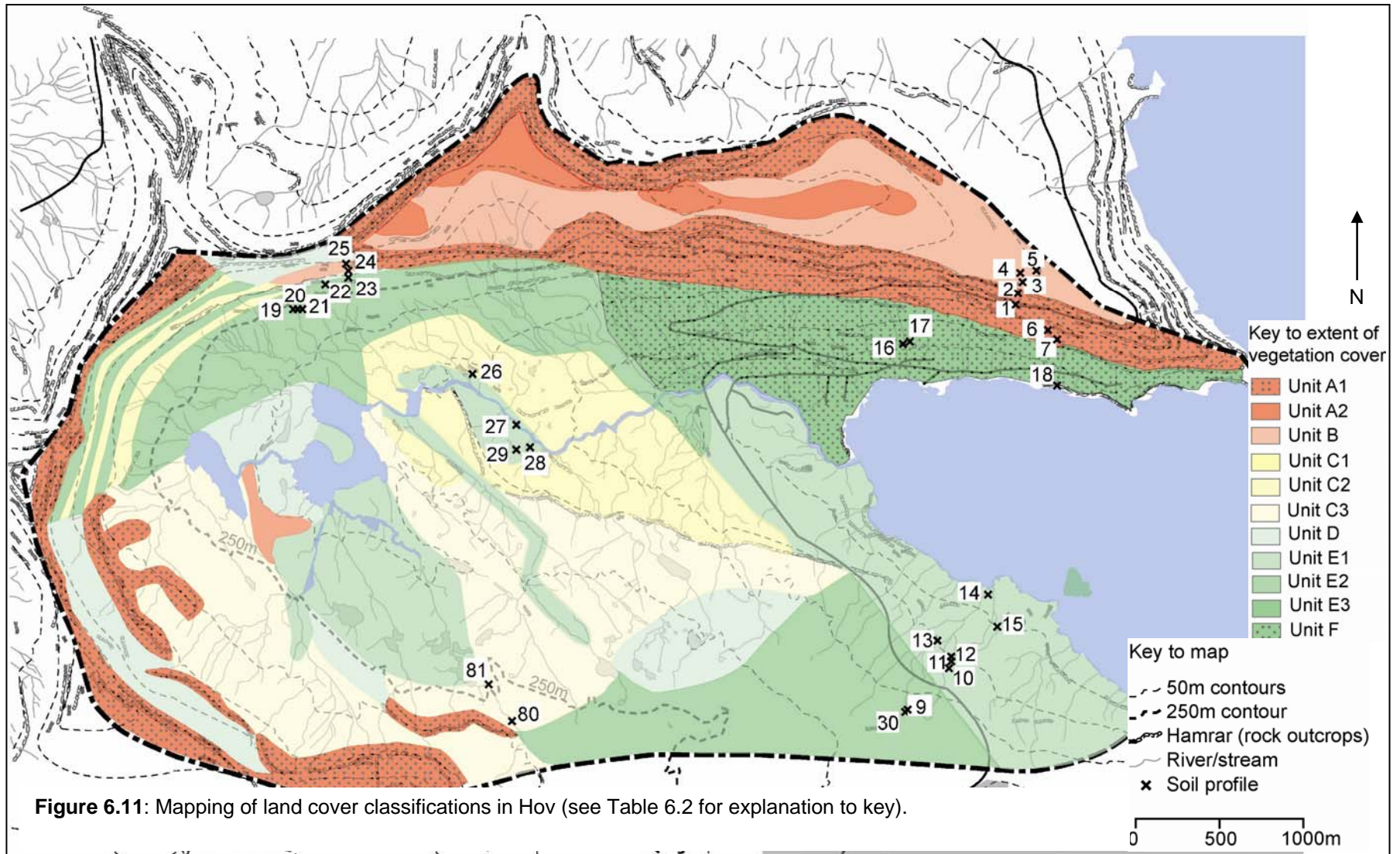
**Figure 6.10i; Unit E2:** Example of land cover classification category E2, with reference to Figure 6.9 and Table 6.2.

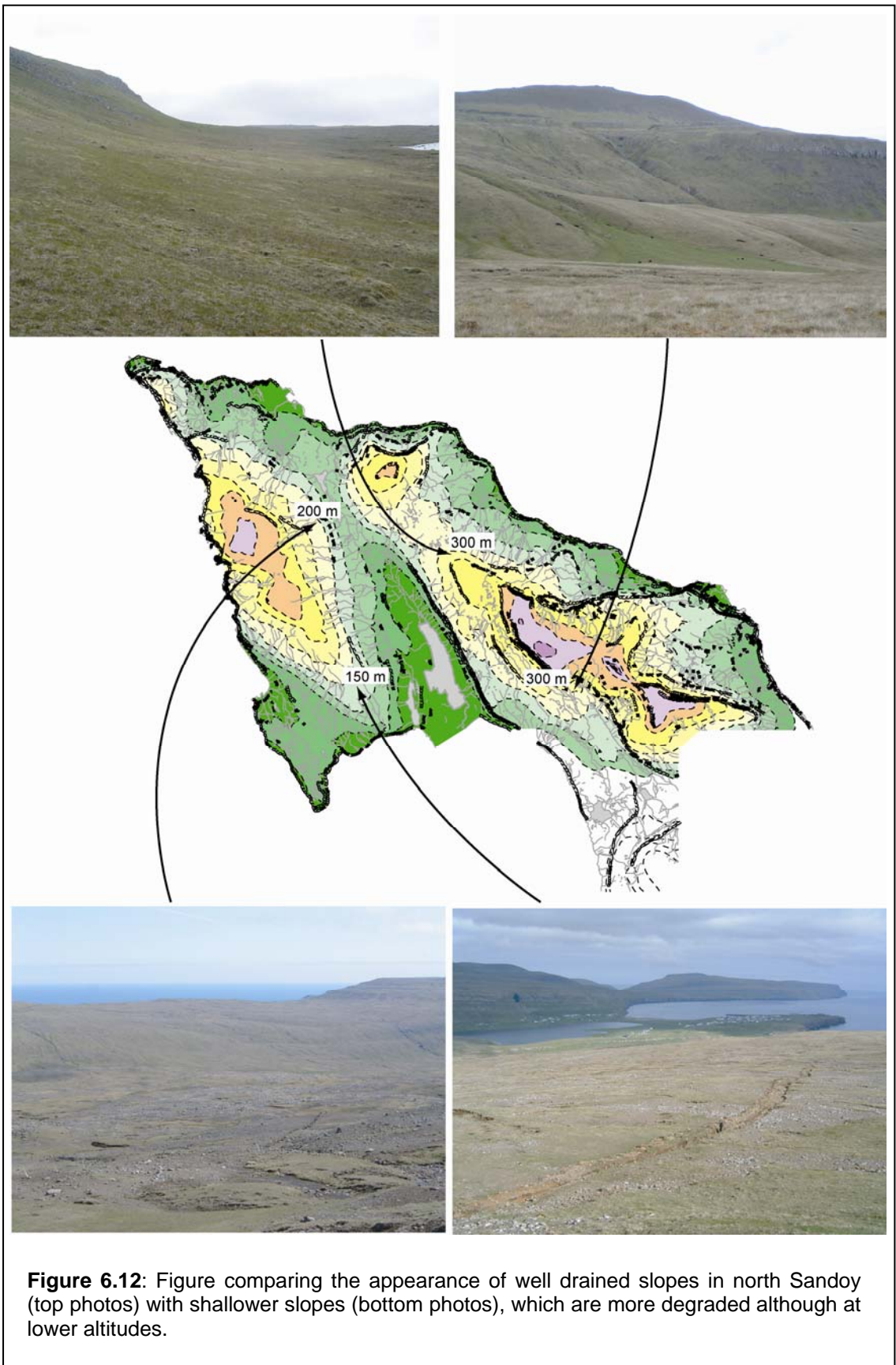


**Figure 6.10j; Unit E3:** Example of land cover classification category E3, with reference to Figure 6.9 and Table 6.2.



**Figure 6.10k; Unit F:** Example of land cover classification category F, with reference to Figure 6.9 and Table 6.2.







**Figure 6.13:** Possible remnants of an aeolian deposit on west facing Sandoy slopes above a vertical 300m cliff. See Figure 6.7 for location.

## 6.2. Hov and Sandoy: sites of cultural activity

### Extent of archaeological survey in Hov and north Sandoy

Walk-over archaeological surveys were carried out both within the Hov catchment, and the larger field site of north Sandoy, to provide data on specific archaeological structures and as a means for comparison between spatial patterns of proposed anthropogenic activity with spatial patterns of landscape degradation. Summary descriptions of the main structures observed and recorded are detailed here, followed by a spatial analysis of areas of archaeological activity, and classification of the landscape into zones characterised by significant archaeological remains.

A total of 101 archaeological features (excluding cairns that make up cairned routes) were mapped in the outfields of the Hov hydrological catchments, of which 60 were recorded in detail and described. This total includes 10 dyke fragments, 54 sheep-shelters and folds, 33 peat-storage structures, a boat house, a shieling, a bridge/footway and a 9<sup>th</sup>-10<sup>th</sup> century drainage ditch. Within three distinct field areas in the outfields of northern Sandoy 125+ structures were recorded and described. This total includes 15 stone and turf and dry stone dyke fragments, 25 sheep-shelters or folds, 26 stone square structures, 51 peat-related structures, 2 relic drainage ditches and 6 structures of unknown purpose.

### General description of archaeological monuments in the Faroese outfields

Based on observations made in the field supported by ethnographic data detailed below, a summary of the most common outfield archaeological structures is presented in accordance with the anthropogenic activities they relate to. A simplified table of archaeological structures documented in the field is presented in Tables 6.3, 6.4a and 6.4b with additional GPS data from the archaeological survey presented in Appendix A.

#### *Outfield structures relating to sheep and cattle*

A considerable number of structures related to the farming of sheep and cattle exist in the outfields and although some are still utilised, the majority are in varying states of disrepair, as a result of natural collapse or after being dismantled for building materials. The most prominent structures in the Hov and Sandoy outfields, as elsewhere in the Faroes (Arge 2006) are the *ból* (referred to on some islands as *støður*) or sheep-shelters (Figure 6.14). The function of *ból* was to provide shelter for sheep in bad weather, which in the past was critical because the Faroese grazing system relied on flocks being able to graze outdoors throughout the year. *Ból* are used rarely by the sheep today because they are fed or brought

in from the outfields over the winter. As a result most *ból* have fallen into disuse and are partially or totally collapsed and have been vegetated over. The form of *ból* in Hov and Sandoy is generally horseshoe-shaped, although some are circular or teardrop in form. Circular *ból* were generally observed to be in a greater state of disrepair and are likely to have been disused for a longer period of time than horseshoe-shaped shelters. Orientation analyses show that the majority of *ból* had an opening facing away from the prevailing wind direction, rather than being simply orientated with the slope (Figure 6.15). This was an important factor in protecting the sheep from snowfall (Arge 2006). In Hov, the majority of entrances were orientated to the south or south-south-east, and in Sandoy, entrances were most commonly orientated to the south, south-south-east or south-south-west. The length of *ból* in Hov ranged from c.4-12 m on the long axis, and although the height of *ból* varied depending on condition, none exceeded a c.1 m in inside depth. The *ból* are dry stone constructed and are built from varying proportions of stone and turf. *Ból* are widespread across the *hagi* at relatively low altitudes, below 250 m, and the majority of *ból* in Hov are located between 50-150 m (Figure 6.16). On Sandoy there were no *ból* recorded above an altitude of 200 m, which is probably a reflection of the island's more subtle topography, and the majority were located at altitudes of 50-100 m, where the sheep would be moved to after coming down from the highlands over winter (Figure 6.17). *Rætt*, or sheep folds, are also found in the *hagi*, but less extensively than the *ból*. They are larger in size and often consist of several chambers and wall fragments, but are also constructed of varying proportions of stone and turf. *Rætt* are usually situated close to the infield in order to gather the sheep whereas *ból* are more widespread across the lower altitude outfields.

A variety of dyke structures were recorded in the outfields of both Hov and Sandoy (Figures 6.18a-d). The majority of dykes were observed in well-defined areas with good vegetation cover. Dykes may function both as boundaries between outfields or villages and as a constraint to cattle or other animals, either as a barrier to keep animals out or as an enclosure to keep animals within (Arge 2006). Dykes in Hov and Sandoy varied from purely stone constructions to those constructed of both stone and turf. Some dykes followed naturally formed features such as *hamrar*, or rock outcrops. In one example, a dyke was built both into and around a large rockfall (Figure 6.19). In the field, it is difficult to determine their function or age, although examples of where dykes had been repaired suggest continued use over longer-time periods. A small number of isolated, walled enclosures, were also observed, including one at Aárkurvur, inland of Hov (Figures 6.20a and 6.20b - refer to Figure 6.2 for location), to which farmers from the village of Porkeri brought cattle and sheep for summer grazing. The enclosure also served for "taming" or calming wild sheep (Mortan Holm, Porkeri resident *pers. comm.*).

<i>ID number</i>	<i>Structure type</i>	<i>Altitude (m)</i>	<i>Form</i>	<i>Length (m) Out/in</i>	<i>Width (m) Out/in</i>	<i>Orientation (long axis)</i>	<i>Open side orientation</i>	<i>Comments</i>
A1	Cairn	110	Circular	N/A	1.06	N/A	N/A	Single cairn as part of footpath linking Hov and Porkeri.
A2	Dyke	90-100	Linear	~50	0.8 (base) 0.3 (top)	N-S	N/A	Dyke/enclosure of stone/turf perpendicular to slope, follows exposed <i>hamar</i> across 50-100m contour.
A3	Dyke	50-100	Linear	~250	1 (base) 0.4-0.5 (top)	W-E	N/A	Dyke/enclosure of stone/turf perpendicular to slope for 120 m, parallel with river for 50 m and joins <i>hamar</i> after 250 m.
A4	Unknown	55	Rectilinear	9.8/7.3	7.8/6.2	WNW-ESE	Unknown	Remains of stone rectilinear structure, possibly sectioned in two. Lower dyke of structure formed by A3.
A5	Sheep fold	95	Circular	12/8	12/8	N/A	SE	Modern stone built and turf covered fold with central partition.
A6	Dyke	0-60	Linear	~400	1.6 (base) 0.6 (top)	SE-NW and NE-SW	N/A	Stone and turf dyke/enclosure parallel to slope down to sea.
A7	<i>Ból</i>	55	Teardrop	9.2/7.2	4.8/2.4	SE-NW	SE	Well maintained <i>ból</i> with stone/turf dykes and tapered entrance. Built into slope.
A8	<i>Ból</i>	35	Teardrop	8.2/5.5	7/2.4	SSW-NNE	SSE	Well maintained <i>ból</i> with stone/turf dykes situated at base of small rocky outcrop.
A9	Enclosure	20	Oval	8.5/6.8	6.8/4	SSE-NNW	SSE	Basic enclosure, stone/turf, also incorporating large in situ boulders.
A10	Stone house	10-15	Rectilinear	7.2/4.5	5.6/2.7	W-E	NNE	Well maintained stone built house/shed with stone dykes 2 m in height.
A11	Dyke	5-25	Linear	~65	1.2 (base) 0.6 (top)	NE/NNE- SW/SSW	N/A	Dyke/enclosure of predominantly stone and some turf that follows the edge of large rock fall to the sea.
A12	<i>Ból</i> /fold	20	Circular	8/4.3	5/3.2	ENE-WSW	SSE	Stone/turf <i>ból</i> /fold with dividing partition, upper side built into slope.
A13	Dyke	30	Linear	~120	0.9 (base) 0.5 (top)	WNW-ESE	N/A	Stone dyke in poor condition with partial turf covering, runs between 2 <i>hamrar</i> and into rock fall.
A14	Sheep fold	5	Complex	25 (main chamber)	8.2 (main chamber)	SE-NW	N/A	Stone built multi-chambered fold between large rock fall and sea.

**Table 6.3:** Summary of archaeological structures recorded in the Hov catchment.

<i>ID number</i>	<i>Structure type</i>	<i>Altitude (m)</i>	<i>Form</i>	<i>Length (m) Out/in</i>	<i>Width (m) Out/in</i>	<i>Orientation (long axis)</i>	<i>Open side orientation</i>	<i>Comments</i>
A15	Boat house	5	Oval	10/8.2	4.3/2.2	NE/SW	NE	Stone boat house, double skinned dykes with rubble infill. Back of structure built into slope.
A16	<i>Ból</i>	20	Teardrop	6/4.9	4.9/2.6	NNE-SSW	SSW	Stone/turf, tapered entrance, back dyke built into slope. Situated in depression between two slopes.
A17	<i>Ból</i>	105	Oval	9.4/7.1	6.7/4.4	N-S	S	<i>Ból</i> in poor condition with collapsed dykes and completely vegetated over. Structure tapers towards entrance. Surrounding area used for peat cutting.
A18	<i>Ból</i>	95	Oval	9/4.3	5.8/2.1	N-S	S	<i>Ból</i> in poor condition with collapsed stone/turf dykes built onto a natural rise/outcrop within a larger sheltered depression.
A19	<i>Ból</i>	95	Oval	8.9/5.9	6.7/2.8	N-S	S	<i>Ból</i> in poor condition, collapsed dykes, turf covered. Surrounding area used for peat cutting.
A20	Dyke	40-50	Linear	~450	0.7 (base) 0.4 (top)	N/NNE- S/SSW	N/A	Stone/turf dyke perpendicular to slope, forms an enclosure thought to have been used for milking ewes in Norse period.
A21	<i>Ból</i>	60	Oval/ circular	9.5/6.5	7.9/5.8	N-S	S	<i>Ból</i> in poor condition, covered over by turf (no stones visible), more circular in form than other <i>ból</i> in parcel A.
A22	<i>Ból</i>	62	Oval/ teardrop	7.1/5.2	6/2.5	SSW-NNE	S	Stone/turf, good condition.
A23	<i>Ból</i>	65	Oval/ teardrop	9/7.1	5.8/3.5	SW-NE	SW	Stone and turf, tapers towards entrance, medium condition.
A24	Dyke	50-150	Linear	-	1.1 (base) 0.4 (top)	NNW-SSE	N/A	Stone dyke with partial turf cover.
A25	<i>Ból</i>	110	Oval/ teardrop	10.4/8.7	8.8/3.2	SW-NE	SW	<i>Ból</i> in good condition, stone and turf, exposed section shows evidence of repair.
B1	<i>Ból</i>	105	Oval	6.3/4.1	5.4/2.4	N-S	S	Good condition, turf and stone, tapering towards entrance that is sheltered by facing

**Table 6.3** (cont.): Summary of archaeological structures recorded in the Hov catchment.

								slope.
B2	<i>Ból</i>	115	Oval	7.1/4.9	5.6/2.5	N-S	S	Stone and turf <i>ból</i> , walls higher at rear of structure. Entrance faces into sope.
<i>ID number</i>	<i>Structure type</i>	<i>Altitude (m)</i>	<i>Form</i>	<i>Length (m) Out/in</i>	<i>Width (m) Out/in</i>	<i>Orientation (long axis)</i>	<i>Open side orientation</i>	<i>Comments</i>
B3	<i>Krógv</i>	120	Circular	3.3/2	3.1/1.5	NNE-SSW	N/A	Small circular/horseshoe shaped, stones are predominantly turf covered. Situated atop natural mound with exposed bedrock in the undulating surroundings.
B4	<i>Krógv</i>	110	Circular	5.8/4.1	5.7/3.2	SW-NE	N/A	Circular construction, surroundings relatively degraded, stabilised talus and exposed bedrock.
B5	<i>Ból</i>	130	Teardrop	9.8/6.8	5.2/2.3	N-S	S	<i>Ból</i> - stone and turf, collapsed W wall, tapers to entrance which curves into th slope.
B6	<i>Ból</i>	116	Circular/ Oval	5.7/3.1	5.1/2.8	WNW-ESE	ESE	Horseshoe shaped <i>ból</i> of stone/turf, with back wall and N wall higher than opposite walls. Floor slopes to entrance.
C1	Cairn	170	Circular	N/A	1.1-1.2	N/A	N/A	Stone cairn forming part of routeway.
C2	<i>Ból</i>	120	Circular/ oval	6.2/3.7	5.8/2.3	SSE-NNW	SSE	Horseshoe shaped <i>ból</i> with stone and turf walls - tapers towards entrance. Exposed bedrock in vicinity.
C3	<i>Ból</i>	150-160	Oval	6.6/4	4.5/1.5	SSW-NNE	SSE	<i>Ból</i> in poor condition, stone and turf with signs of repair made to structure which have since re-collapsed. Sheltered entrance.
C4	Enclosure?	190	Rectilinear	46	10.1-15	W-E	N/A	Large possible enclosure with small circular sub-chamber within W end of structure. Walls at the height of a single stone.
D1	Enclosure	210	Rectilinear	35	10-20	Various	N/A	Stone built enclosure in relatively isolated and seheltered valley. In situ boulders form part of walls.
D2	Dyke and enclosure	235	Various	100 (wall) 10.2 (enclosure)	4.6 (enclosure)	N-S (enclosure)	N/A	Stone built enclosure comprising inner chamber (3.4x 2.3 m). W wall of enclosure forms part of a dyke that extends to the

**Table 6.3** (cont.): Summary of archaeological structures recorded in the Hov catchment.

<i>ID number</i>	<i>Structure type</i>	<i>Altitude (m)</i>	<i>Form</i>	<i>Length (m) Out/in</i>	<i>Width (m) Out/in</i>	<i>Orientation (long axis)</i>	<i>Open side orientation</i>	<i>Comments</i>
								edge of a lake.
D3	Dyke	240	Linear	~25	1.4 (base)	NNE-SSW	N/A	Turf and stone dyke that adjoins with wall as part of structure D2.
E1	<i>Ból?</i>	185	Oval	8/6.8	2.8 (outer)	W-E	?	Stone and turf walls, poor condition.
E2	<i>Krógv</i>	185	Oval	4.6	2.9	NE-SW	N/A	Composed of loose stones, raised centre from repeated stacking of turves.
E3	<i>Krógv</i>	185	Oval/circular	4.1	3.1	NNW-SSE	N/A	Composed of loose stones, raised centre from repeated stacking of turves.
E4	<i>Ból</i>	230	Oval/teardrop	6.8/5.2	4.5/2	N-S	S	Built of turf and stone.
E5	<i>Ból</i>	195	Oval/teardrop	8.8/6.2	4.5/2	SSW-NNE	NNE	Walls composed of turf and stone, built into slope on W and N sides.
E6	<i>Krógv</i>	210	Oval	5	4	NNW-SSE	N/A	Composed of loose stones, raised centre from repeated stacking of turves. Structure is one of a concentration of 10 structures of a similar size and form that were not recorded in detail.
E7	<i>Ból</i>	205	Circular	5.8/3.1	5.3/2.5	NNW-SSE	NNW	Turf and stone walls, some collapse, floor slopes to entrance.
E8	<i>Ból</i>	120	Oval/teardrop	8.8/6.3	4.5/2.3	SSW-NNE	E	Stone and turf walls, floor slopes to entrance.
E9	Dyke	120	Linear	150-250	~50	SE-NW	N/A	Rough built stone dyke running parallel with river. Dyke is fragmented and missing or absent in places.
E10	<i>Ból?</i>	125	Oval	5.7/4.3	3.1/1.7	SSE-NNW	NNW	Stone built walls without turf cover. Entrance facing into slope.
E11	<i>Ból?</i>	90	Elongated oval	8.8/7.2	2.5-1.2	SSE-NNW	NNW	Stone built walls without turf cover. Entrance facing into slope.
E12	<i>Ból</i>	90	Oval	8.7/6.9	4.7/2.5	SSE-NNW	SSE	Turf and stone walls with tapering entrance. Floor slopes to entrance.
F1	<i>Ból</i>	181	Oval	7.1/5.3	5.1/2.3	NNE-SSW	SSW	Turf and stone walls with tapering entrance. Floor slopes to entrance.
F2	Fold/	181	Rectilinear	14-15	6-7	ENE-WSW	NWN	Raised stone platform (vegetated over

**Table 6.3** (cont.): Summary of archaeological structures recorded in the Hov catchment.

	enclosure							
<i>ID number</i>	<i>Structure type</i>	<i>Altitude (m)</i>	<i>Form</i>	<i>Length (m) Out/in</i>	<i>Width (m) Out/in</i>	<i>Orientation (long axis)</i>	<i>Open side orientation</i>	<i>Comments</i>
F3	<i>Ból</i>	215	Oval	6/3.8	4/1.9	N-S	S	Turf and stone walls. Large in situ boulder (1-2 m) forms part of wall and is also turf covered. Structure tapers towards entrance.
F4	<i>Ból</i>	210	Circular	5.5/3.5	4.5/2.8	N-S	S	<i>Ból</i> in poor condition with turf and stone walls tapering towards entrance.
F5	<i>Ból</i>	255	Circular	3.9/2.4	2.7/1.7	NW-SE	S	Stone built shelter built into rockfall - structure can only be seen from above.
F6	<i>Ból</i>	215	Oval	5.6/3.8	4/2.1	NNE-SSW	SSW	Turf and stone walls, floor slopes to entrance.
F7	<i>Ból</i>	-	Complex	Chamber 1: 8.8/6.2 Chamber 2: 9/6.1	Total outer: 9.2	N/A	SSE	Structure composed of two separate enclosures joined by a wide central partition.
F8	Shieling	185	Rectilinear			SW-NE	SE	Medieval shieling. Floor is sunk below natural ground level, with back of structure built into slope behind
F9	Bridge/ walkway	220	Linear	14-23	2	N-S	N/A	Linear structure crossing small river, constructed of stone and covered by turf. Aligned with cairn route.

**Table 6.3** (cont.): Summary of archaeological structures recorded in the Hov catchment.

ID number	Altitude (m)	Form	Length (m) In/out	Width (m) In/out	Orientation (long axis)	Open side orientation	Comments
SA14	43	Oval	6/7	3.2/5.7	SW-NE	SW	Located on raised mound
SA21	62	Elongated oval	4.7/9.3	2.3/6.6	S-N	S	In situ boulder (2m high) forms part of structure
SA29	70	Circular	6.7 (centre of wall)	5.9 (centre of wall)	SSW-NNE	SSW	Turf covered
SA57	71	Oval/tear drop	6.3/8.7	2.5/4.8	SSW-NNE	SSW	Built into natural mound
SA88a	55	Circular	4.5	3.5	WSW-ENE	WSW	Adjoined with SA88b
SA88b	55	Circular	5.5	4	S-N	S	Adjoined with SA88a
SA90	45	Oval	8	4.4	SSW-NNE	SSW	In situ boulder forms part of back wall
SC8	84	Oval	4.4/6.2	2.8/4	SSW-NNE	SSW	One wall collapsed and rebuilt
SC9	66	Oval	5.4/8	3.3/6.2	SSW-NNE	SSW	Built on raised mound
SC10	59	Oval	6.2/7.4	3.2/5.8	S-N	S	Built on raised mound
SC11	97	Irregular	4.8	2.6	S-N	S	Built into slope behind, in-situ boulders form walls
SC12	49	Oval	4.8	2.7	S-N	S	Built on raised mound, rebuilding of some walls
SC26	68	Oval/circular	6.8/8.8	2.6/5.7	S-N	S	Built into raised mound, not marked on map, grown over with turf
SD2	87	Oval	4.8	2.4	ENE-WSW	SSE	In situ boulder (3m) forms one wall of structure
SD8	47	Irregular	Various	Various	Various	Various	Triple ból/rætt
SD9	108	Semi-circular	4.5	3.6	ENE-WSW	SSE	SSE facing side completely open
SD12	111	Semi-circular	7	8	ENE-WSW	SSE	Much of structure collapsed and turf covered, SSE facing side completely open (8m)
SD14	83	Oval/rectilinear	11	4.5	SE-NW	S	Built into natural mound, one wall completely straight, turf covered collapsed sections
SD15	104	Semi-circular	10	8	ENE-WSW	SSE	Turf covered, SSE facing side completely open
SD16	98	Semi-circular	3.5	3	WNW-ESE	SSW	Entirely grown over with turf, located within small depression
SD18	101	Rectilinear	5.5	3	S-N	S	Partially turf covered, built into slope beneath <i>hamar</i>
SD19	97	Oval	4	3	S-N	S	Entirely covered over with turf
SD26	100	Oval/tear drop	7	3	SW-NE	SW	Partial collapse of one wall
SD27	122	Oval	6	3	SSW-NNE	SSW	Partial collapse of one wall
SF3	31	Circular	-	-	-	-	Large circular ból with thick stone and turf walls

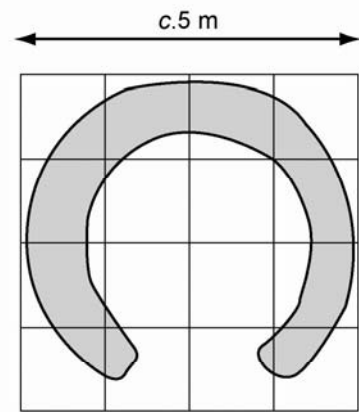
**Table 6.4a:** Summary of ból recorded in specific areas of the Sandoy outfields.

<i>ID number</i>	<i>Altitude</i>	<i>Length</i>	<i>Width</i>	<i>Orientation (long axis)</i>	<i>Additional comments</i>
SA22	71	5.6	2.7	SE-NW	Oval shaped, 3 loose stone walls
SA23	63	5.5	2.5	SE-NW	As SA22 but partially vegetated over
SA24	66	5.5	2.5	E-W	As SA22 but back wall more defined
SA25	64	-	-	N-S	3 rough stone walls
SA26	65	-	-	N-S	Predominantly vegetated over
SA27	55	-	-	-	Very small <i>krógv</i>
SA28	54	-	-	-	Very small <i>krógv</i>
SA30	77	-	-	-	-
SA31	79	-	-	-	-
SA32	82	-	-	-	-
SA33	77	-	-	-	-
SA40	81	4	2	NE-SW	-
SA41	81	4	2	NE-SW	-
SA47	90	5.4	3.2	SSW-NNE	3 rough stone walls, curving at end
SA48	55	3	1.8	-	3 rough stone walls
SA49	52	3	1.8	-	3 rough stone walls
SA50	48	3	1.8	-	3 rough stone walls
SA51	50	3	1.8	-	3 rough stone walls
SA52	49	N/A	N/A	N/A	Only back wall visible
SA53	46	N/A	N/A	N/A	Only back wall visible
SA60	126	1.5	1	NE-SW	3 rough stone walls
SA61	123	1.5	0.75	N-S	
SA62	130	3	1.8	-	3 rough stone walls
SA63	128	1.5	1.5	NNE-SSW	2 walls remaining
SA64	130	3.5	1.8	SE-NW	3 rough stone walls
SA69	165	1	1	N/A	Very poor condition
SA70	160	2.5	1	ESE-WNW	3 rough stone walls
SA71	179	5	2	ESE-WNW	4 rough stone walls
SA72	154	2	1.5	N-S	4 rough stone collapsed walls
SA73	173	3.5	1.5	WNW-ESE	Oval shaped as opposed to rectilinear
SA74	177	2.5	1.8	NW-SE	3 rough stone walls
SA75	174	4	1.8	-	3 rough stone walls
SA76	192	2.5	1.5	NW-SE	3 rough stone walls
SA77	121	1.5	1.5	N/A	Only 2 rough stone walls discernable
SA78	124	2.5	1.8	E-W	3 rough stone walls
SA79	127	2.5	1.5	NNE-SSW	3 rough stone walls
SA80	127	3	1.5	NNE-SSW	3 rough stone walls
SA81	128	2	1.5	SE-NW	3 rough stone walls
SA82	111	3.5	2	N-S	3 rough stone walls
SA83	115	2.5	1.5	NNE-SSW	3 poorly defined stone walls
SA84	103	2	2	N/A	3 poorly defined stone walls – vegetated over
SA86	107	3.5	2	-	3 rough stone walls
SA87	109	2.5	1.5	-	3 rough stone walls, semi-circular form
SB3	-	-	-	-	-
SB4	-	-	-	-	-
SB5	-	-	-	-	-
SC21	44	8	2.4	NNW-SSE	-
SC22	41	7	2.5	NNW-SSE	-
SC24	51	1	1	N/A	3 rough stone walls
SC25	49	2.5	1.5	-	Rectangular, 3 rough stone walls
SC27	41	2	1.5	-	One wall still standing ~80 cm high

**Table 6.4b:** Summary of *kráir* and *torvhús* recorded in specific areas of the Sandoy outfields. (-) denotes data unavailable or inaccessible or not collected. N/A denotes not applicable.



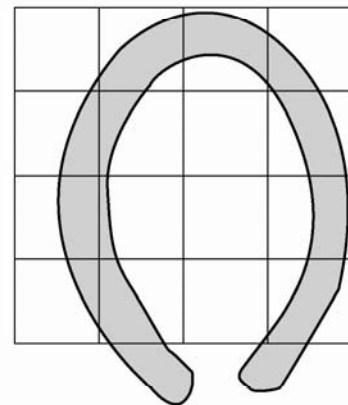
Relic circular type *ból* in the Hov outfields



Circular type



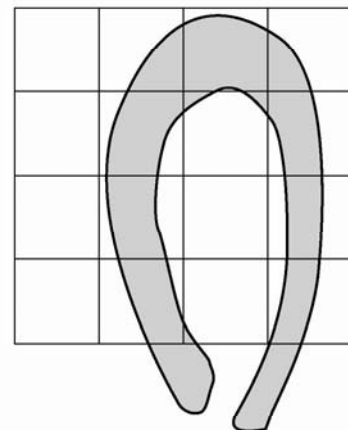
Large oval type *ból* in the Hov outfields



Oval type



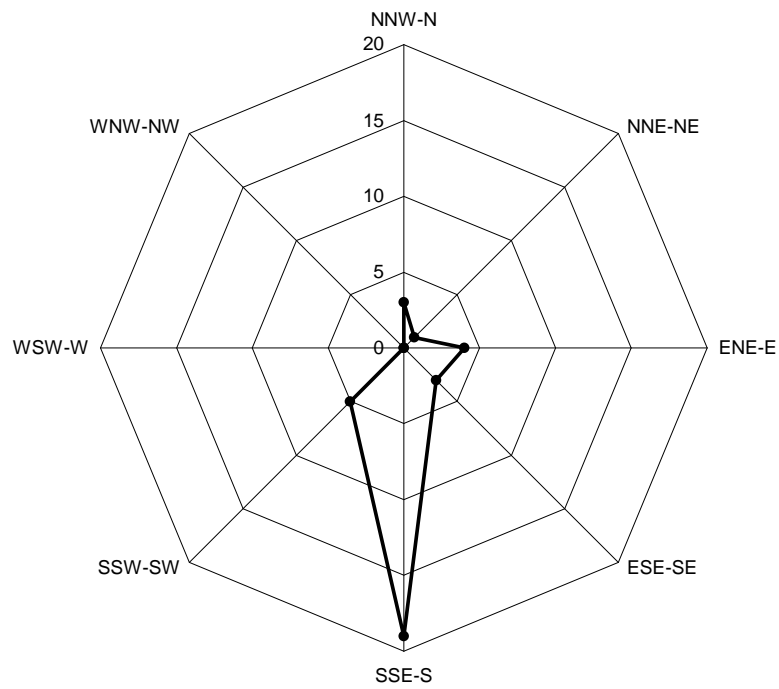
Teardrop type *ból* in the Porkeri outfield overlooking the village of Hov. Note the narrow and often tapered entrance facing south against the wind and the large turf banks.



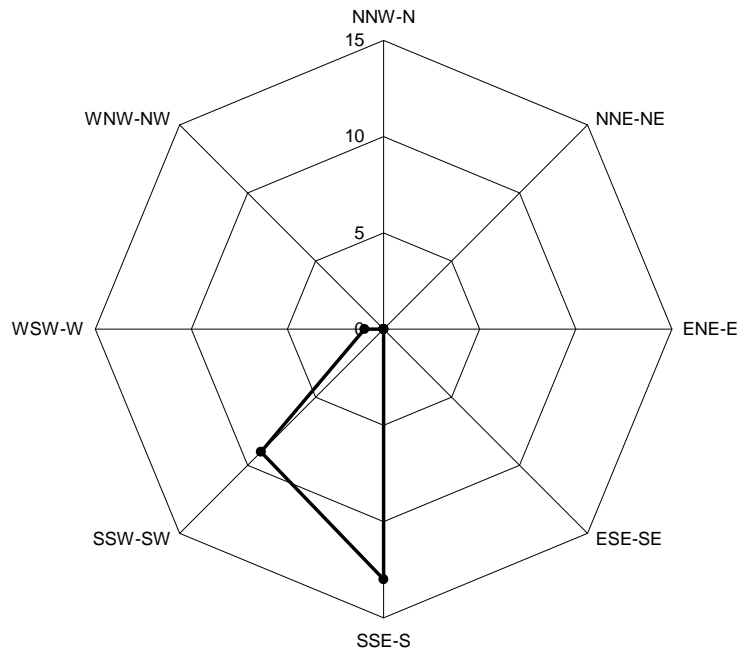
Teardrop type

**Figure 6.14:** Characteristic examples of *ból*, winter shelters for sheep, in Suðuroy and Sandoy. Note that circular type *ból* tend to be less pronounced while oval and teardrop *ból* tend to be more prominent with higher vertical relief.

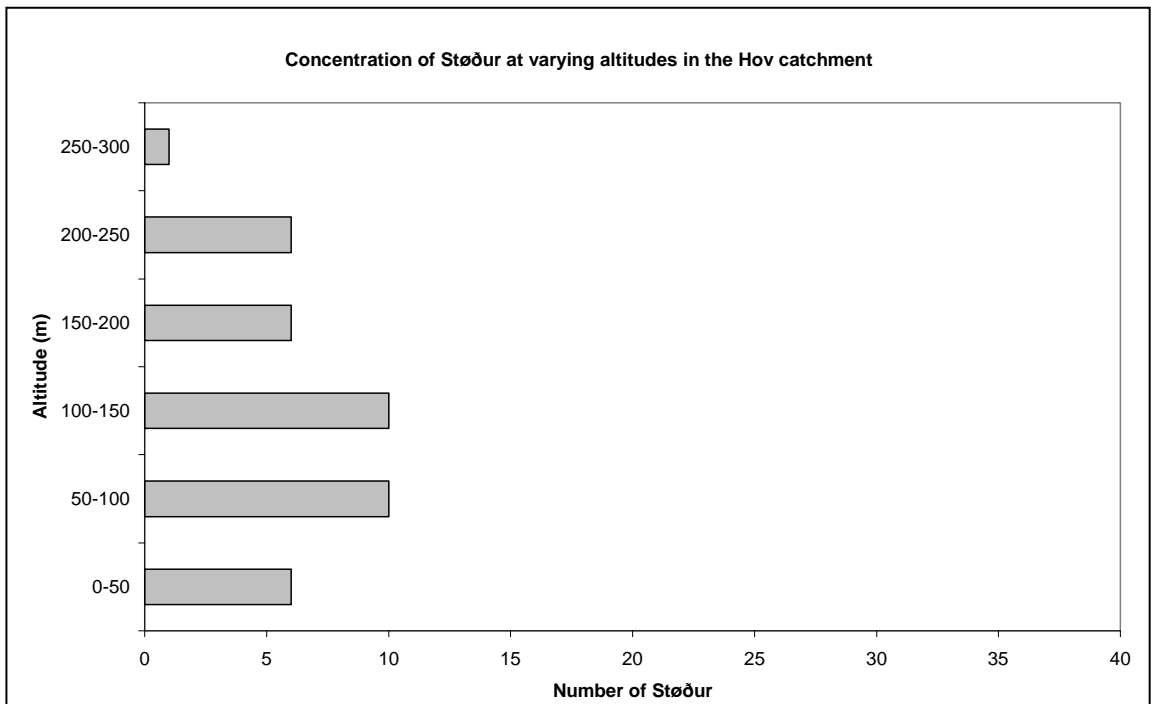
**Ból entrance orientation in the Hov catchment**



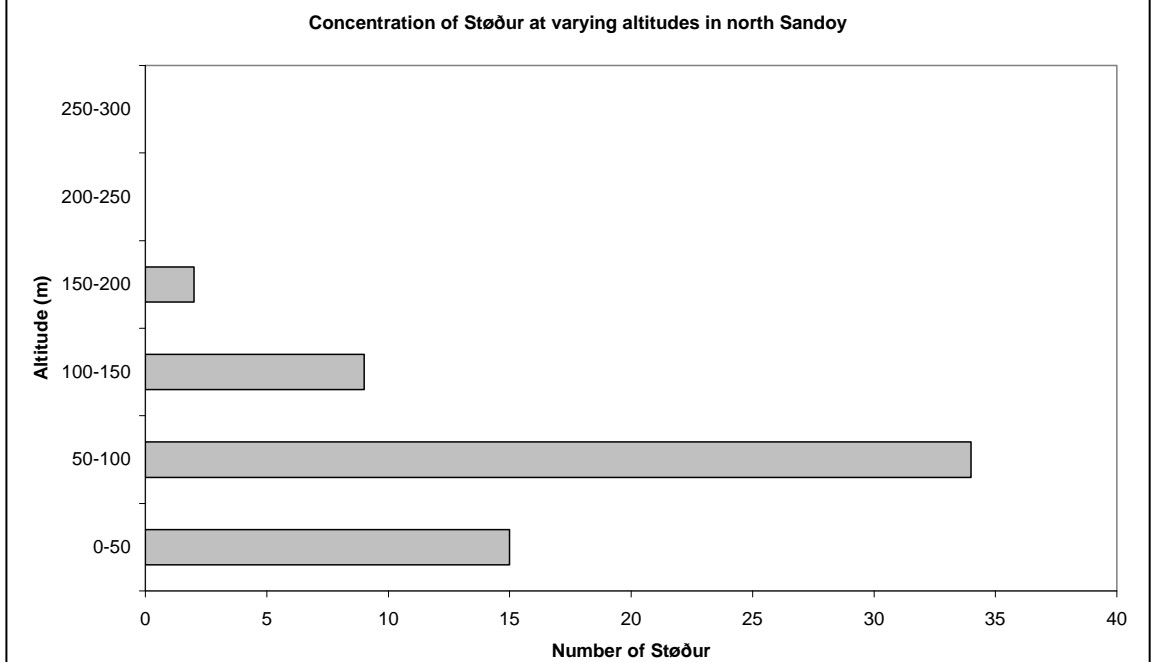
**Ból entrance orientation in northern Sandoy**



**Figure 6.15:** Rose diagrams illustrating the orientation of the entrances of *ból* in the Hov catchment (top) and in selected areas of north Sandoy (bottom). *Ból* are specifically orientated with the entrances predominantly S-SE facing in Hov, and S-SW facing in north Sandoy, in order to provide shelter to sheep from the northerly winds in winter.



**Figure 6.16:** Histogram illustrating the concentration of *ból* or sheep shelters at differing altitudes in the Hov catchment.



**Figure 6.17:** Histogram illustrating the concentration of *ból* or sheep shelters at differing altitudes in north Sandoy.



**Figure 6.18a and 6.18b:** Stone and stone/turf walls in the Hov catchment.



**Figure 6.18c and 6.18d:** Stone/turf walls in north Sandoy. Note that a breach in the stone/turf dyke in the photo on the right has been repaired with stones, demonstrating a continuity of use.



**Figure 6.19:** Stone wall built into natural rock fall (Hov catchment)



**Figure 6.20a and 6.20b:** Isolated stone enclosure located in an inland valley (Hov catchment)

*Structures relating to peat cutting activity*

Aside from the structures relating to sheep, the most extensive remains are those associated with peat cutting and drying. As wood has always been scarce in the Faroes, peat and turf have been vital for hundreds of years as fuel, and for building. Peat use is discernable in the landscape, both by the banks where peat was cut, and also by mounds of terrain (*torvlutir*) in peat cutting areas, which are the result of the repeated stacking of peat at the same location year after year (Figures 6.21a-c). When dried, the peat was gathered up and stored in special rectangular peat shelters called *krógv* (pl. *kráir*) or in larger “peat houses” called *torvhús* (Figure 6.22a). In the *kráir*, the peat was surrounded by loosely built stone walls on the long sides and back of the structure. The stacked peat was covered by a layer of especially long turf strips, straw thatch or sacking, which functioned as a roof (Poulsen *et al* 1998). Peat was taken home from the *kráir* two or three times a week, and today a layer of turf often remains as evidence of the activity. Construction and use of *kráir* declined when imported fuels took the place of peat, and today the loose stone constructions with raised floors can be witnessed in the outfields of both Hov and Sandoy in varying states of recognition (Figures 6.22b-c). On Sandoy *kráir* are generally rectilinear in form with one noticeable longer axis, although some are approximately equal in length and width. Dimensions range from 1 m<sup>2</sup> to a length of c.8 m, however, widths did not exceed c.3.2 m and the long-axis orientation was variable. *Kráir* and *torvhús* were not always differentiated in the field as identification between the two was sometimes difficult.

*Drainage ditches*

Relic drainage ditches were observed in the outfields of both Hov and Sandoy. The base of a drainage ditch in Hov was radiocarbon dated to 1120 ± 35 yr BP (858-996 AD) (GU-11661), indicating that drainage as a system of land management was underway comparatively soon after settlement (refer to Figure 6.2 for general location and to Figure 6.3 for a detailed context of the ditch). In the Sandoy outfields, two drainage ditches were recorded but are undated. The first was a relatively small ditch fragment cutting across a hill slope at altitudes between c.96 m and c.84 m. A second, more extensive ditch, was observed on the hill slopes to the east of Søltuvík, cutting diagonally into the slope between altitudes of c.274 m and c.180 m, before draining into a natural channel (refer to Figure 6.7 for location). At present, this drainage ditch is observed cutting through a landscape, which in places is considerably degraded (Figure 6.23), suggesting that at the time the ditch was constructed, this area of the landscape was more vegetated.



**Figure 6.21a:** Mounds where peat has been stacked to dry (*torvlutir*) are common in certain parts of the outfields on Sandoy.



**Figure 6.21b:** Close up view of Figure 6.18b illustrating that peats were stacked directly onto, natural raised bedrock mounds.



**Figure 6.21c:** Evidence of more recent peat cutting (*torvgrøvd*, or peat banks) in the Litlavatn area of Sandoy.



**Figure 6.22a:** Remains of a *torvhús*, a stone house structure used for storing peat observed in the Sandoy outfields.



**Figure 6.22b:** A small *krógv* observed in the Sandoy outfields, used for storing peat over winter.



**Figure 6.22c:** A larger *krógv*, also observed in the Sandoy outfields.



**Figure 6.23:** Relic drainage ditch observed on slopes east of Søltuvík, Sandoy (refer to Figure 6.23 for ditch location) that cuts diagonally into the slope between altitudes of c.274 m to c.180 m. The top left photo illustrates the outset of the ditch at 274 m in a vegetated landscape. The top right photo illustrates the ditch a little further downslope and the bottom photo illustrates the ditch at lower altitudes, cutting through a partially de-vegetated landscape.

*Cairns*

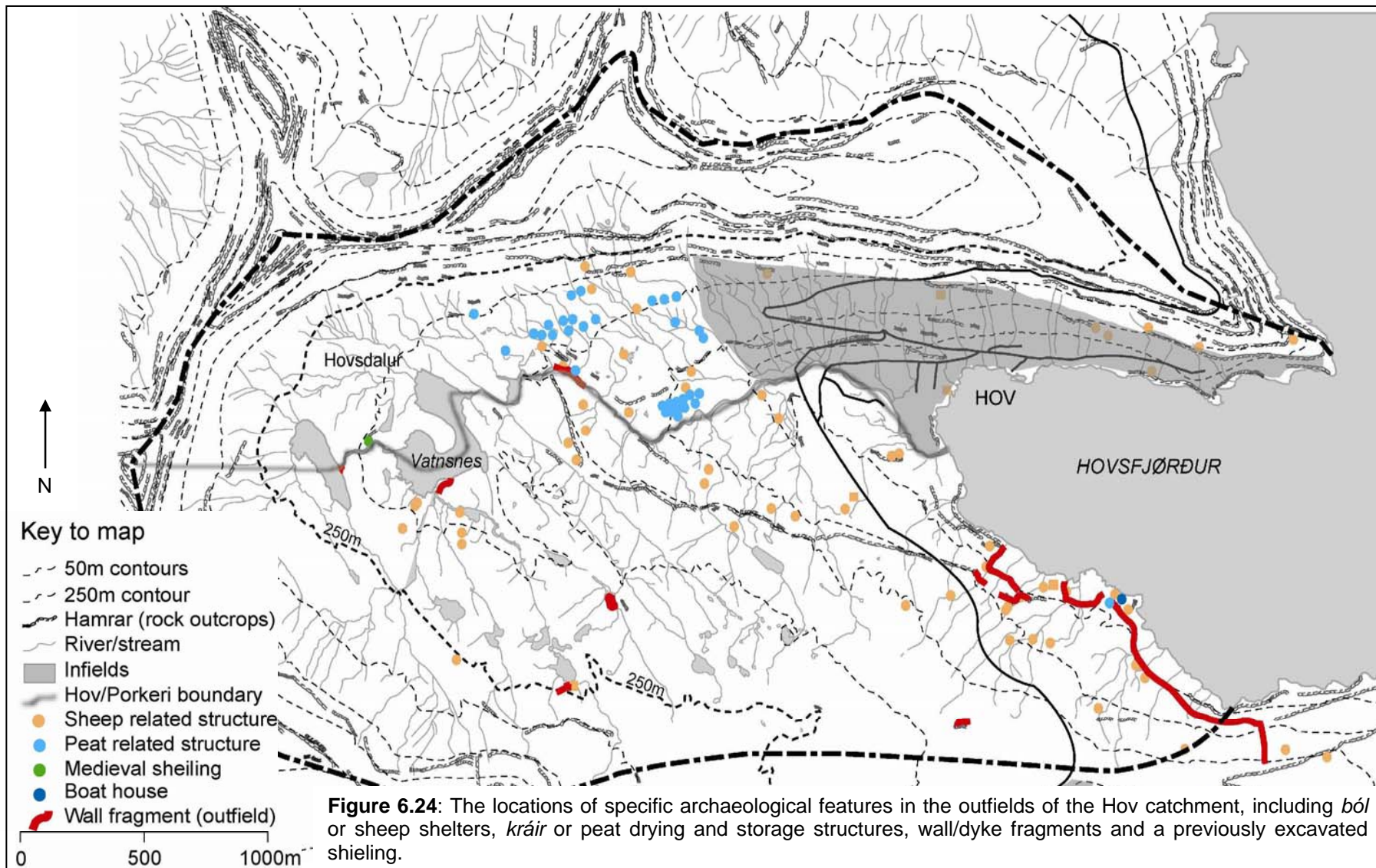
Paths through the outfields between villages and settlements were marked by stone cairns called *varðar*, which were particularly important for people to find their way in poor visibility. Several cairn paths (*varðagötur*) were observed criss-crossing the field site areas, although the individual stone cairns or pathways were not recorded in detail in this study.

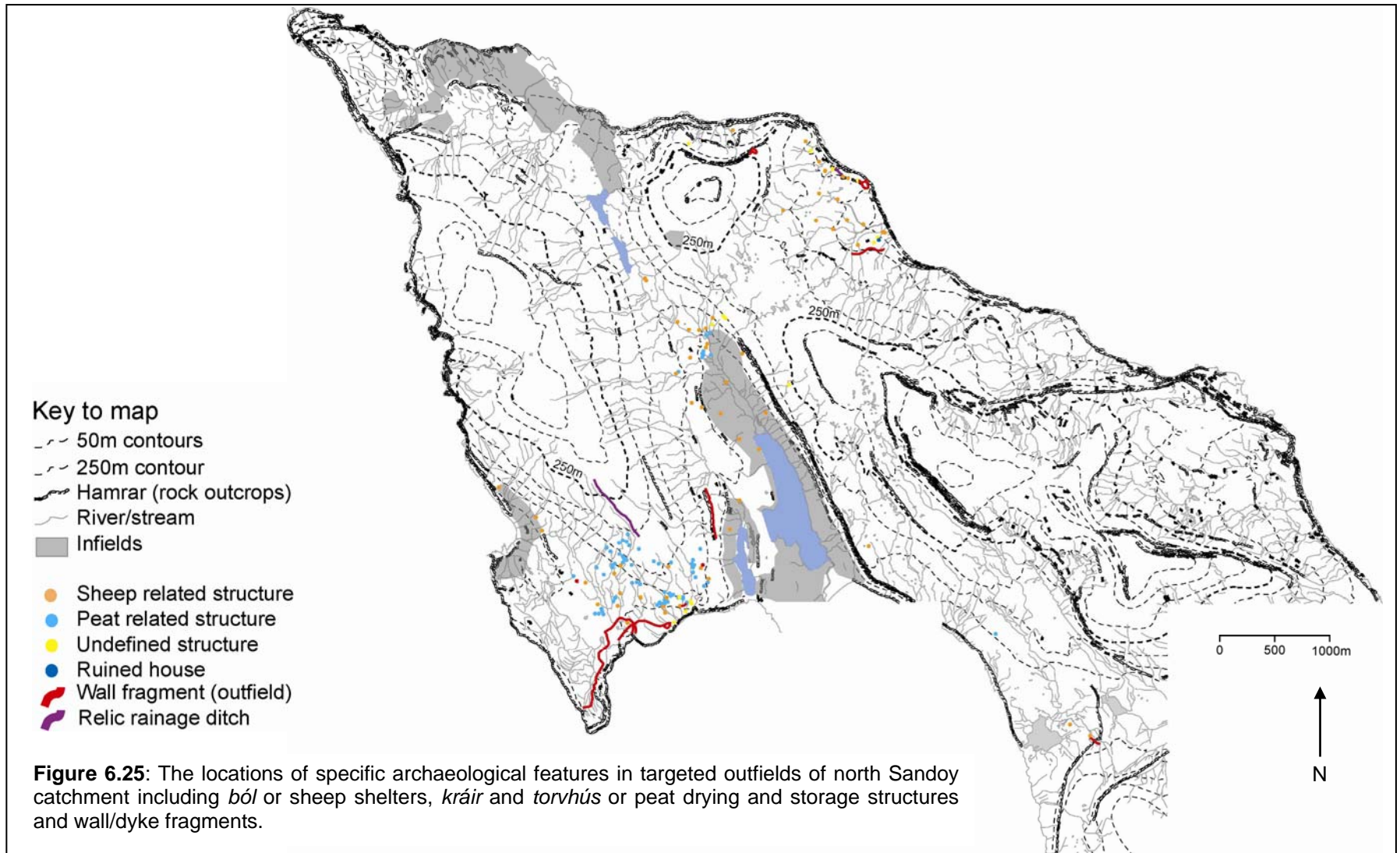
**Identification and description of archaeological “zones”**

After conducting the archaeological survey, locations of the various structures were mapped in order to assess their spatial distribution in Hov (Figure 6.24), and north Sandoy (Figure 6.25). Following analyses of the maps, areas with either distinctive or a high density of monuments were classified as “zones”, which are described and compared below. A map illustrating the location of archaeological zones for Hov is presented in Figure 6.26 and for Sandoy in Figure 6.27. Classification of the archaeological landscape into zones allowed clearer identification and analyses of specific areas in the landscape that might have been targeted or affected by anthropogenic activity. For example an area with a high density of *kráir*, would suggest that peat had been extensively cut in the localised landscape. Zones of inferred anthropogenic activity were then compared with the results from the land cover classification mapping to identify patterns between areas of high archaeological density and the surrounding natural landscape.

*Hov archaeological zones*

Four major archaeological zones suggestive of specific anthropogenic activity were identified in the Hov catchment (Figure 6.26). As well as being located in distinct geographical areas in the catchments, each zone is associated with a specific range of archaeological features connected to particular anthropogenic activities. Archaeological features were also observed outside these zones, but did not have such a high density concentration. Zones 1, 2 and 3 are located in relatively close vicinity in the Hov and Porkeri infields, and Zone 4 is located further inland in the vicinity of an excavated Norse shieling site (Mahler 1993).





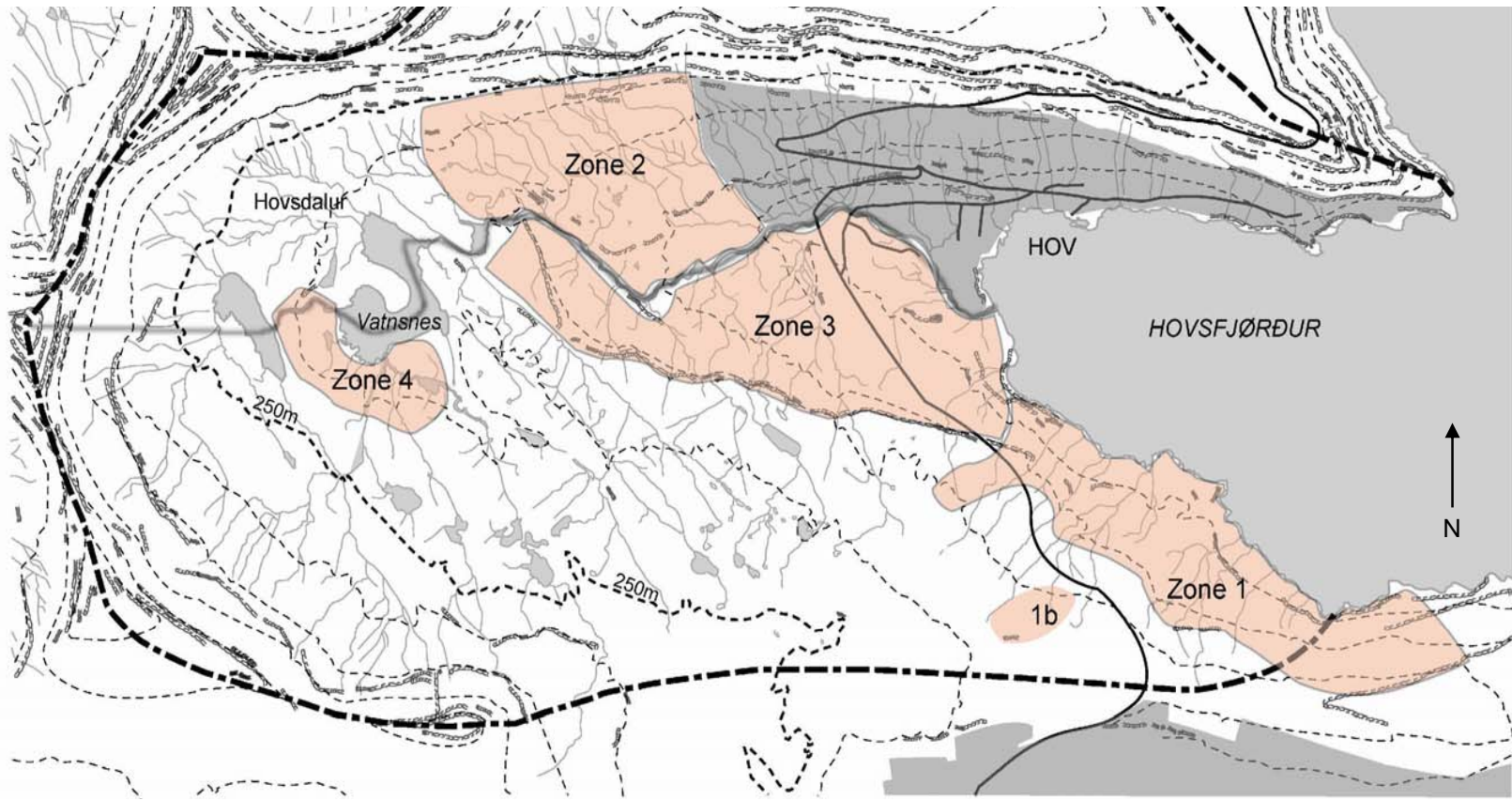
**Figure 6.26:** Hov catchment archaeological “zones”, which have been designated as areas with either distinctive or a high density of archaeological monuments.

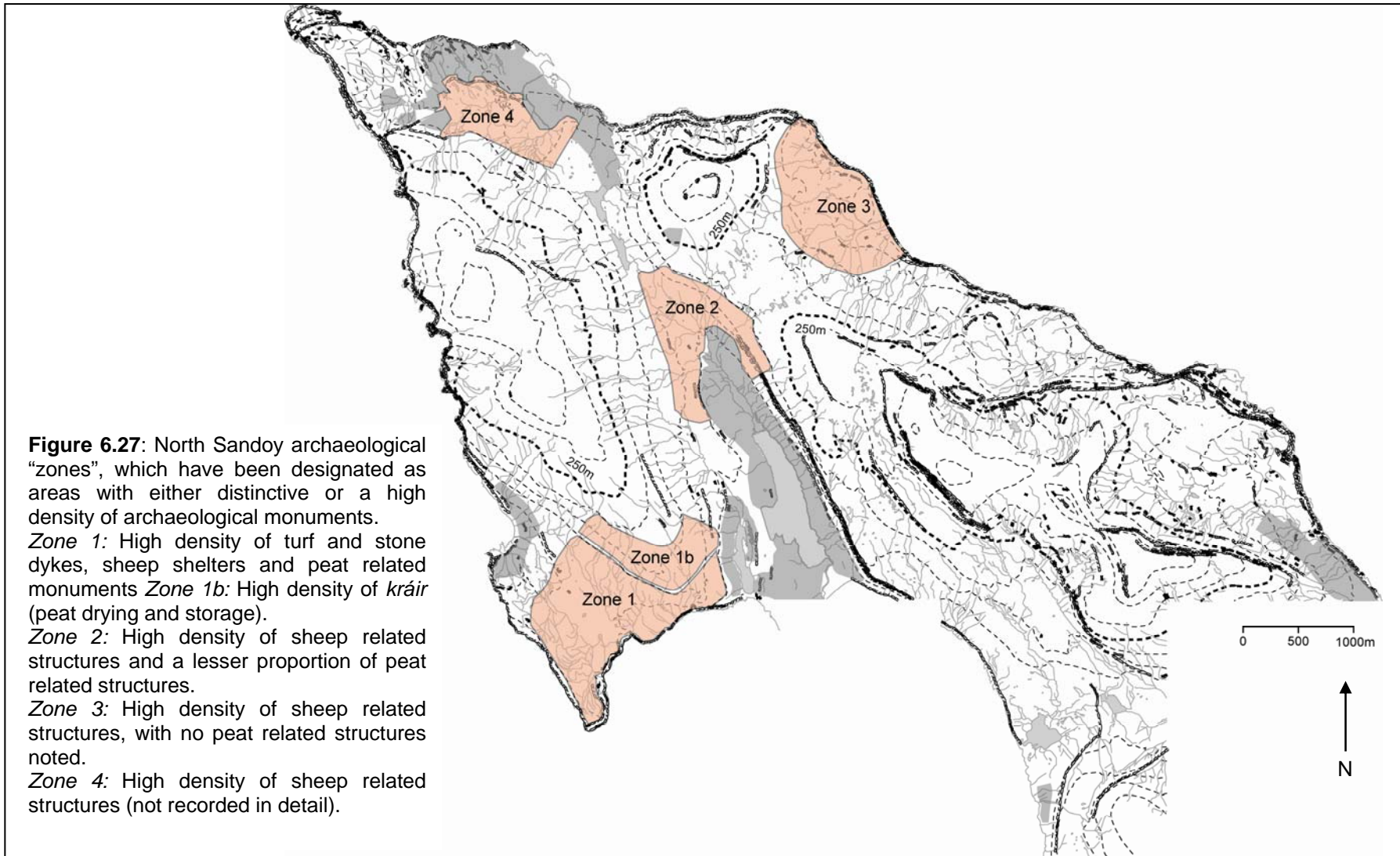
*Zone 1:* High density of turf walls and other structures, used in medieval period for milking ewes, place-names associated with pigs; *Zone 1b:* Drainage ditches.

*Zone 2:* High density of peat related structures/mounds and several sheep related structures.

*Zone 3:* High density of sheep related structures.

*Zone 4:* Inland area around lake with medieval shieling and several sheep related structures.





**Figure 6.27:** North Sandoy archaeological “zones”, which have been designated as areas with either distinctive or a high density of archaeological monuments.  
*Zone 1:* High density of turf and stone dykes, sheep shelters and peat related monuments  
*Zone 1b:* High density of *kráir* (peat drying and storage).  
*Zone 2:* High density of sheep related structures and a lesser proportion of peat related structures.  
*Zone 3:* High density of sheep related structures, with no peat related structures noted.  
*Zone 4:* High density of sheep related structures (not recorded in detail).

Zone 1 encompasses low altitudes of c.0 to 100 m and has a generally north east facing aspect. Although part of Porkeri commune or district, this area falls within the hydrological catchment of Hov. Archaeological features within this zone include a high density of *ból*, a small number of *kráir* and *rætt* and numerous stone and turf dykes. A boathouse, small square house structure and a small number of unknown features were also recorded. The most distinctive feature of Zone 1 is the high density of stone and turf dykes, as very few dykes (aside from those that form infield boundaries) were recorded elsewhere in the catchment. The purpose of the dykes is not known, although as the form of the dykes differs between those composed of dry stone, those built using turf as well as stone and those that follow natural features etc., it is probable that within this area the dykes assumed several different purposes. One suggestion is that the dykes are connected with pig keeping (Mortan Holm *pers. comm.*), which is known to have continued in the Faroes until the 13<sup>th</sup> century (Church *et al* 2005, Arge *et al* 2005). The nearby place names Svínstarhamar and Porkeri refer to pigs, but there is no firm archaeological evidence to confirm the presence of pigs in Hov, and the strategy for pig husbandry in the early Medieval Faroes is currently unknown. Some of the recorded wall fragments in Zone 1 may relate to the milking of ewes (Arge *pers. comm.*), which is attested to by place names such as Lambhagin, Lambhellir, Lambagarðar and Lamburð. Lambhagin refers to a stone and turf dyke that follows the top of the *hamar* or rocky outcrop to form an enclosure between the dyke and the sea. The place-name suggests that this area was used to separate lambs from the ewes to enable the ewes to be milked (Thorsteinsson 1982). As the practise of milking ewes is not known in Faroese tradition and was most likely a Norse activity, it is possible that the enclosure wall associated with the place-name dates back to the Norse period (Arge *pers. comm.*). Other suggestions are that the dykes prevented cattle from straying into dangerous terrain or falling off cliffs, or that they were used as a means to enclose cattle.

Zone 1b is separate from Zone 1a and is characterised principally by a 9<sup>th</sup>-10<sup>th</sup> century drainage ditch, which is described in detail above in connection with an area of gullying.

Zone 2 is located to the west of, and borders the Hov *bøur* or infield, north of the river Hovsá, which forms the present day boundary between the Porkeri and Hov outfields. The zone covers a relatively wide altitudinal range of between c.50-250 m, and is characterised by gently sloping topography. Several *ból* were recorded in the area, along with a single stone wall fragment following the river (which could relate to the Hov-Porkeri boundary). The most distinguishing archaeological characteristic of this zone compared with elsewhere, was the high density of *kráir* or peat drying structures, the majority of which had collapsed leaving two or three loose stone walls or platforms still identifiable. The high density of *kráir* confirms the relatively intensive utilisation of peat in this area, and peat from this side of the river was reputed to burn well (Mortan Holm *pers. comm.*). This area was also easily accessible from

Hov village, which was necessary as peat would be collected from the *kráir* every couple of days.

Zone 3 is located in the valley to the south of the river Hovsá and is well constrained by an extensive rock buttress to the south and the river to the north. This area has an altitudinal range between c.0 and 150 m and a gently sloping topography. This zone is characterised by a high number of well-defined *ból*, which suggests the site has been important for winter sheep grazing. The lack of peat-related structures may be a function of the relation to district boundaries; although this zone is close to Hov *bygd*, this section of outfield belongs to Porkeri, which is some distance away from Porkeri *bygd* and therefore may not have made an ideal location from which to collect peat.

While Zones 1 to 3 are located at low altitudes, relatively close to the villages of Hov or Porkeri, Zone 4 is located inland from Hov near the Vatnsnes lake (c.200 m altitude). This zone has a lower density of structures than the zones previously described, but encompasses a cluster of *ból*, some of which were in a very poor condition, a wall fragment and a shieling (*Ærgidalur*). The place name relates to the use of the area as a summer pasture and the remains of a shieling have been found on the north side of the river with the remnants of a cattle enclosure to the south. The inside of the shieling measures 5.15 m by 3.5 m and has a raised fireplace. The period of occupation of the shieling has been dated to the Viking Age by distinctive clay bowls found within the structure (Schei and Moberg 2003). A number of isolated archaeological structures were also found in this upland region, which contrasts with that of lower altitudes where the structures tend to be clustered together. For example, a walled enclosure at Aárkurvur is located within a large sheltered depression along a river valley where farmers from Porkeri brought cattle and sheep for summer grazing. This isolated structure functioned as an enclosure for “taming” or calming wild sheep (Mortan Holm *pers. comm.*).

#### *Sandoy archaeological zones*

Based on the results from the Hov survey, it was hypothesised that particular types of archaeological monuments would also be found in explicit locations on Sandoy. In view of the larger scale of the Sandoy survey, specific zones were targeted based on a general walk-over of the north Sandoy area, with four specific areas identified as having a distinctively high density of archaeological structures (Figure 6.27). Three of these locations were walked over in detail and the structures within the zones recorded.

Zone 1 encompasses the area between Sandur village and the west coast of the island incorporating the Salthøvdi promontory to the south. The general topography of Zone 1a is

level or gently sloping and covers low altitudes between c.0 and 100 m. A particularly high density of archaeological remains was observed within Zone 1a including several turf and stone dykes, *ból*, *kráir*, rectangular stone structures and a small number of unidentified archaeological structures. The concentration of dykes in this area is particularly intriguing, as only limited sections of dykes (aside from infield boundaries) were identified outside of this designated archaeological zone. The relationship of features in Zone 1a on Sandoy is similar to those in Zone 1a in Hov, as both are characterised by a high concentration of dykes, good vegetation coverage, a similar altitudinal range and an association with pig place-names, which in Sandoy include Svínadalur, Svínadalsurðin, Grísagarðarnir and Grísurðin. Therefore, although the purpose of the dykes at either site is not known, the similarities in archaeological features and in vegetation coverage suggests that these zones, although on different islands, are comparable in terms of the nature of anthropogenic activity carried out.

Zone 1b is located adjacent to Zone 1a and north of the present day road to Søltuvík, but is classified separately from Zone 1a because of its higher altitude range and distinctive archaeology, which suggests a different anthropogenic use of the area. Zone 1b is characterised by a very high density of *kráir* but also by a lack of other structures, such as the dykes and *ból* that characterise Zone 1a. Reference to the archaeology and local interviews determined that this area was used for peat cutting, whereas the structures in Zone 1a are associated predominantly with cattle and winter sheep grazing. The *kráir* varied in size and form from small (1 m<sup>2</sup>) square structures to larger (8 m in length) rectangular structures, although the latter were less common. From ground truthing descriptions conducted at each site within Zone 1b, and based on the landscape degradation mapping, a sharp contrast in vegetation quality was observed between Zone 1a and Zone 1b. Zone 1a is considerably well vegetated (80 % - 100 % vegetated) and Zone b is relatively degraded with a vegetation cover ranging between 40 % and 60 %. The difference in extent of vegetation cover between the two zones is probably anthropogenically influenced and is discussed in more detail in chapter 7.

Zone 2 is located in the valley beyond the infield boundary to the north of Sandsvatn at altitudes between c.40 m and c.100 m and in terms of archaeological structures is characterised principally by *ból* of varying proportions, as well as a smaller proportion of *kráir*. This area has probably been utilised as both an area of winter sheep grazing with some limited peat cutting also having taken place.

Zone 3 is located in the vicinity of two well vegetated valleys on the east facing coast of Sandoy in an area isolated from the closest villages of Sandur and Skopun by the mountain chain that runs down the centre of the island. According to the surviving outfield structures, Zone 3 is associated primarily with grazing. No evidence of peat related structures was

observed in this area despite good peat deposits, probably because of the distance and mountainous terrain between the area and the nearest village. The area contained a number of interesting structures besides horseshoe shaped *ból*, including semi-circular stone structures with one side completely open that were unlike any structures observed in any other zone. A stone dyke fragment is connected to the “byrgi” place-name, referring to an area enclosed either by the natural topography or by anthropogenic structures that may have been used for rounding up livestock (Arge *pers. comm.*), and thus probably functioned as an enclosure.

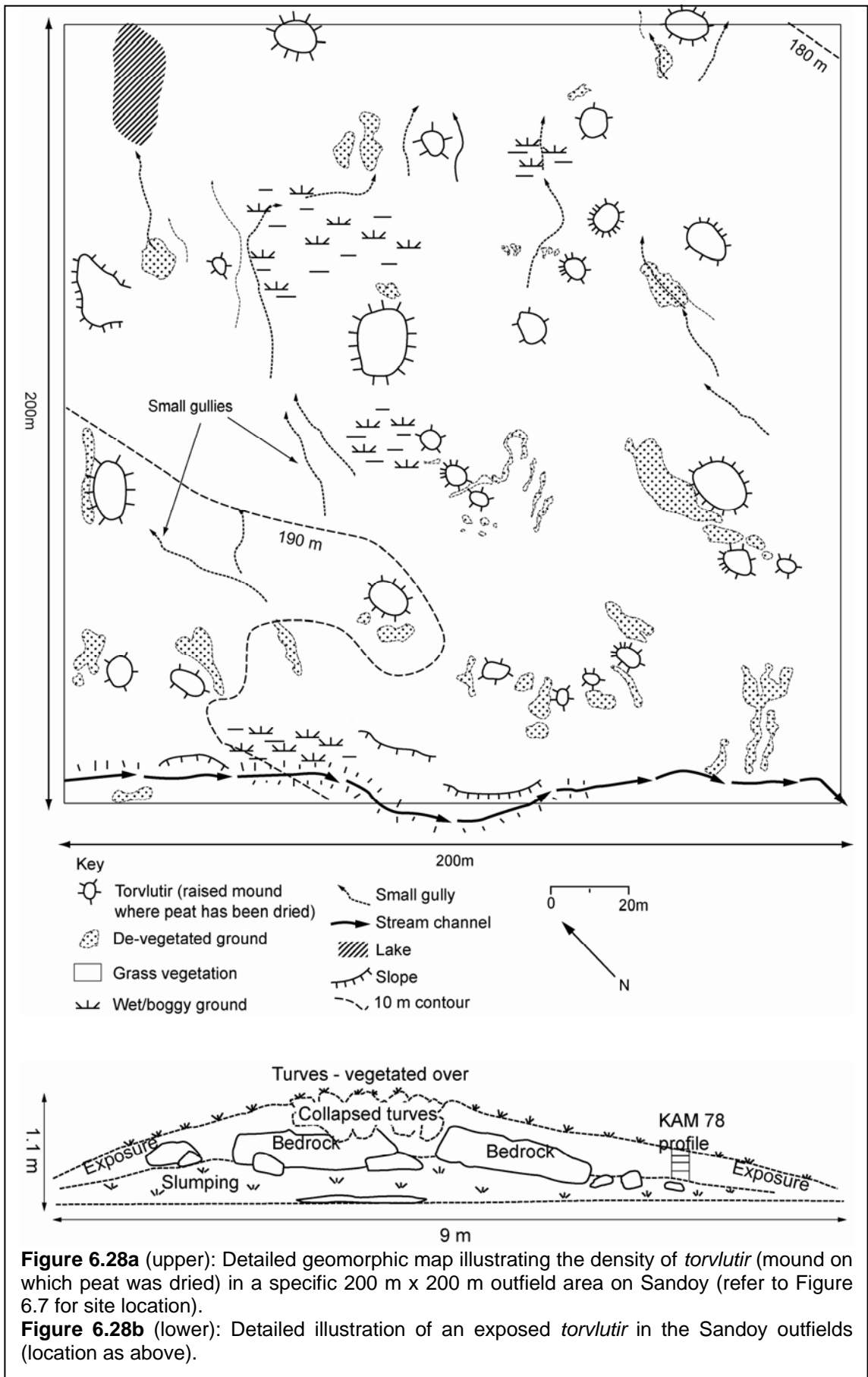
#### *Detailed mapping of torvlutir in central Sandoy*

In addition to the three archaeological zones described above, a 200 m<sup>2</sup> area in the central eastern area of Sandoy at an altitude of c.180 m was mapped in detail in order to illustrate the relationship at a micro-scale between *torvlutir* (peat mounds) and the localised landscape degradation and gullying (Figures 6.28a and 6.28b).

#### **Comparison between cultural zones and landscape cover classification mapping**

Archaeological mapping was compared with the landscape cover classification mapping in order to assess the relationship between the spatial patterns of anthropogenic activity and landscape quality. The hypothesis to test was that a positive spatial correlation between degradation and structure density would indicate a dominance of human impact, while a negative spatial correlation between degradation and structure density might imply that human impact was negligible (refer to hypothesis 4 in Table 1.1). Comparison between the archaeological and geomorphological mapping indicates that, in general, zones of high density archaeology corresponded with well vegetated land with limited exceptions. In Hov, for example, Zone 1, which has a high density of *ból* and dykes is very well vegetated in comparison to locations elsewhere in the outfield. In Sandoy, the archaeological Zones 1a, 2 and 3 strongly correlated with areas where the vegetation cover was characterised as “very dominant” (80-100 % vegetated). The environs of Zone 1b and a small strip on the western edge of Zone 2 were exceptions, as here the landscape was categorised by areas of “significant” (40-60 % vegetated) or “limited” vegetation (10-30 % vegetated).

To conclude, locations characterised by *ból* or by stone and turf dykes were very well vegetated compared with locations at similar altitudes where archaeological monuments were scarce (but which would still be affected by sheep grazing). In contrast, locations associated predominantly with peat-related activity, and characterised by *kráir* and *torvlutir*, were more degraded than areas with few archaeological structures at a similar altitude.



**Figure 6.28a** (upper): Detailed geomorphic map illustrating the density of *torvlutir* (mound on which peat was dried) in a specific 200 m x 200 m outfield area on Sandoy (refer to Figure 6.7 for site location).

**Figure 6.28b** (lower): Detailed illustration of an exposed *torvlutir* in the Sandoy outfields (location as above).

### 6.3. Interview data

Four in-depth interviews were conducted with farmers living in, or around Sandur, each lasting the duration of between one and two hours (Table 6.5). An additional hour-long follow-up interview was made with one of the participants. A combined summary of the interview data is presented below, structured around the themes of the interview framework (Appendix B), which focussed on peat cutting, fowling and egg collecting, the *grind*, farming and climate. Full transcripts of the interviews conducted in English and more detailed notes from the interviews conducted in Faroese, which were not transcribed, are also presented in Appendix B.

	Date of interview	Interviewee	Location of farm	Duration of interview	Language of interview
1	28/04/2006	Gunnar Bjarnarsson (GB)	Sandur	~96 minutes	English
2	01/05/2006	Johan Petur (JP)	Í Trøðum	~100 minutes	Faroese (translated by Símun Arge)
3	02/05/2006	Joannes Johannessen (JJ)	Í Trøðum	~89 minutes	English
4	02/05/2006	Petur Clementson (PC)	Sandur	~110 minutes	Faroese (translated by Símun Arge)
5	04/05/2006	Gunnar Bjarnarsson (GB) (additional interview)	Sandur	~60 minutes	English

**Table 6.5:** Table detailing interviewees made with Faroese farmers on Sandoy.

#### Combined summary of interview data

##### *Peat; methods of extraction, its geographical exploitation and ownership*

In Sandur, peat cutting was still common in the 1950s, but by the 1960s activity had been reduced to a few farms (JJ). Peat was cut around the same time each year between mid-late May and late June, and the whole process of cutting and drying lasted around a month. The peat cutting method was described by JJ; turf would need to be dug for 5-6cm before good quality (i.e. well humified) black peat was reached, which would be cut down c.50-60 cm. Each turf would be laid out on the ground to dry initially. They would be gathered and two turves stacked together for a further short period of drying, following which, many were stacked up together in small piles where they would be left to dry for two or three weeks. Once dried, peat was kept over the winter in *kráir*. It was very rare to have *kráir* close to the house, and instead turves were collected from *kráir* every one, two or three days.

The quality of peat was an important consideration according to JP, JJ and GB. The best quality peat, defined as that which gave the most heat, is black and well humified. A less humified or less developed peat that did not burn well is known by the Faroese term *taðingur*

(GB). Sometimes it was necessary to cut peat of lesser quality depending on your designated peat cutting area, because peat cutting areas were allocated according to land ownership. As a result, a compromise often had to be made between peat quality and the distance from the farm to the peat banks (JJ, GB). The deeper in the profile, the better quality the peat was, but cutting too deep caused water-logging in the surrounding area, which created a problem for grazing sheep;

“you would cut it so that the water would run off, because if you got a wet area, the sheep would get a form of liver disease...now days we have medicine for this liver disease so it's no problem today, but it was a problem in the older days” (JJ).

With regards to regulating the use of peat, there was no control over how much peat could be cut, providing you cut only from the peat banks as designated to your particular farm (GB, PC). In I Trøðum, close to the village of Sandur, a peat cutting area was defined and divided into four, one part for each of the four farms that used to exist in I Trøðum. The specified location was alternated every 10-15 years (JP). Those who did not own peat banks were allowed to cut from the vicar's land in the vicinity of Sondum to the east of Sandur (JP).

Interview respondents gave differing responses with regards to visible erosion caused by peat cutting. GB had been informed that in “old times” the vegetation cover overlying the peat was cut along with the peat itself and he expressed that;

“...when you look at an area where people have cut peat in the Faroes you can see it's not good, it's ugly to see I think. But in the Faroes, people don't think about it, it's OK they say. So people in older times in the Faroes didn't think so much about their environment” (GB).

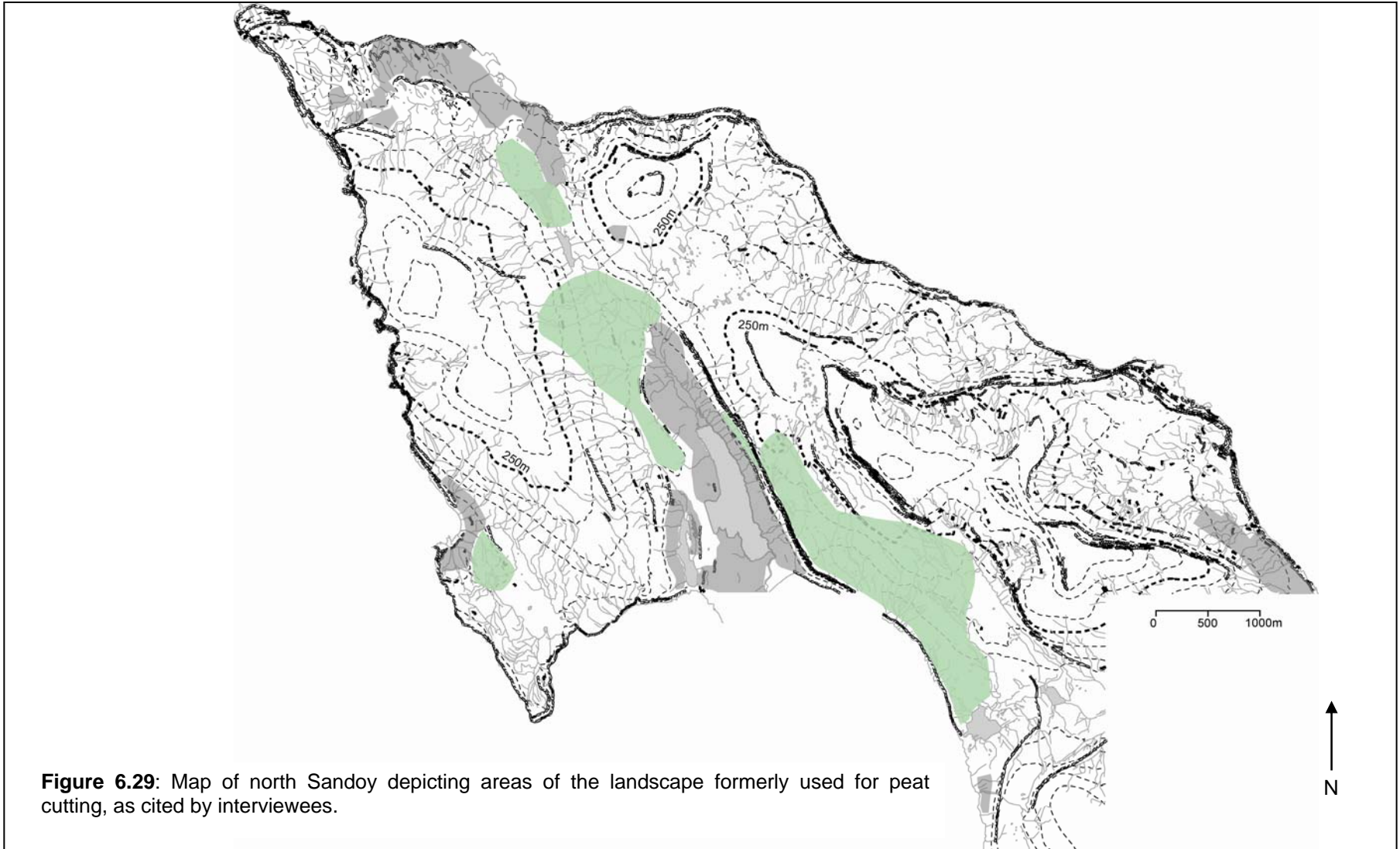
JJ however, expressed a contrasting opinion, suggesting that in older times people looked after their environment to a greater degree than today;

“...yeah, you were looking after the environment in those days, in the older days, today we just, puh!”

A map was composed from information regarding the locations used for peat cutting mentioned by the interviewees (Figure 6.29).

#### *Fowling; ownership, methods and geographical exploitation*

In terms of ownership of cliffs and fowling rights, each village had a specified fowling area, which was divided among the farms in that village. The vicar and the largest farms had access to the best fowling cliffs on Sandoy; just one farm owned nearly half the cliffs along the west coast between Sandur and the northern tip of the island (JJ). Of the interviewees,



**Figure 6.29:** Map of north Sandoy depicting areas of the landscape formerly used for peat cutting, as cited by interviewees.

one lived on a farm that had very little access to fowling: the cliffs around Gleðin owned by the farm in question had been eroded by the 19<sup>th</sup> century and no provision for fowling was made for the farm elsewhere (PC). Conversely, an interviewee in Í Trøðum had access to cliffs of several kilometres “from Lonin to Gleðin” (JJ). The interviewees were not clear about how different farms were designated access to particular cliffs. One interviewee suggested that decisions regarding cliff access/ownership were made by the *grannastevna*, although another suggested;

“...you can perhaps imagine that a big farmer like this has said ‘I want this, this is my place’, they are powerful, and you know, they had the rights everywhere you know” (JJ).

Fowling methods varied according to the birds hunted (Nørrevang 1979). To take puffins, one or two persons were required. In Í Trøðum one person from each of the four farms would usually go together. There would be several ledges where each person could sit and at the end of the day the birds would be shared among the four (JP). Guillemots on the other hand, breed on some of the highest and most precipitous cliffs, so a guillemot fowling expedition would require more people, at least 15-20. Interviewees also mentioned the requirement of a boat for guillemot fowling, which was sent to the base of the cliffs, both to get people to the cliffs and because in some cases, when caught, the birds were tied together and thrown into the sea from where a boat would be waiting to collect them (JJ). Aside from the birds themselves, bird eggs were also taken. Some of the regulations mentioned by the interviewees with regards to fowling, but especially to gathering eggs, are outlined below;

- There was no regulation on the number of bird eggs taken but you could only collect them before 8<sup>th</sup> June (JJ)
- The *fygla*<sup>1</sup> method could only be used every third year (JJ)
- The method of catching puffins (*fleyga*<sup>2</sup>) wasn't regulated and you took as many as you needed in order to survive the winter (JJ)
- Bird eggs could be collected from the first week in June (JP)
- If using the *fygla* method you could only take birds once every four years (JP)
- The village (Dalur, southern Sandoy) could take up to 32,000 puffins a year. Once this figure was reached you couldn't take any more (GB)
- With guillemots, only the first laid egg could be taken (GB)
- You could only take puffin eggs from their burrows once every 3-4 years (GB)

Although these attest to the existence of a wide variety of regulations, some which may appear contradictory, it does suggest that there were a series of regulations which probably

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<sup>1</sup> *Fygling* refers to a method of fowling used mostly to catch guillemots which breed on high steep cliffs. The fowler was lowered down the cliff and used a long-handled net to catch the guillemot (Schei and Moberg 2003, Nørrevang 1979).

<sup>2</sup> *Fleyging* refers to a method used to catch puffins with the aim of catching the birds in mid-flight by the means of a long-handled net (Schei and Moberg 2003, Nørrevang 1979).

varied from village to village. It is not known how the regulations were enforced but GB added that these regulations were absolutely adhered to because people had great respect for them.

*The importance of the grind (pilot whale hunt)*

K: So you needed a lot of food?

JJ: Yes

K: And how much of the diet did birds make up, was it, you know, did you eat more birds than sheep or-

JJ: No, no, I think, I think *grind* (whale) was number one...

*Grind* (pilot whale) was considered to play the most important part in the diet by both JJ and PC. JJ connected times of hunger in the Faroes to times when there were few whales sighted adding;

"...we couldn't have survived if the whales were not around, I don't think so".

The importance of the *grind* is supported by the distances travelled to take part and thereby lay claim to a share of the catch. This was mentioned by JP, who had heard of people from Suðuroy, the most southern island rowing to the northern Faroe Islands to partake in a *grind*. This was supported by JJ;

K: ...how far would people go to take part in a grind?

JJ: They would go very far, they would go very far, because often the fishermen, they see the *grind*, so they follow the *grind* to the place where they are slaughtered and that could be far away...and then they came back with the boat loaded with food...it would take them several days to come back with this food...

The importance of *grind* also lay in its social function, which was stressed by JJ.

*Farming and sheep grazing*

Hay and barley were the main products of the infield, and south facing infields, which received the most sunlight, were the most prized infield land. Sandur had less mountainous surroundings and was more open than other villages on other islands, and as a result was a good location for cultivation. In Sandoy, hay cutting took place twice a year, in June and in August, whereas in most villages hay cutting took place only once a year (GB).

GB emphasised the importance of looking after the infields, adding that people compared the appearance of their own infields with that of others.

“...as I was growing up, people had a big, big respect for the infields, very big respect, it was, it was the best thing, and they did it (looked after it) very well...”

With regards to sheep grazing, the respondents affirmed that sheep were not important for their meat and that the mainstay of the diet was based on whales, birds, and also fish. Sheep were kept predominantly important for their wool (JJ, JP, PC), which is illustrated by an extract from the Faroese Farming Times (Føroya Búnaðarfelag 1926), reproduced as Table 6.6. This was supported by comments from JJ;

K: So were sheep more important for wool or meat?

JJ: No, you kept sheep for the wool, that was number one, yeah, because you could get something to eat from something else, but you could only get wool from the sheep...

Sandur			
Hagi	Markatal (land value)	Áseyðatal (stock)	Skuðtal (slaughtered)
Traðarhagi	24	960	384
Høvdahagi	8	290	116
Skopunarhagi	8	320	128
Fjalshagi	15.5	390	115
Klivaløkshagi	12	315	126
Søltuvíkshagi	21.25	560	224
Sandahagi	8	400	160

Hov			
Hagi	Markatal (land value)	Áseyðatal (stock)	Skuðtal (slaughtered)
Hjallaskorahagi	8	250	100
Ytstihagi	8	300	120
Dalshagi	8	336	135
Tjaldavíksholmur		10	5
Porkerishagi	37	932	370

**Table 6.6:** Extracts from Føroya Búnaðarfelag (1926) *Búnaðartíðini* (farming times) 7/8. Published in July/August 1926 and details land values and stock and slaughter rates for the outfields belonging to the villages of Sandur (Sandoy) and Hov (Suðuroy). The large disparity between rates of overall stock and those slaughtered supports the interviewees' declarations that at least in the recent past and probably for several centuries before that, sheep were kept primarily for wool rather than meat.

In terms of outfield grazing land, the most valued land was that which was steeply sloping, because it was nourished by bird guano and was well drained (GB). GB mentioned both Dalur on Sandoy and Tjørnuvík on Streymoy as having some of the best outfield grazing in the Faroe Islands. In some parts of Sandoy, where there is a large proportion of gently sloping land, drainage was more of an issue, which is attested to by the relic drainage ditches. Access to good winter grazing was equally as important as having good summer grazing (GB).

With regards to slope erosion, opinions were mixed, suggesting that the processes of erosion are not fully understood. Some interviewees were not concerned by erosion of the outfields (JP, PC) while another stated;

“...all the stones you can see in the field [i.e. the degraded land in the outfields], if you travel to Shetland or the Orkneys you don't see this, but here in the Faroes you do and I think that the sheep have a part of this because we have had so many sheep that the grass has gone, of course it can be the climate as well, it's wet and it's a very rough climate...” (JJ).

#### *Settlement patterns, social structures and connections*

Sandur was considered a very good location for settlement by the interviewees. In older times, the most important factor for settlement was good land for growing barley (GB), and Sandur was well located for this. Some of the smaller islands in the Faroese archipelago were also considered to be good locations for settlement as they abounded in excellent resources with good opportunities for fowling and fishing (GB). This was emphasised by the following story;

“...they say you are not to take (i.e. marry) a woman from Skúgvoy, because they use so much food and clothes, because they were rich people. You had to take a woman from Tórshavn, because they were poor people, they had to take care of everything” (GB).

Although today, farms are more independent, in the past it was imperative that people worked together. For example, farmers were also fishermen, but in order to fish you needed perhaps eight people to man the boat, and according to JJ the obligation of fishing was sometimes enforced by the landowners, who were evidently the most powerful figures (aside from the vicar) in the village;

JJ: ... in the older days farmers had to have a boat, it was their duty to have one, and there was as well a duty for people to be on the boat, to you know, row the boat and fish with the boat, that was one of the duties people had and they didn't like that very much –

K: When you say 'duty', was it a duty to the family, or do you mean they had to –

J: No, they had to because when the farmers say “we are going to fish”, they had to go with them you know, they couldn’t just say “I’m doing something else”, no they (the farmers) were commanding them...

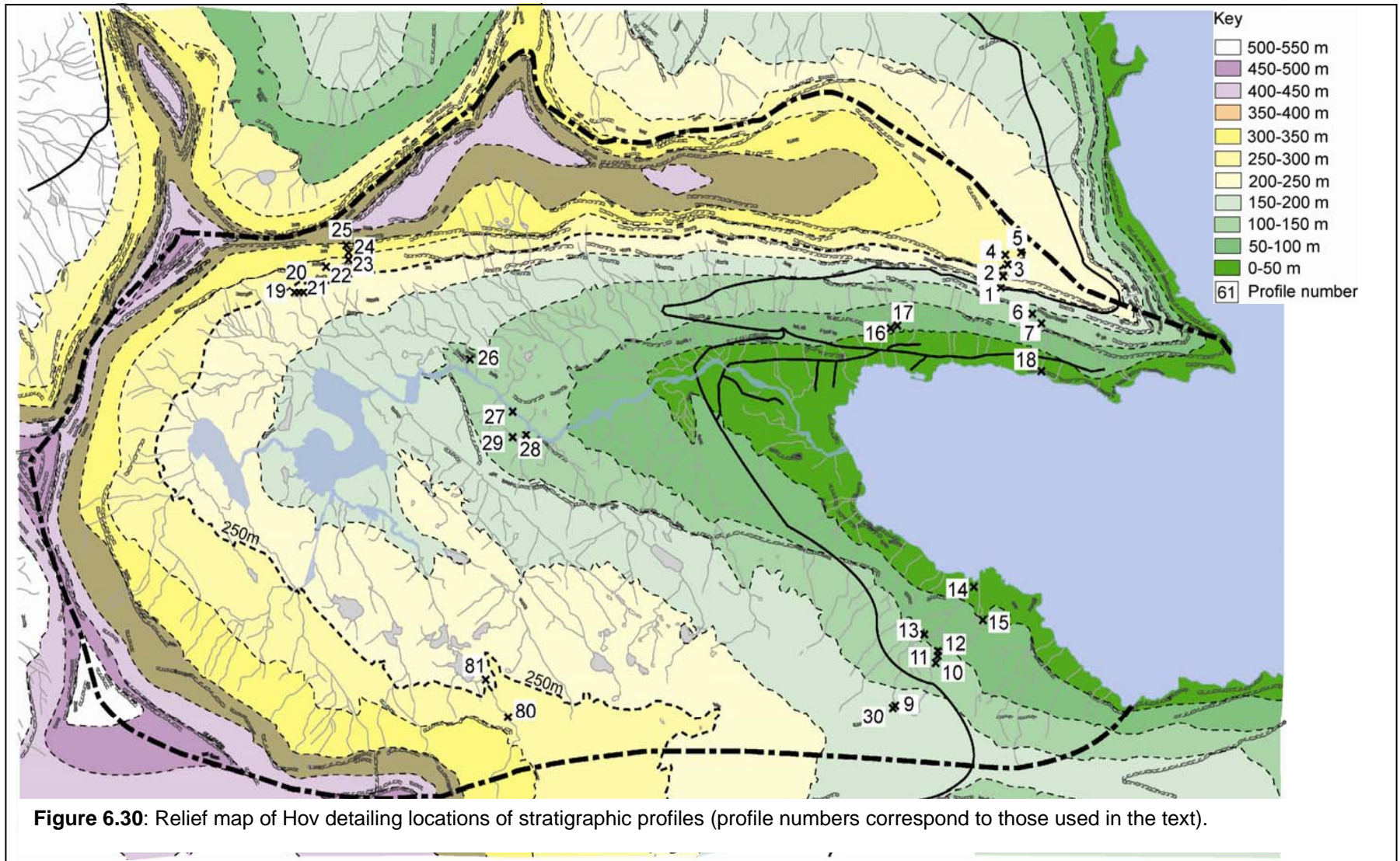
Fowling, especially for guillemots, and rounding up the sheep, also required several people to work together. On big farms there would be enough people on that farm to perform such tasks and as it was often the elderly people in a family who owned the farm, different generations of a family were required to work together (GB). Sons were often tied to working together on a farm as there was a law that prevented marriage unless you owned your own land. Smaller farms pooled labour with adjacent farms. There were few connections between neighbouring villages, unless the villages were small, with the principle connections being amongst the family and between neighbouring farms (JP).

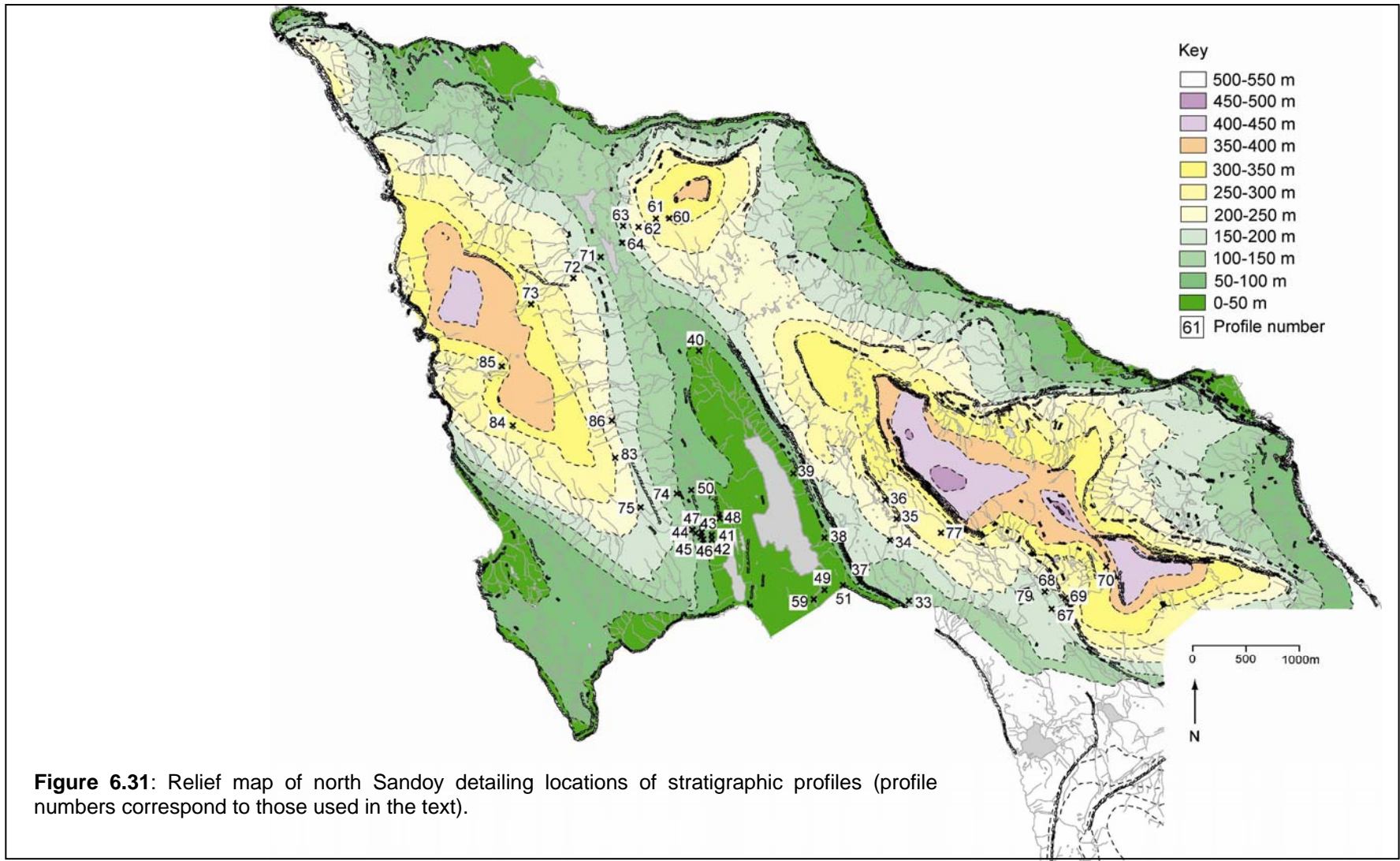
#### *The impact and significance of weather and climate*

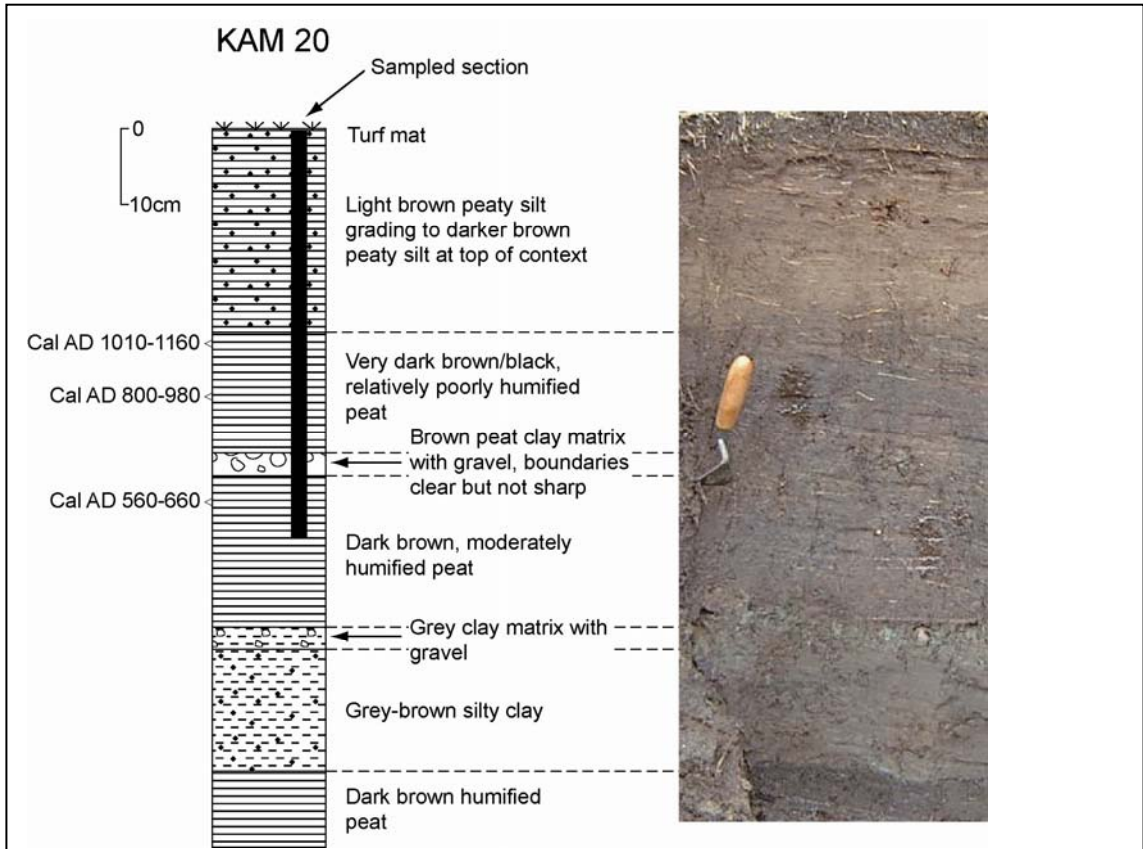
Weather determined the timing of the majority of farming activities (GB). Wet weather was consistently cited as being the most problematic type of weather for farming, particularly wet conditions during lambing (JP). Snow, however, is an issue only on occasions when it lies for several weeks, although today there are fewer winters with heavy snow (JP). On Sandoy they had a system using shelters where the sheep could go and take shelter when it was snowing heavily. JP related farmers’ stories about the length of time sheep can remain for under a cover of snow; by keeping close together and eating the wool from each other, sheep can survive for a week to ten days without being fed. It was proclaimed that the sheep can look after themselves providing they get shelter or can get into a *ból* and remain standing rather than sitting.

### **6.4. Presentation of temporal data**

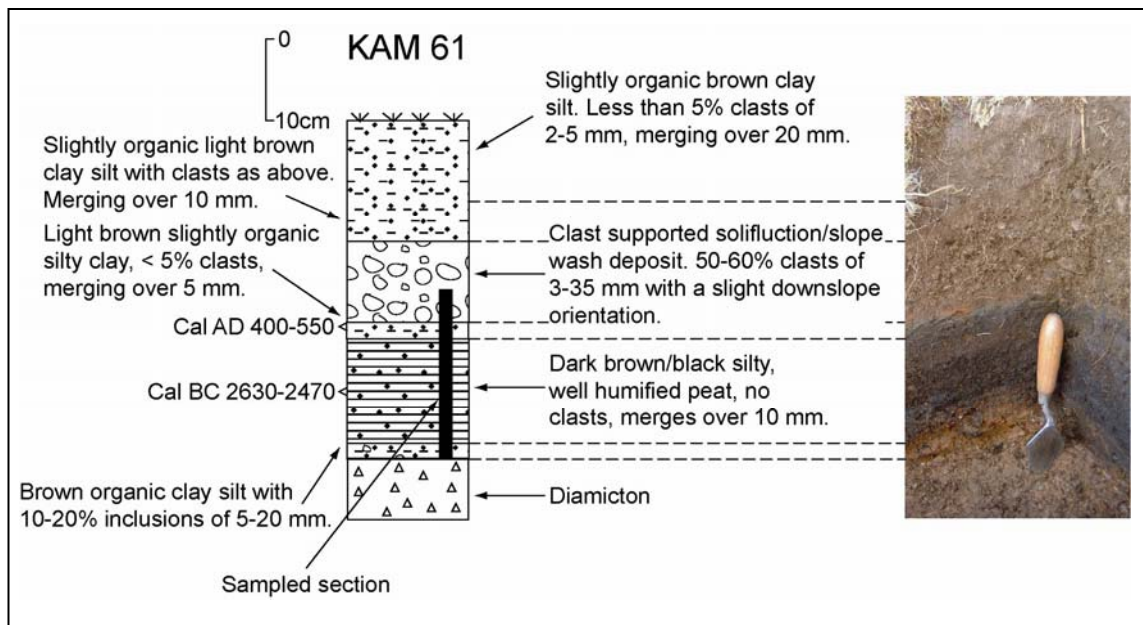
A total of 86 stratigraphic sections were recorded from the field sites of Hov and Sandoy, whose locations are illustrated by Figures 6.30 and 6.31 respectively. Details of the sediment stratigraphy of two profiles are presented below. KAM20 is characteristic of profiles from Hov on Suðuroy (Figure 6.32), and KAM61 is representative of the general sediment sequence in profiles from north Sandoy (Figure 6.33). To avoid repetition, data from additional profiles are presented as annotated stratigraphies in Figures 6.34a-g (Hov) and 6.35a-h (Sandoy), as opposed to being described in detail. A general summary of the southern Faroe Islands soil stratigraphy and detailed transect descriptions follows the detailed accounts.



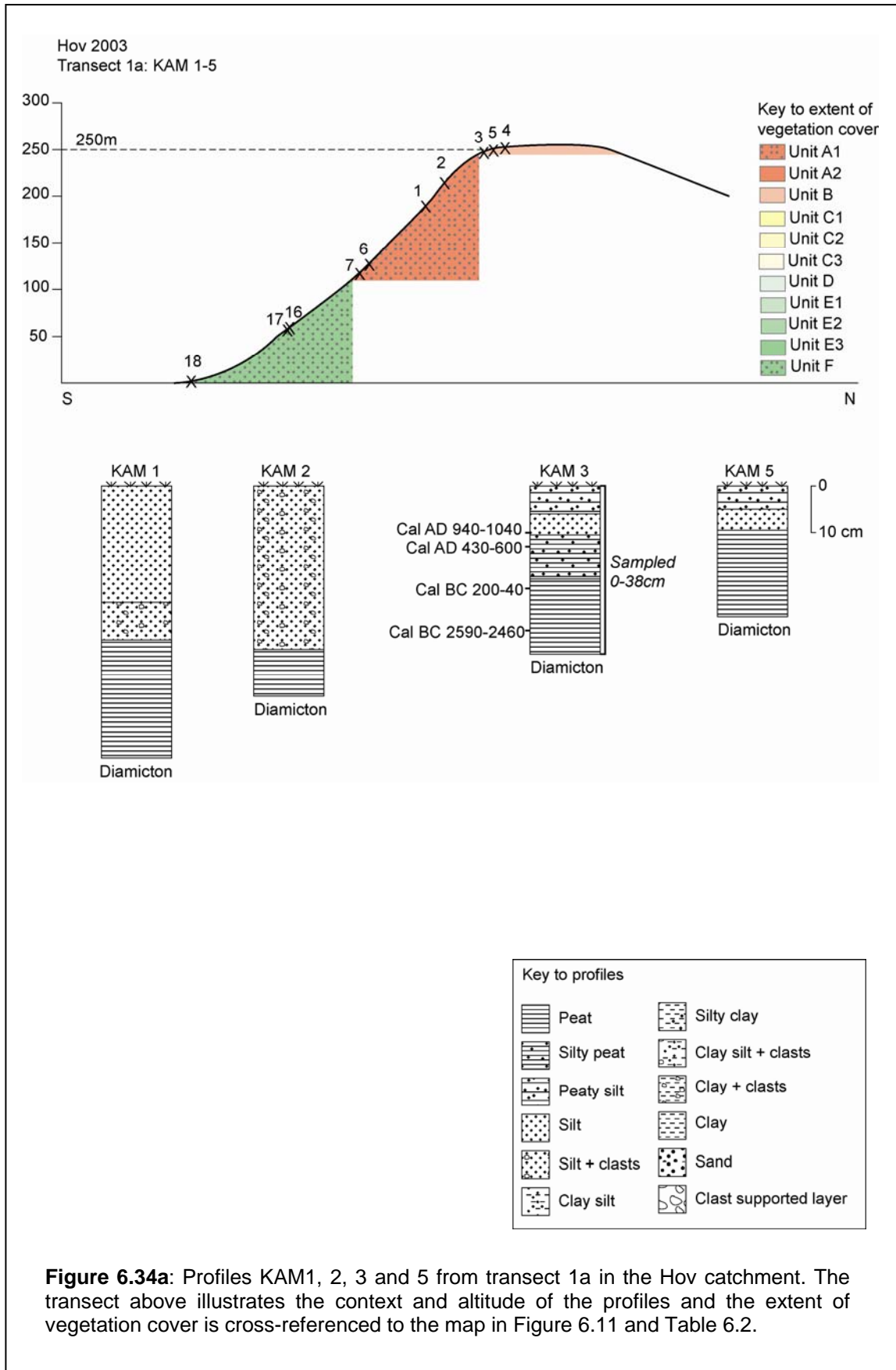


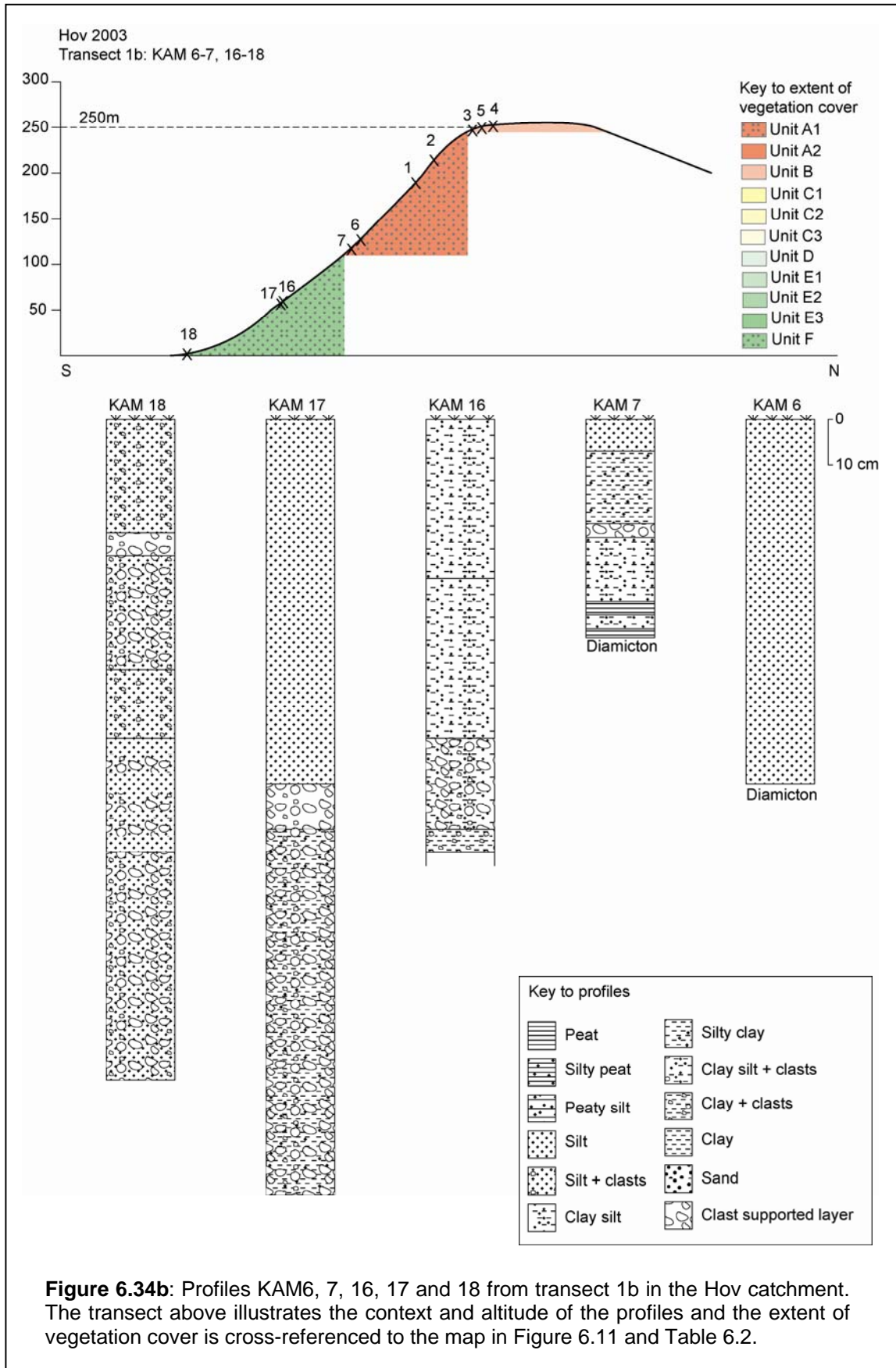


**Figure 6.32:** The detailed annotated stratigraphy of KAM20 is illustrated as an exemplar for stratigraphic profiles on Hov. See Figure 6.5a and Figure 6.5b for the geomorphic context of this profile.

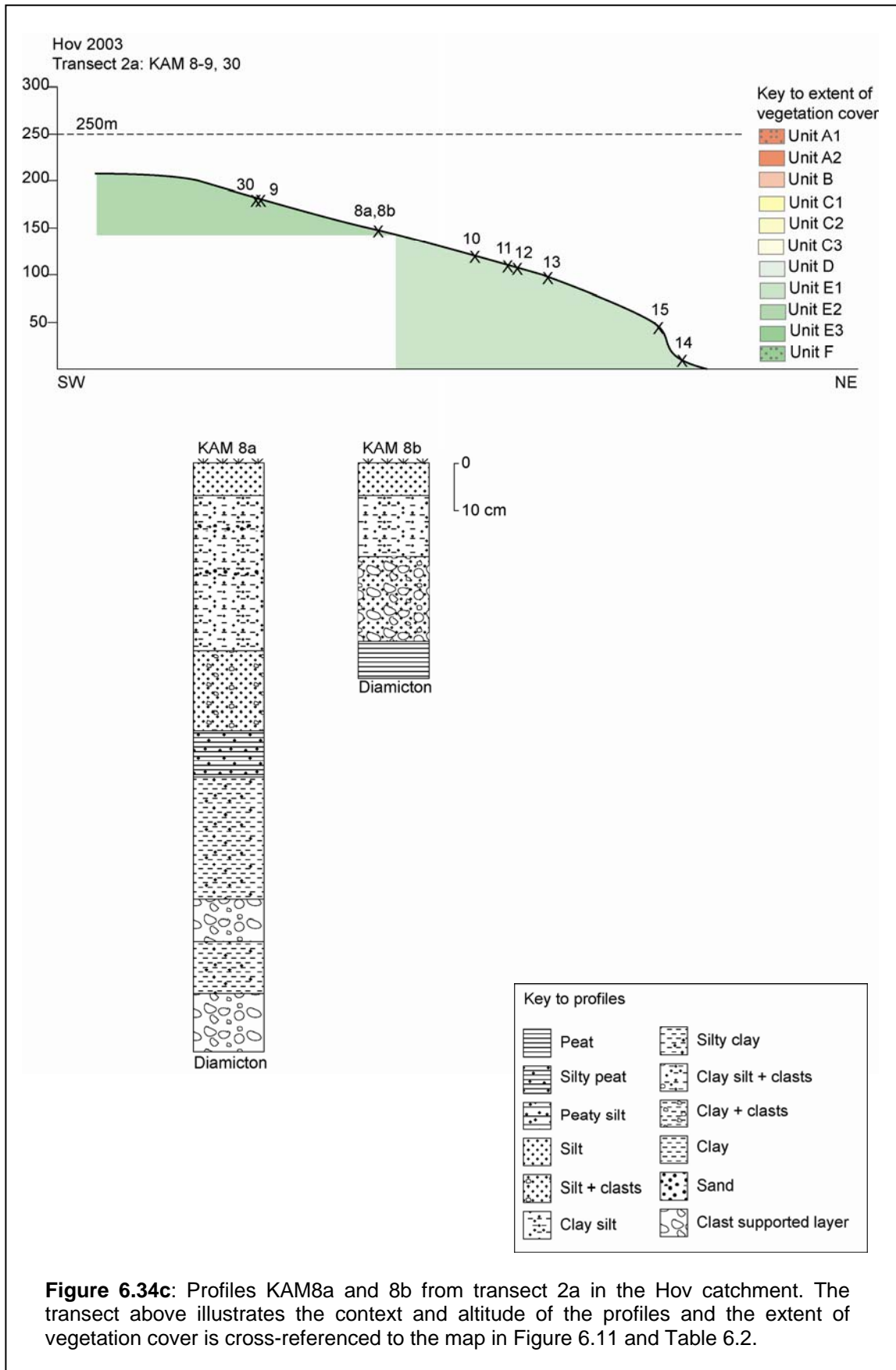


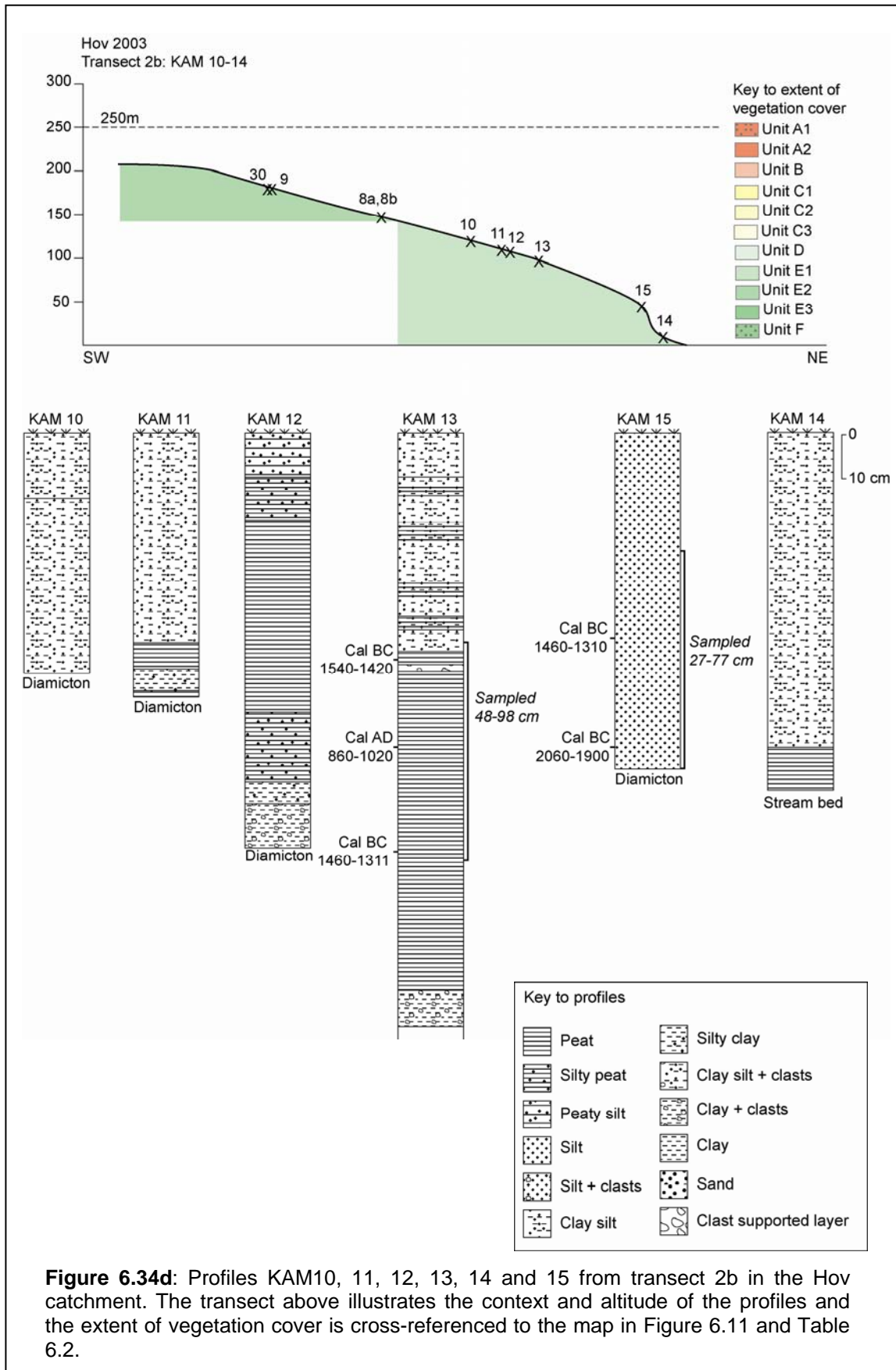
**Figure 6.33:** The detailed annotated stratigraphy of KAM61 is illustrated as an exemplar for stratigraphic profiles on Sandoy.

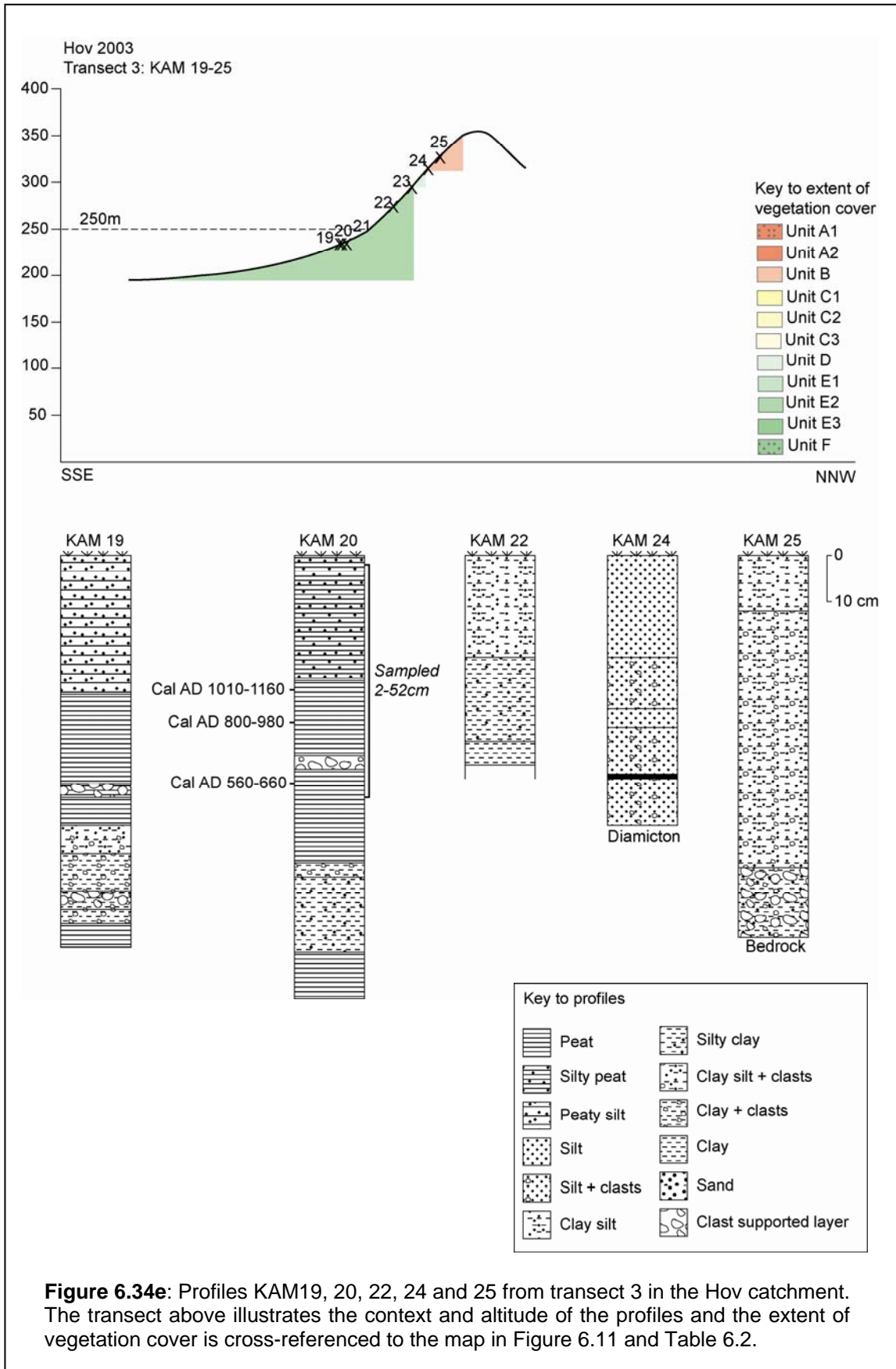


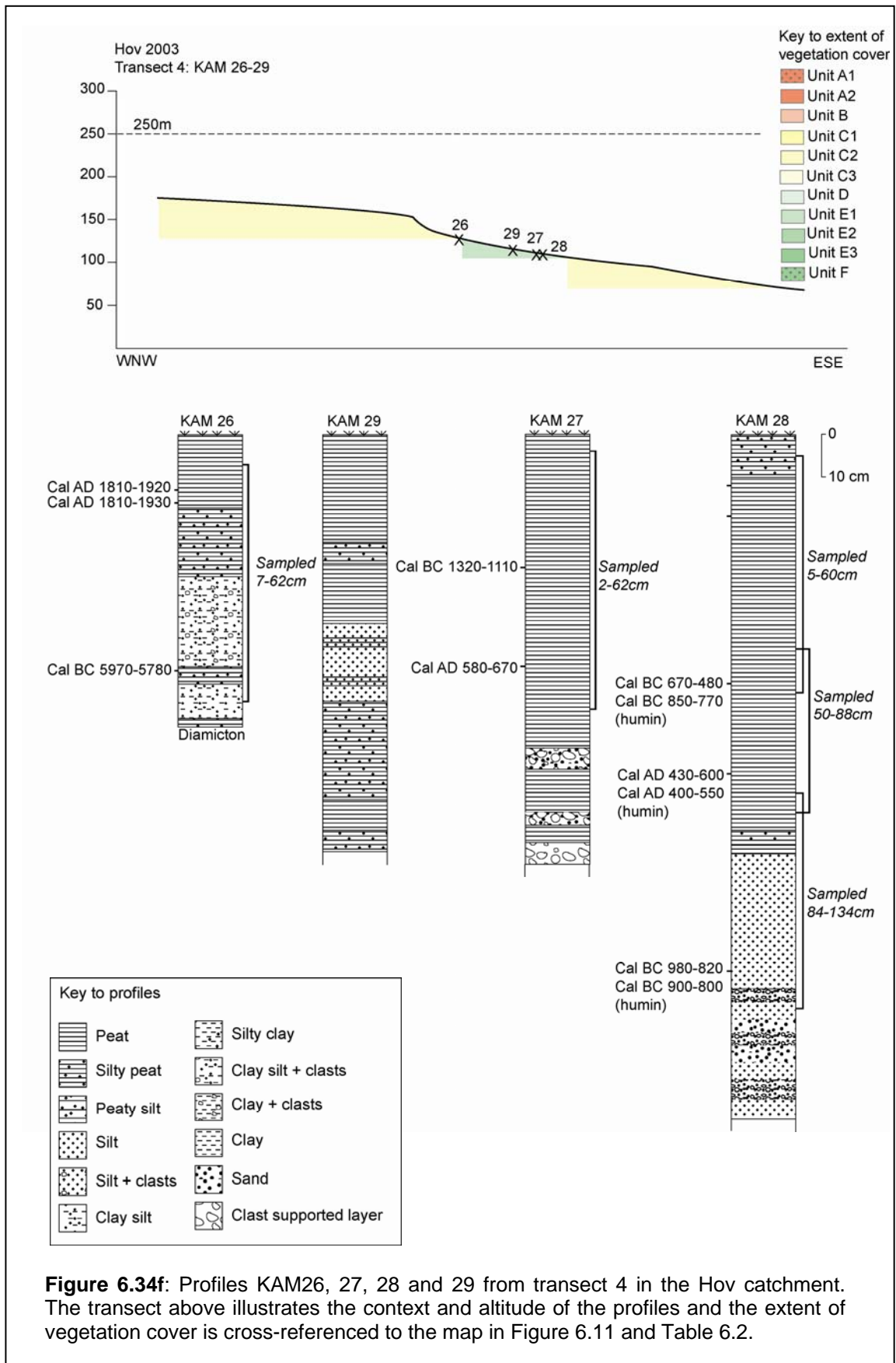


**Figure 6.34b:** Profiles KAM6, 7, 16, 17 and 18 from transect 1b in the Hov catchment. The transect above illustrates the context and altitude of the profiles and the extent of vegetation cover is cross-referenced to the map in Figure 6.11 and Table 6.2.

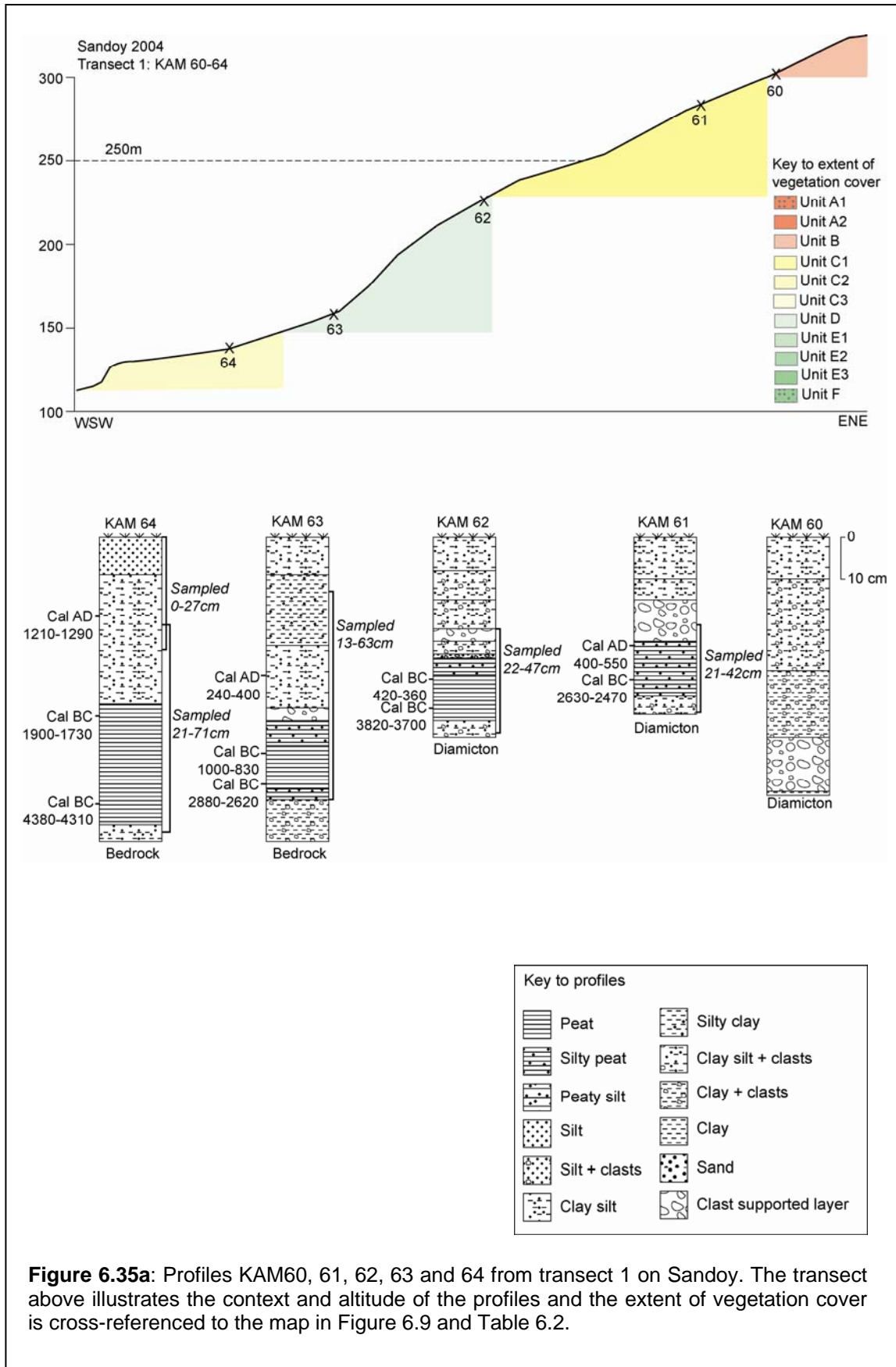




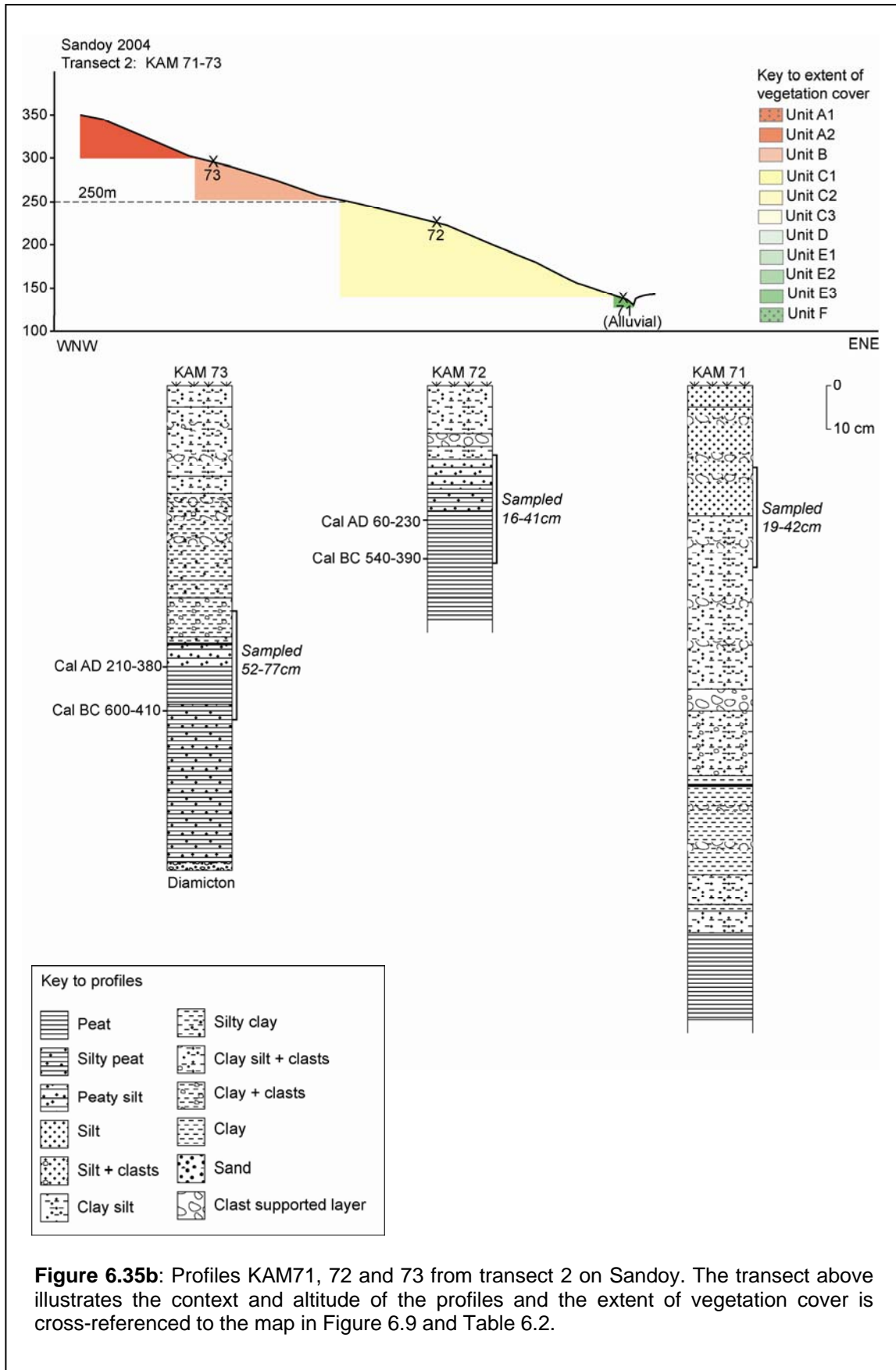


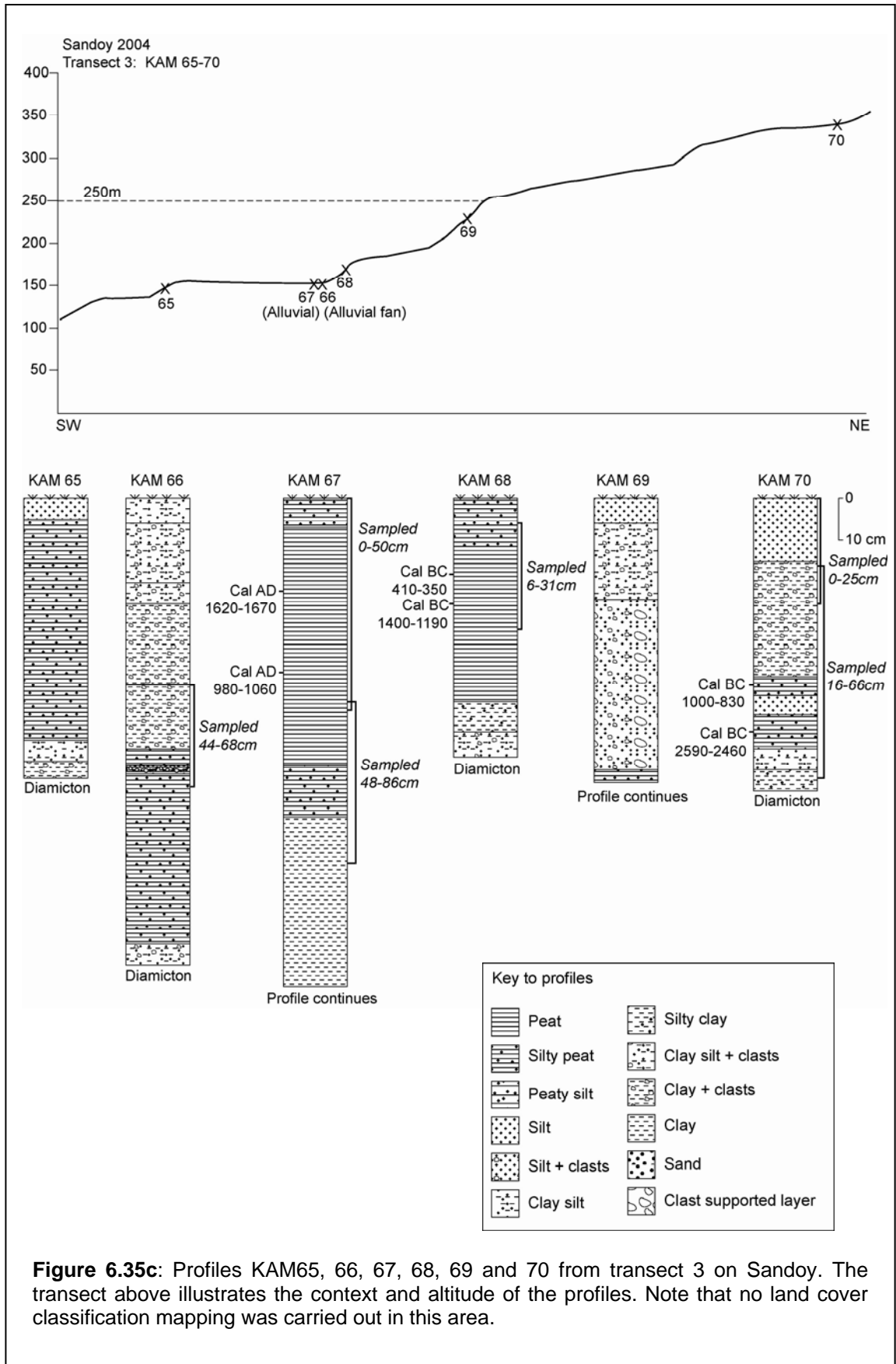


**Figure 6.34f:** Profiles KAM26, 27, 28 and 29 from transect 4 in the Hov catchment. The transect above illustrates the context and altitude of the profiles and the extent of vegetation cover is cross-referenced to the map in Figure 6.11 and Table 6.2.

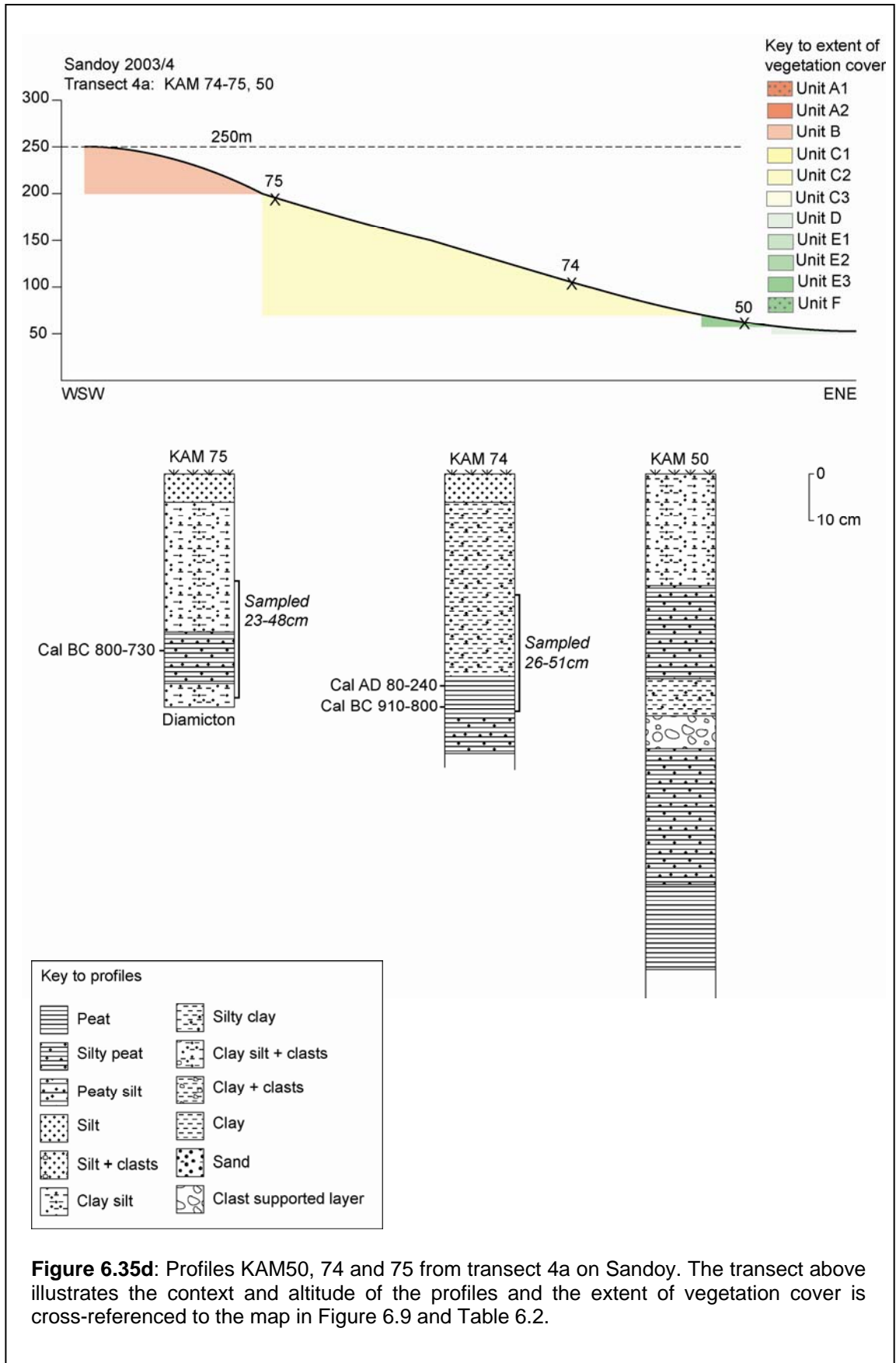


**Figure 6.35a:** Profiles KAM60, 61, 62, 63 and 64 from transect 1 on Sandoy. The transect above illustrates the context and altitude of the profiles and the extent of vegetation cover is cross-referenced to the map in Figure 6.9 and Table 6.2.

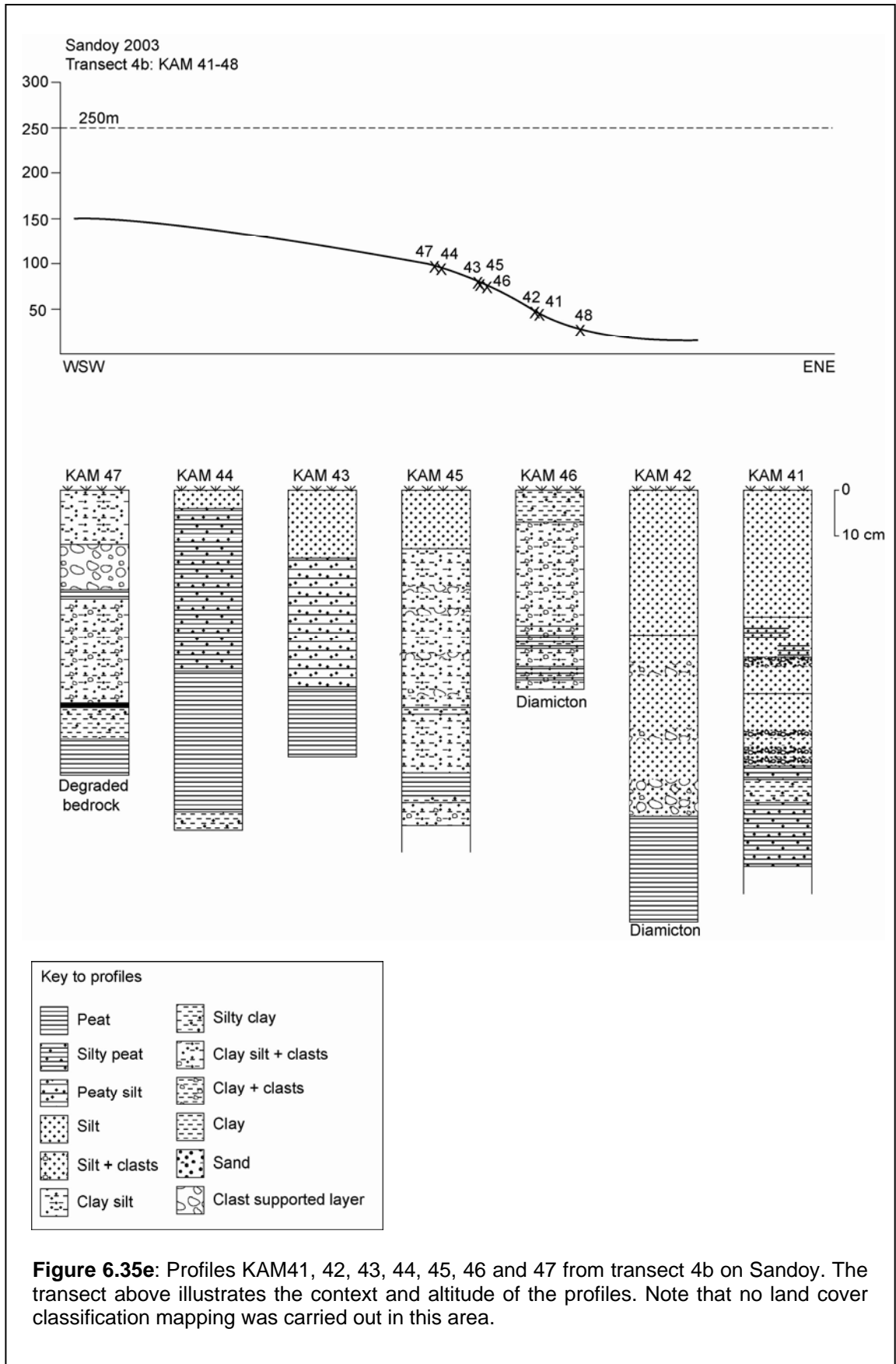


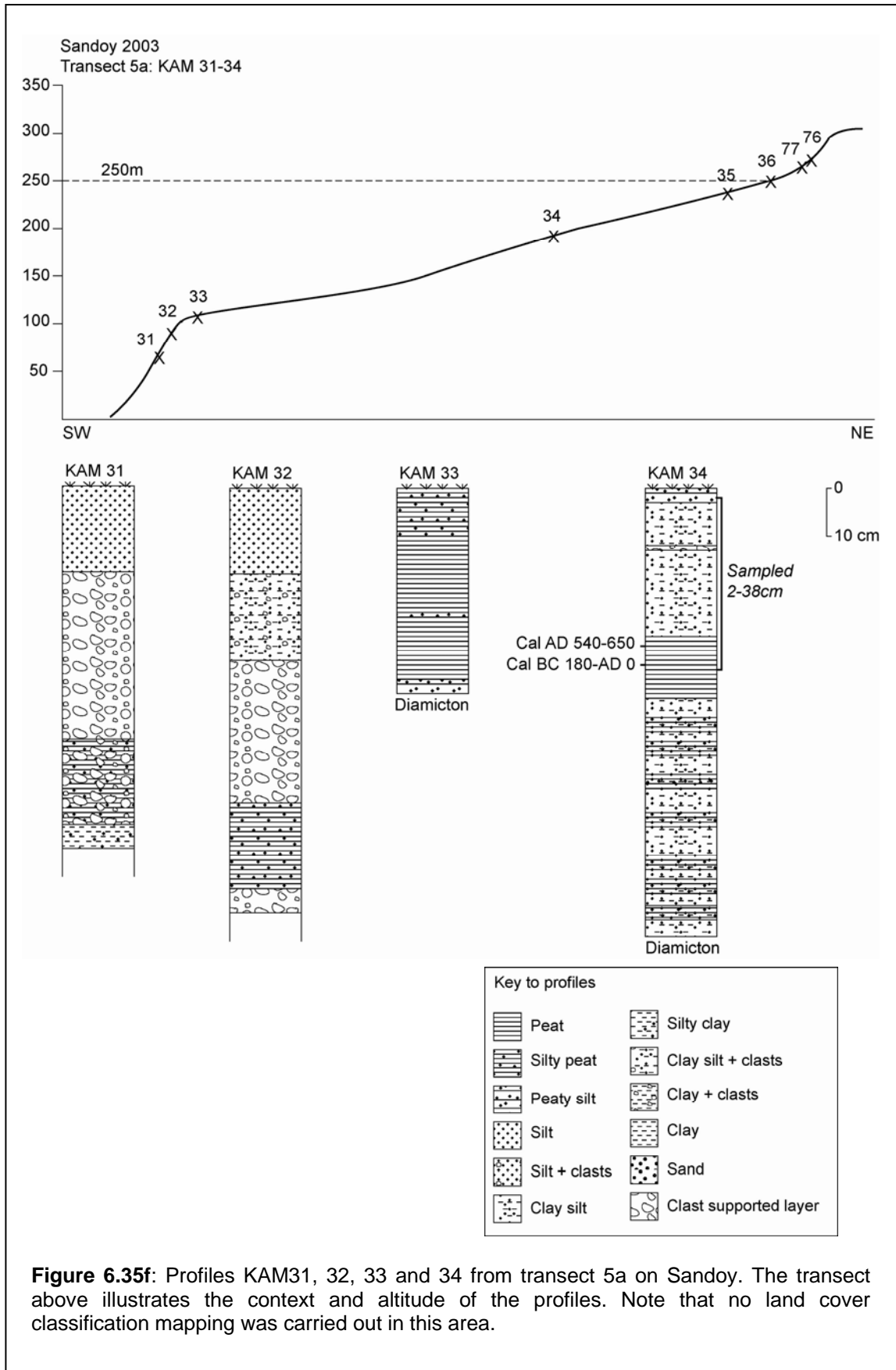


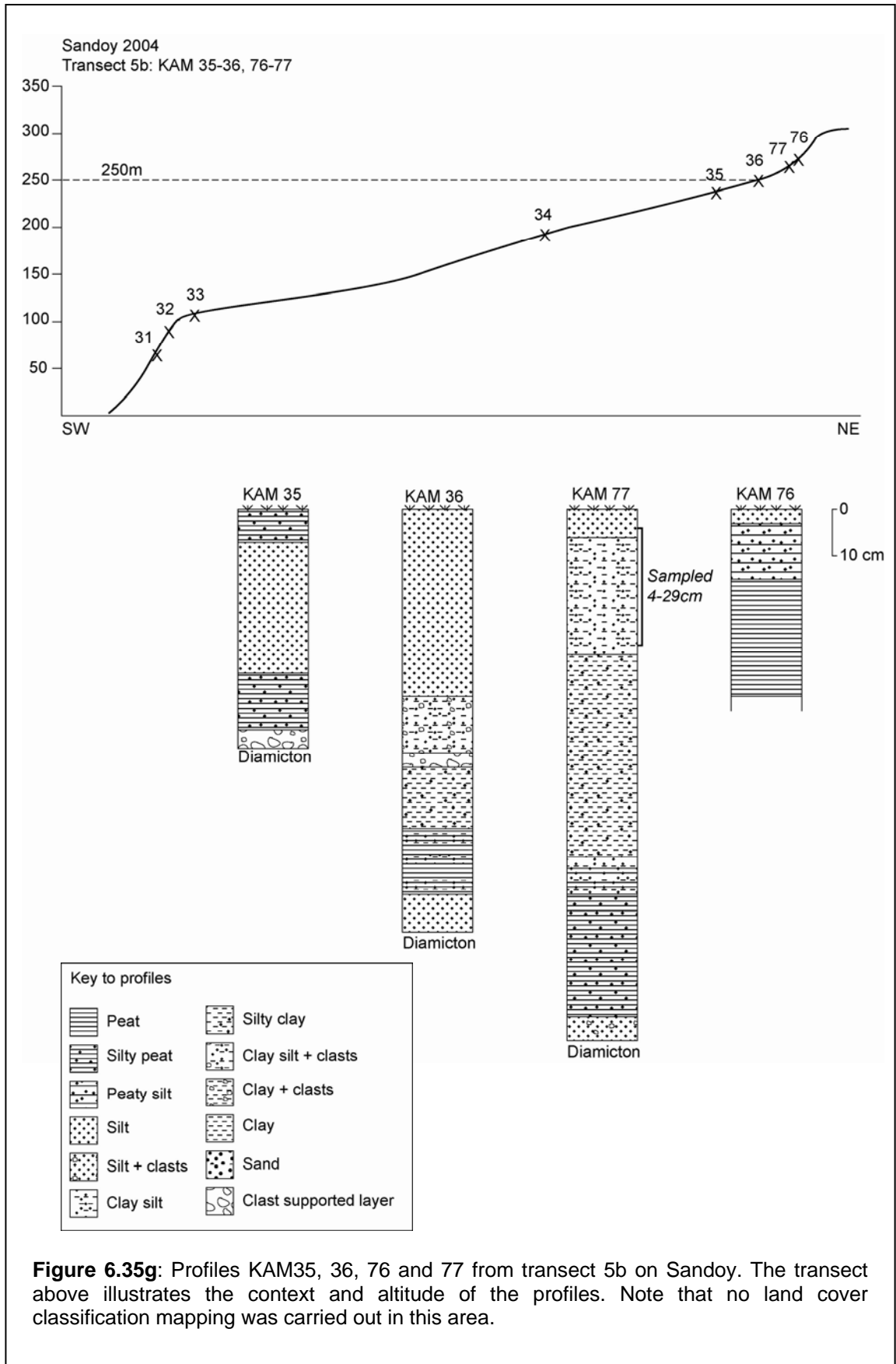
**Figure 6.35c:** Profiles KAM65, 66, 67, 68, 69 and 70 from transect 3 on Sandoy. The transect above illustrates the context and altitude of the profiles. Note that no land cover classification mapping was carried out in this area.

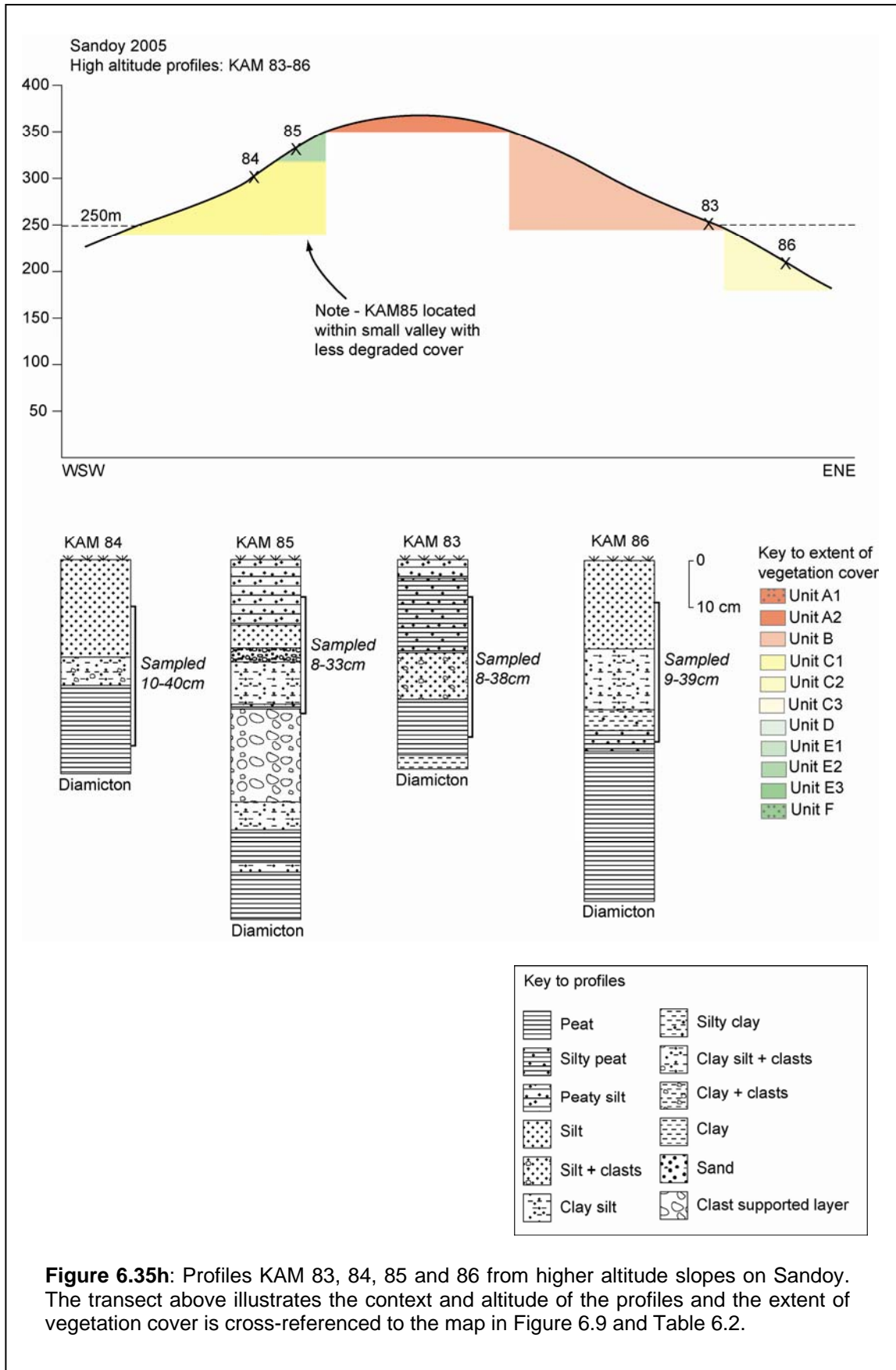


**Figure 6.35d:** Profiles KAM50, 74 and 75 from transect 4a on Sandoy. The transect above illustrates the context and altitude of the profiles and the extent of vegetation cover is cross-referenced to the map in Figure 6.9 and Table 6.2.









## Detailed descriptions of characteristic profiles

### *Detailed description of example profile from Hov (KAM20)*

KAM20 is one of three profiles (KAM19-21) recorded from an extensive natural exposure that cuts across a major debris fan on south facing slopes in Hovsdalur (Figure 6.5). The stratigraphy of KAM20 is representative of the fan surface as a whole, and records changes occurring on the slopes above (Figure 6.32). The basal unit of the profile is a diamict comprising glacial, fluvioglacial and paraglacial sediments overlying bedrock. The upper section of this unit sometimes exhibits a shallow weathering profile consistent with soil formation. Overlying the diamict is a dark brown-black humified peat. There is a relatively sharp contact between the peat surface and a layer of grey-brown clay that has been deposited overlying the peat, which is capped by a clast supported layer within a grey-brown silty clay matrix. A moderately humified, dark brown peat unit overlies the clay, but within the peat context an extensive gravel unit was deposited c.1390-1290 cal yr BP (560-660 AD). Towards the top of the peat unit, c.940-790 cal yr BP (1010-1160 AD), the peat becomes more silty and forms a discrete unit of brown peaty silt. This becomes more organic toward the top of the profile.

### *Detailed description of example profile from Sandoy (KAM 61)*

KAM61 (Figure 6.33) is one of 5 profiles recorded along an 800 m long hill slope transect in north Sandoy, between altitudes of 150-300 m (Figure 6.35a). KAM61 was recorded from a natural exposure at 280 m, close to the boundary between where limited soil remains (where the landscape surface is 70-90 % eroded) and where soil and vegetation become more significant (where the landscape surface is 40-60 % eroded). KAM61 is also located at a threshold of peat erosion as KAM60, located 15 m higher than KAM61, has been stripped of peat cover. The basal unit of the profile is a diamict comprising glacial, fluvioglacial and paraglacial sediments overlying bedrock, which towards the top of the unit becomes more organic and represents early-mid Holocene soil formation. The diamict is overlain by a well-humified, dark brown-black, slightly silty peat. Above this, the profile becomes more inorganic with the development of a limited unit of light brown, slightly organic, silty clay, with 5 % clasts within the unit. The contact between this unit and the peat below is distinct. Above this, a more considerable clast supported unit has been deposited by solifluction or slope wash and is composed of 50-60 % angular to sub-rounded clasts that have a slight down slope orientation. Dating of the profile indicates that deposition of this unit occurred c.1400-1550 cal yr BP (400-550 AD). The top unit is composed of light brown clay silt, which becomes more organic towards the top of the profile.

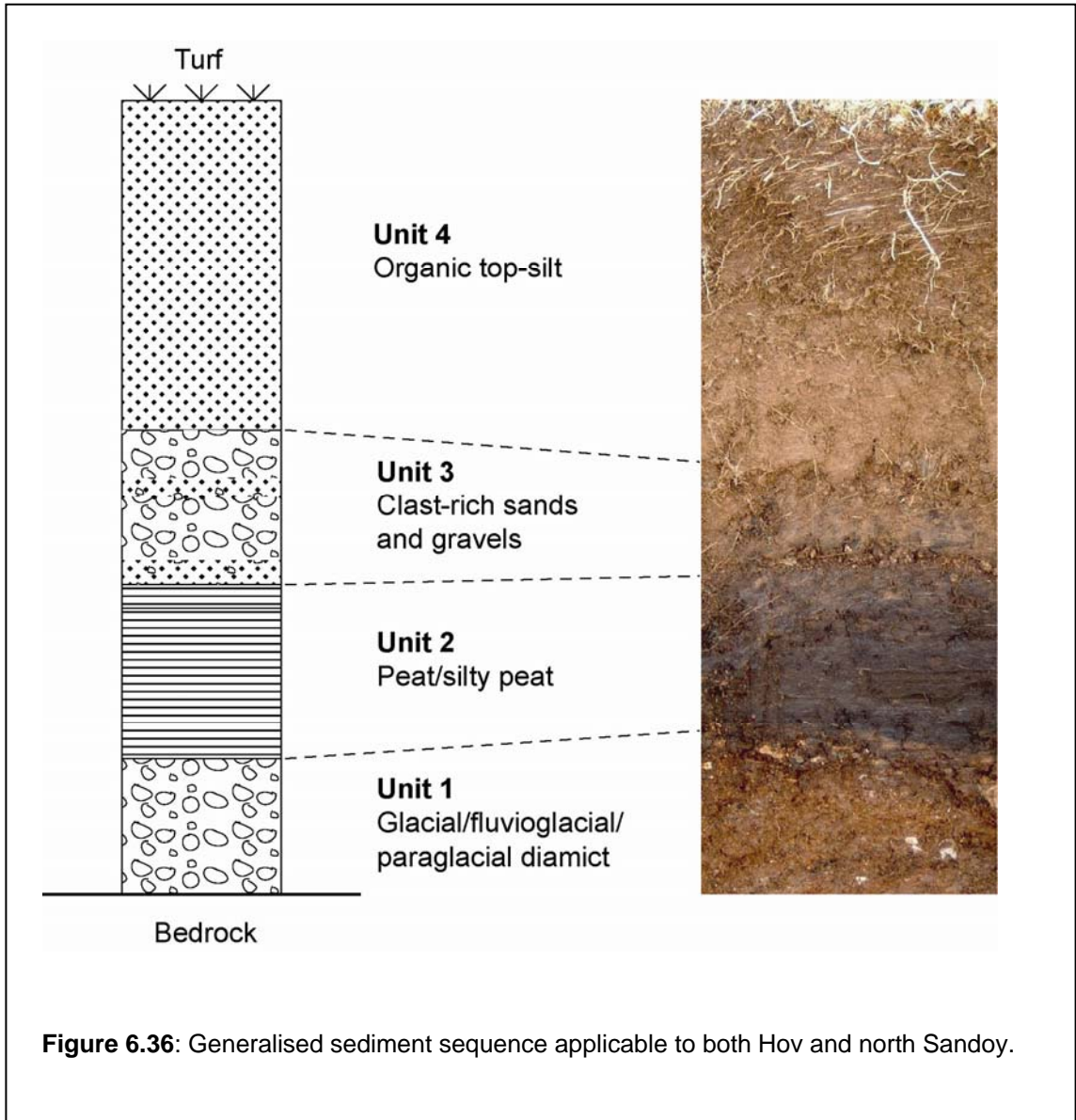
After analysis and description of the soil profiles in the field, sampled stratigraphic profiles were re-recorded under laboratory conditions and sampled for percentage dry bulk density values and percentage weight loss-on-ignition (LOI) analysis, which was used to estimate the organic content of the sediments and assist in identifying sediments for radiocarbon dating analysis. A dating protocol was set-up prior to going into the field in order to target periods of instability in the landscape that would test various hypotheses (see hypothesis 1 in Table 1.1). For the aforementioned profiles, three dating horizons were proposed for KAM20 to constrain the onset of the extensive gravel unit and to date the initialisation of top silt. For profile KAM61, two dating horizons were proposed which targeted one date on the high altitude peat and the second on the onset of the gravel unit above.

### **Summary description of Holocene sediment sequences in Hov and Sandoy**

Although the composition of sediment profiles varies according to local geomorphological and topographic conditions, the majority of recorded profiles from natural exposures at both Hov and Sandoy exhibit a similar sediment sequence. A generalised sequence is presented below (Figure 6.36), while an interpretation of the sequence based on the stratigraphic units, LOI data and targeted radiocarbon dates is given in chapter 7.

In general, the stratigraphic profiles illustrate four principle regional lithostratigraphic units that are ubiquitous across Sandoy and Suđuroy and indicative of a regional geomorphic trajectory. While in a few profiles a sequence forms on bedrock, the majority exhibit a basal glacial diamict unit (Unit 1) with a shallow weathering profile comprising the upper part of this unit at many profiles. An extensive unit overlying the diamict (Unit 2) is characterised by a high organic content and comprises peat or silty peats that are absent only from heavily eroded and high altitude areas above c.300 m. This organic-rich unit is overlain by a third unit, distinguished by gravels or coarse sands that are locally inconsistent in composition and thickness and are associated with destabilisation of the surface landscape. In some profiles this forms a distinct unit, and at others forms a series of laminations interspersed with finer organic silts. Lying directly over the older units, the fourth and youngest unit is an extensive, predominantly silt-rich layer, often becoming increasingly organic towards the top of the unit and which varies in thickness between profiles.

This generalised pattern characterises the majority of the recorded sediment stratigraphies, although not all profiles contain every context as described above, either because the unit did not form or because it has eroded away since formation. The stratigraphy of alluvial profiles also diverges from that described above because of their different processes of formation. The timing of development from one unit to another also differs between locations,



**Figure 6.36:** Generalised sediment sequence applicable to both Hov and north Sandoy.

which may be a result of landscape changes impacting more sensitive or unstable areas earlier.

### **Summary description of targeted transects in Hov and Sandoy**

Specific profiles were recorded along slope transects, enabling units to be traced up and down slope, and to allow comparison between the form and timing of changes at different altitudes and across altitudinal thresholds. Transects in a similar location, but with a different slope aspect or slope angle can also be compared, and again, differences in the form and timing of changes can be examined. Three transects from Suðuroy and three transects from Sandoy were described and along with other profiles are presented in Figures 6.34a-g and 6.35a-h respectively. In order that individual profiles may be understood in a wider geomorphological context, concise transect descriptions are recorded below.

*Hov: Transect 1a and 1b (KAM 1-7, 16-18)*

*Figures 6.34a and 6.34b*

Transect 1 is located on south facing slopes above Hovsfjørður and Hov *byggd* and covers a wide spectrum of morphological and vegetational detail, including semi-vegetated plateaux, relatively steep but well-vegetated slopes between *hamar*, and the cultivated Hov infields, which also encompass the distinctive box gully features previously described. Recorded profiles along the transect ranged in altitude from 4 m to 252 m. At c.250 m, profiles KAM3-5 provide an opportunity to constrain change around this altitudinal threshold and also mark a boundary between a partially eroded plateau above, and *hamar* interspersed with well-vegetated slopes below. Profiles KAM16-18 record deposition on lower altitude slopes where deep sediment has accumulated to give comparatively long sedimentary profiles composed predominantly of gravels, sands and silts. KAM16 and KAM17 specifically record the formation process of the Hov box gullies.

*Hov: Transect 2a and 2b (KAM 8-9 and 30,10-15)*

*Figures 6.34c and 6.34d*

Transect 2 is located on the north facing slopes above Hovsfjørður, directly opposite the village of Hov on a more gentle slope, and at a lower altitude (c.10 m to 172 m) compared with Transect 1. The area across which the transect is located exhibits widespread evidence of anthropogenic impact (Zone 1 in Figure 6.26) and specific profiles along the transect directly record some of these impacts. For example, KAM9 and KAM30 are recorded from an exposure of a relic drainage ditch, which cross-cuts the slope and the base of which has been dated to  $1120 \pm 35$  yr BP (858-996 AD) (GU-11661). KAM13 was recorded from an

exposed cross-section of a *krógv*, a simple structure used for drying and storing peat, and the profile records a deep 70 cm unit of (re-deposited) peat. KAM15 is recorded from an alluvial context on a small tributary stream from which a juniper log was discovered lodged into the bank. Although the log was dated to 510-420 cal yr BP (1440-1530 AD), the context in which the juniper was lodged was considerably older, dating to 3850-4010 cal yr BP (2060-1900 BC), establishing that the log was not preserved *in situ* and has been transported down slope.

*Hov: Transect 3 (KAM 19-25)*

*Figure 6.34e*

Transect 3 is located in Hovsdalur, inland and to the west of Hov village. The transect 3 profiles record changes at higher altitudes than those of Transects 1 and 2 (between c.236 m and 320 m). KAM22-25 trace an altitudinal transect down a south east facing cirque headwall and represent localised landscape changes, particularly incidents of slope wash, which have been continuous throughout the profiles. The slopes stabilise towards the surface of the profile, as attested by the presence of the ubiquitous top silt unit. KAM19-21 are located at 236 m and record an extensive exposure cutting across most of a major fan. These profiles provide an effective cross-sectional view of the feature and a stratigraphy documenting fan development.

*Sandoy: Transect 1 (KAM 60-64)*

*Figure 6.35a*

Five profiles were recorded (four of which were dated) from the west facing slopes of Knúker in north east Sandoy, at altitudes ranging from c.146 m to 305 m. Together, this series of profiles constrains the 250 m geomorphic threshold (Humlum and Christiansen 1998a; 1998b). This transect also crosses the threshold of peat erosion in this area; while a 13cm peat deposit was recorded from KAM61 at 280 m, peat was absent from KAM60 at 305 m. The four characteristic sediment units were identified in KAM61-64 illustrating that there were no specific localised peculiarities in these profiles and allowing the sediment units to be traced down slope. The thickest surviving peat is preserved in the profiles at lower altitudes, and although the influx of gravel begins at KAM61 around 390-550 AD (at 280 m), it is not present in KAM62 (at 225 m) until later in the 7<sup>th</sup> century. All profiles in the transect are capped by a silt or clay silt unit.

*Sandoy: Transect 2 (KAM 71-73)*

*Figure 6.25b*

Transect 2 is located on slopes directly opposite that of transect 1 and records three profiles (two of which were dated) on the contrasting east facing slopes of Eiriksfjall, which in surface character are more eroded, although at lower altitudes than the west facing Knúker slopes. KAM72 and 73 straddle the 250 m threshold (at 310 m and 225 m respectively), and the stratigraphy of both profiles compares with the generalised characterisation above. KAM71 was recorded from an active alluvial fan at the base of the slope and exhibits a more complex stratigraphy. Slope disturbance is dated at KAM72-73 slightly earlier than on the west facing slopes, which may be a result of the higher altitude of the profiles or because the east facing slopes are more sensitive to landscape changes. Gravel is also more abundant in the sedimentary units in the east facing slope profiles and the surface of the slope is also characterised by loose talus (refer to Figure 6.12). The profiles have stabilised recently as few clasts are visible in the uppermost silt unit.

*Sandoy: Transect 3 (KAM 65-70)*

*Figure 6.35c*

Six profiles were recorded from transect 3 (four of which were dated) and comprise both slope exposures and alluvial profiles. In addition, profile KAM66 dates an inactive alluvial fan. The six profiles cover an altitudinal range between c.162 m and 350 m. The highest altitude profile at 350 m (KAM70) mirrors the generalised profile model, and mid-Holocene peat formation overlies the diamicton and weathering sediments despite the high altitude. After around 2800 yrs BP, a clay and gravel matrix dominates the profile, corresponding to the destabilisation layer in the generalised model. The profile is capped by the silty top soil typical of profiles in the southern Faroes. Destabilisation is therefore dominant at this profile in the late Holocene.

KAM68 is a shallow profile recorded on a relatively steep slope of 24°. Despite the slope angle, a peat horizon exists, formed in the early-mid Holocene and overlying diamicton. Significant clast layers are absent but a change is recorded by the influx of more aeolian material estimated to between the late 4<sup>th</sup> and mid 6<sup>th</sup> century AD.

*Sandoy: High altitude profiles (KAM 83-86)*

*Figure 6.35h*

Profiles KAM83-86 were targeted to represent landscape change in higher altitude areas located above 250 m. Profiles were sampled from both west and east facing slopes of Vørðan in order to constrain the onset of landscape change at this altitudinal threshold. The sediment stratigraphy of the above profiles conforms to the model profile of diamicton or bedrock overlain by peat, probably having formed in the mid-late Holocene, followed by an

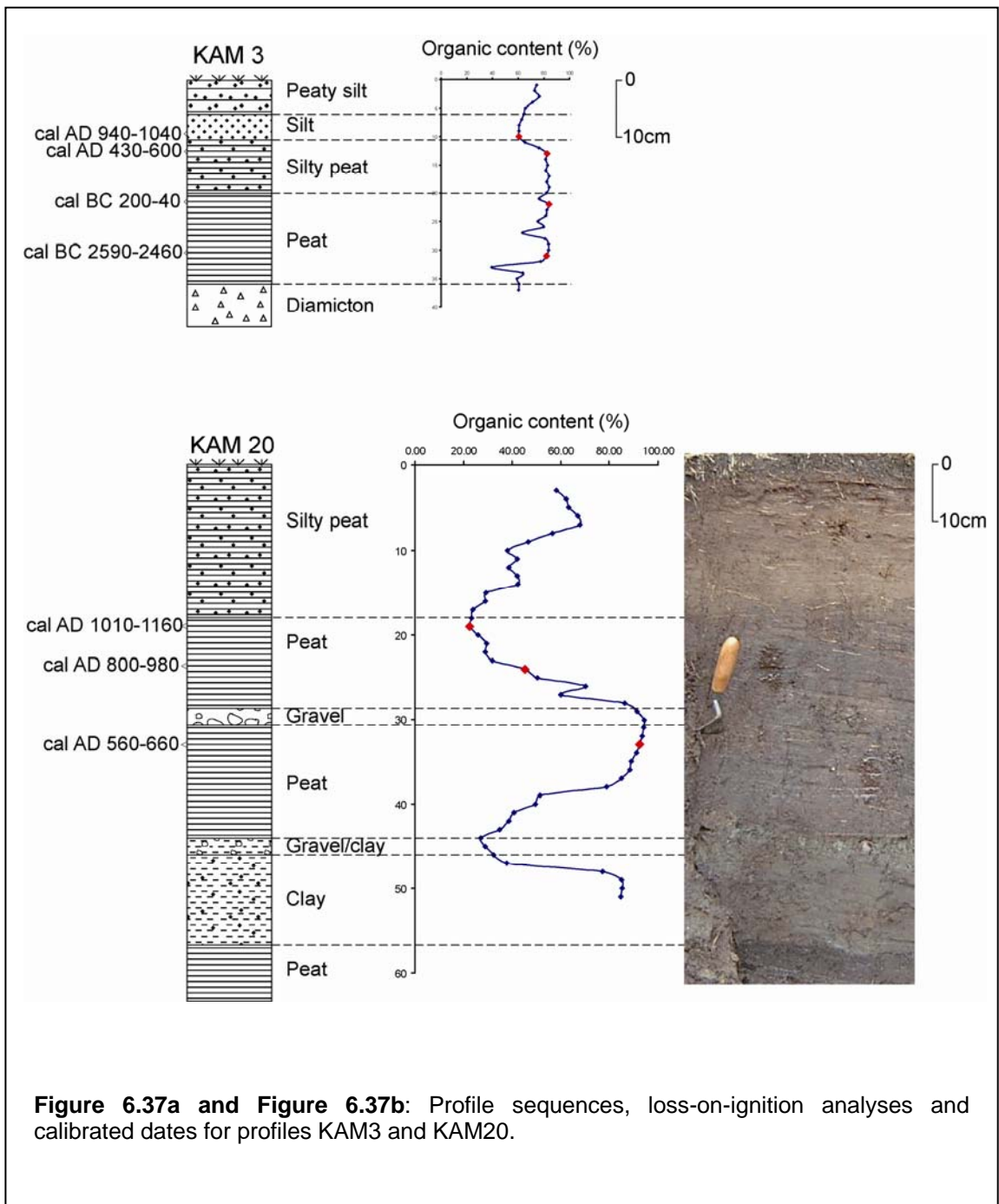
influx of clast or clay dominated sediments, with the final unit composed of a silty top soil. The profiles were sampled for dating to constrain the clast rich layer, but dating was not carried out due to timing constraints.

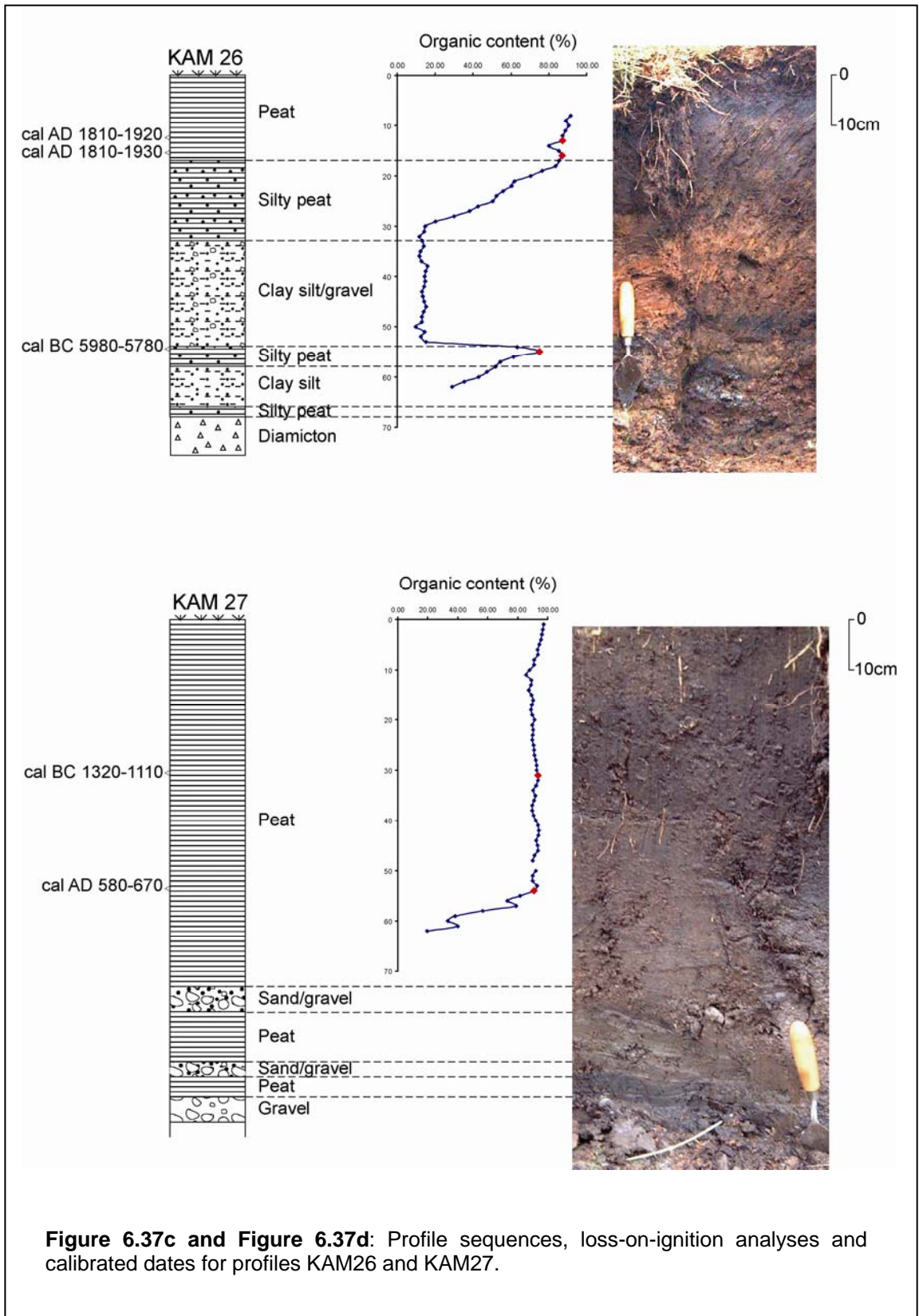
### **Loss-on-ignition and radiocarbon dating**

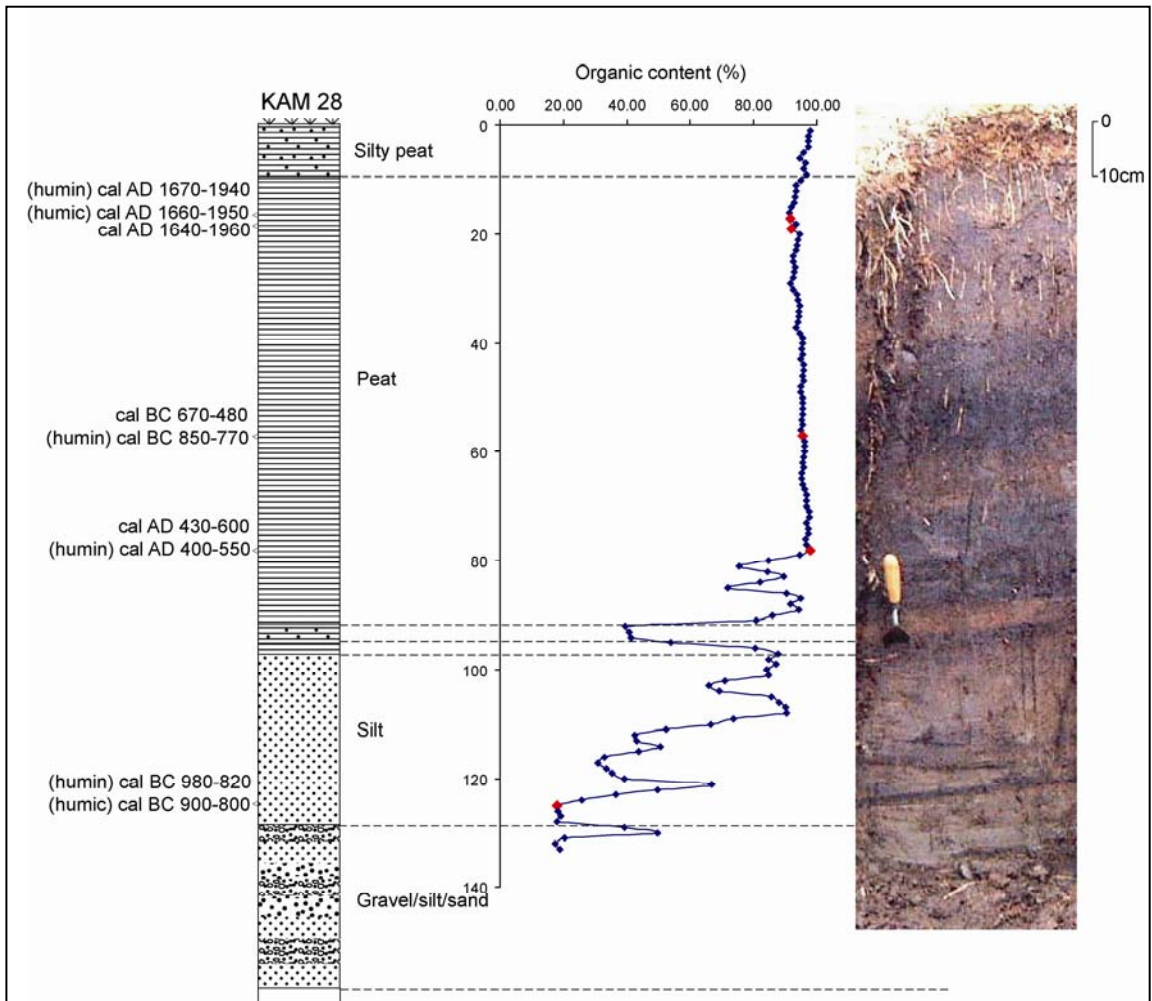
Seventeen profiles were sampled for loss-on-ignition (LOI) analyses and radiocarbon dating. Profile chronology was based on a series of accelerator mass spectrometry (AMS)  $^{14}\text{C}$  measurements on the humic (and in KAM28 the humin) acid fraction of small ( $1\text{ cm}^3$ ) samples. AMS samples were processed and measured at the SUERC Radiocarbon Laboratory in East Kilbride and calibration of  $^{14}\text{C}$  estimates was performed using Calib 5.0.2 (Stuiver *et al* 2005). The LOI profiles illustrate the percentage of organic content in each  $1\text{ cm}^3$  sample and give a more precise indication of changes in organic content in an individual profile than the stratigraphic descriptions. The LOI profiles are grouped into transects with each profile illustrated alongside the stratigraphic sequences recorded in the field. Stratigraphies, LOI data and calibrated dates for profiles from Hov are illustrated by Figures 6.37a-f and those from Sandoy are illustrated by Figures 6.38a-l. A comprehensive table detailing all calibrated and uncalibrated (BP and BC/AD) dates and errors from the study are presented in Tables 6.7 (Hov) and 6.8 (Sandoy).

### **Review of original Icelandic data**

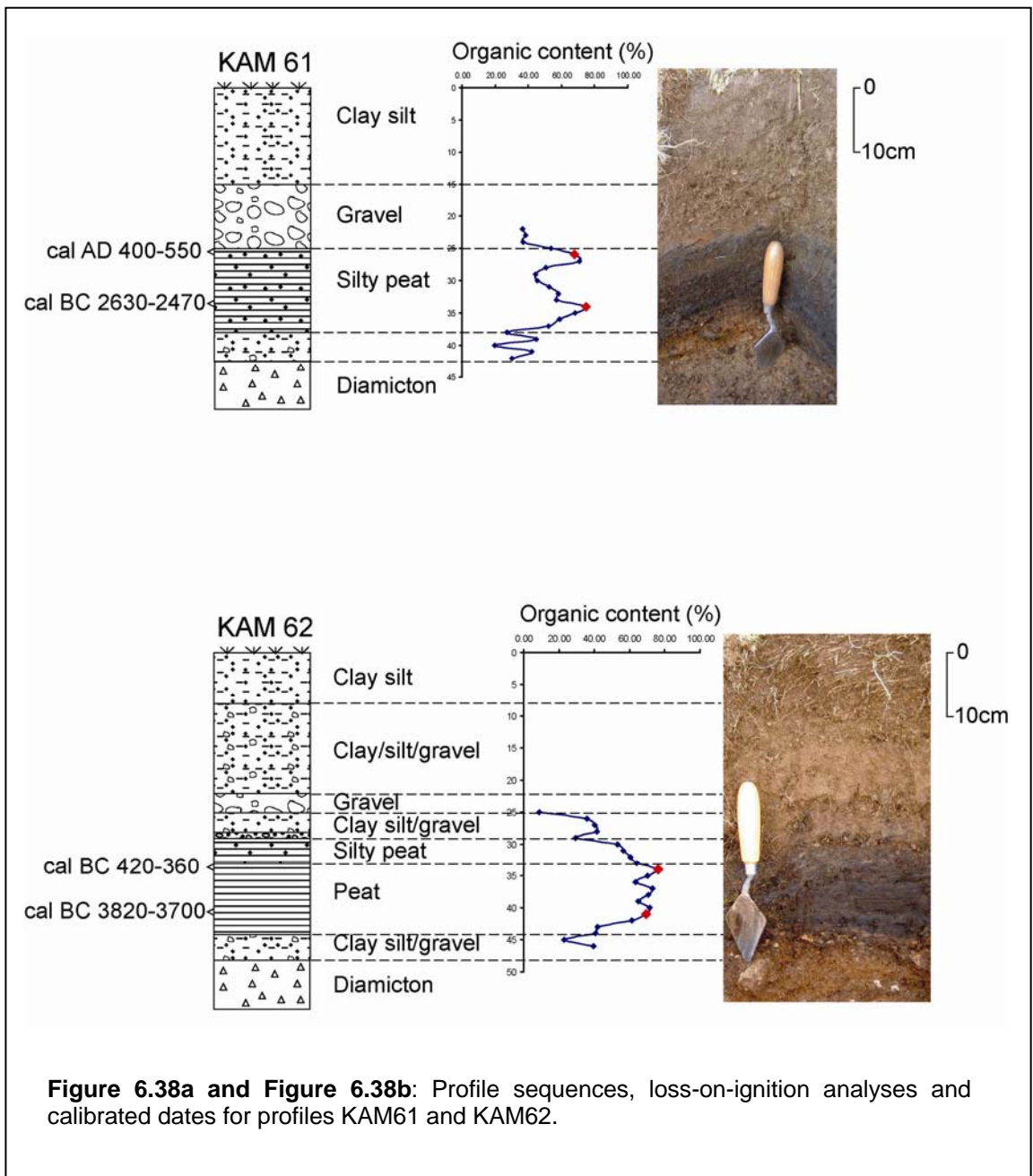
Original sediment accumulation rate (SAR) data was also collected from Iceland and is used to discuss comparisons of landscape history and degradation between the Faroes and Iceland in chapter 8. The discussion and interpretations are based on a total of 135 sediment profiles within the Eyjafjallahreppur and Mýrdalshreppur regions, 61 of which were recorded over the period of an MSc thesis and 37 which were recorded over the course of the PhD thesis research. The profiles incorporate over 1100 tephras and over 700 dated tephras over 8 landholdings in Eyjafjallahreppur and 2 landholdings in Mýrdalshreppur. A summary of the SAR data is presented in Appendix D.

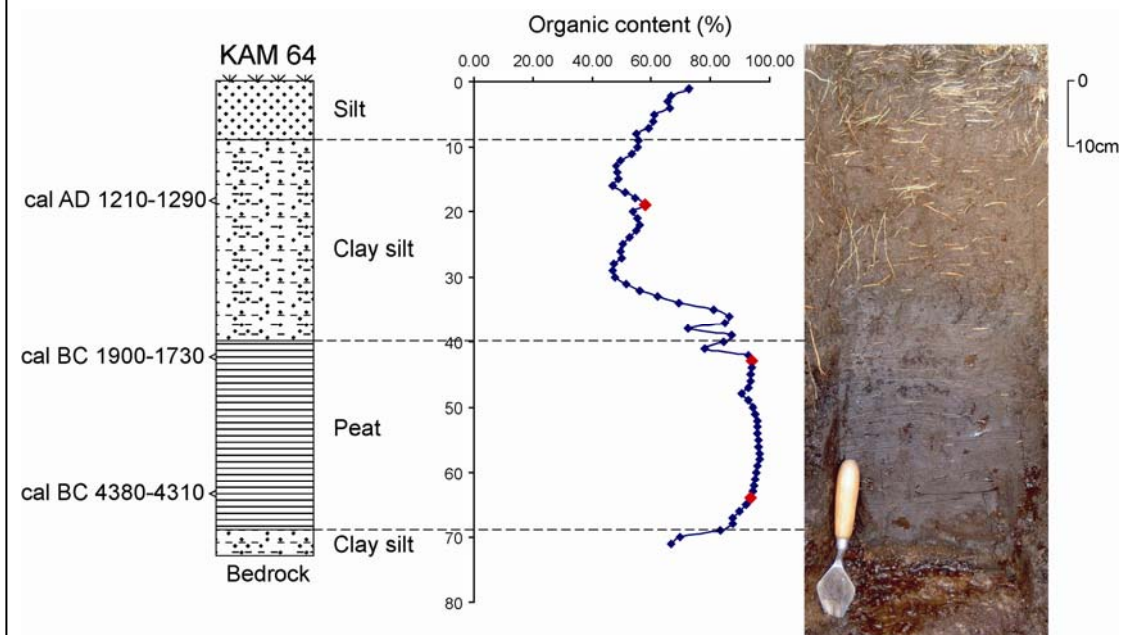
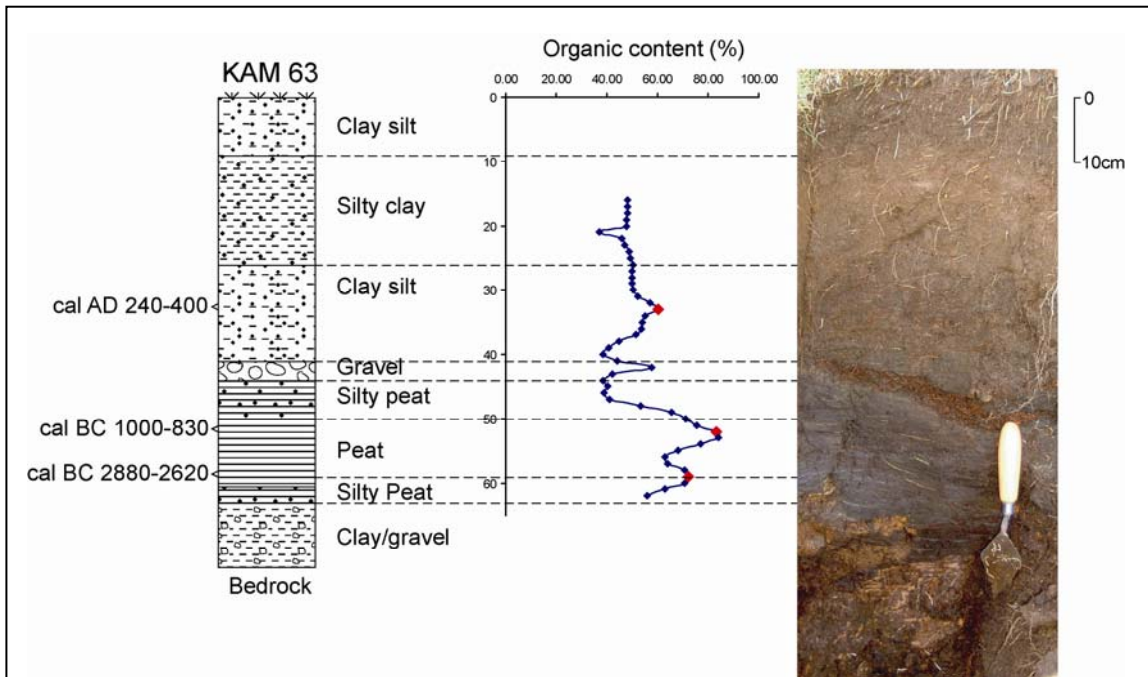




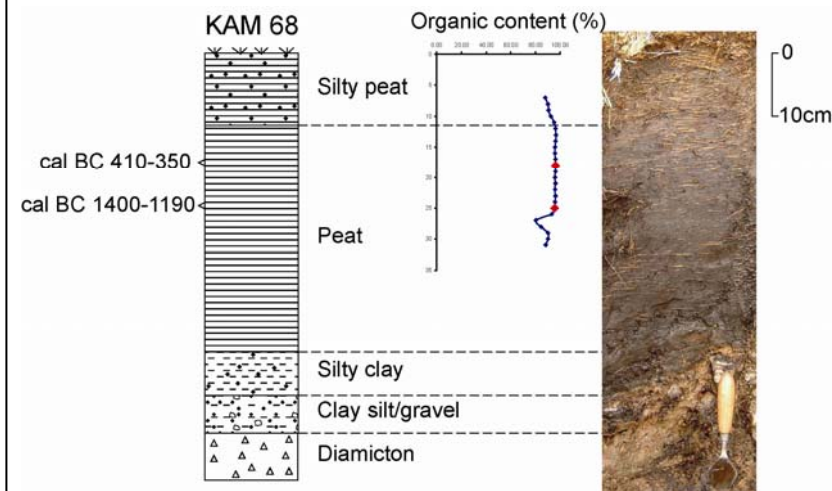
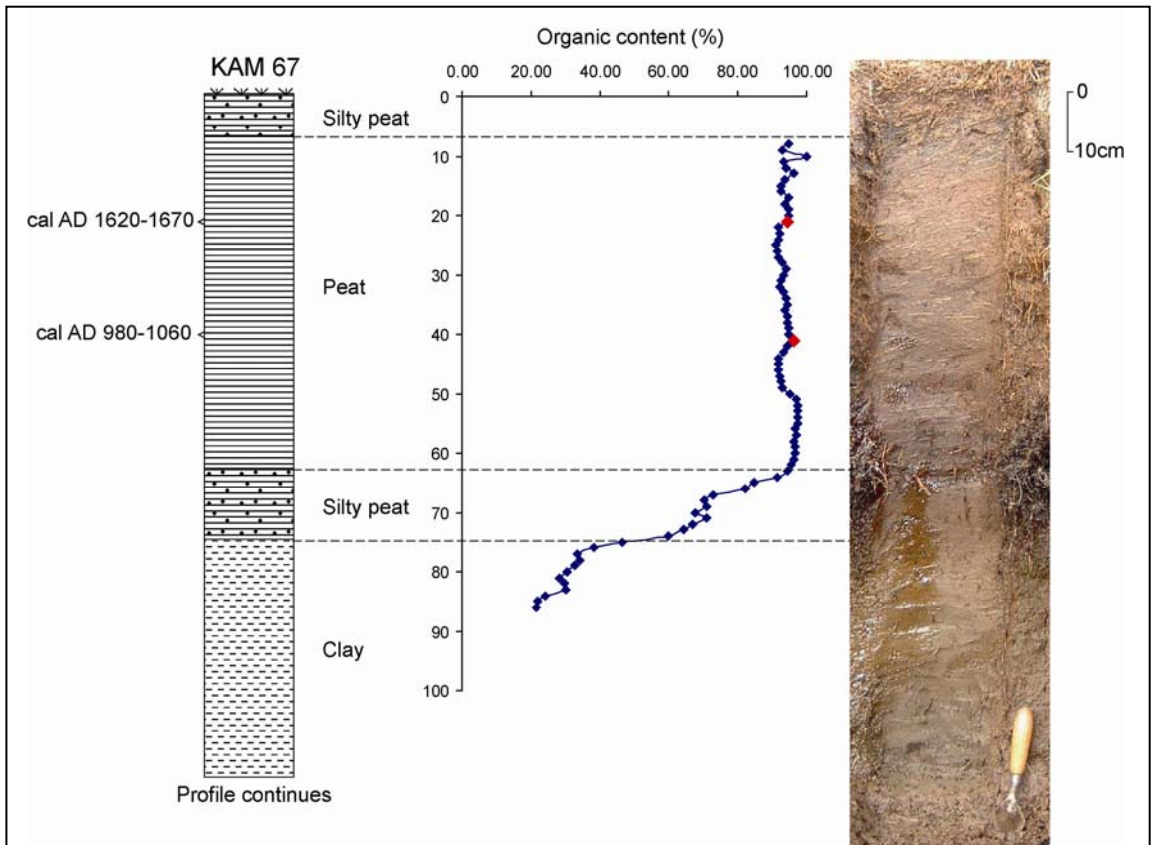


**Figure 6.37e:** Profile sequence, loss-on-ignition analysis and calibrated dates for profile KAM28.

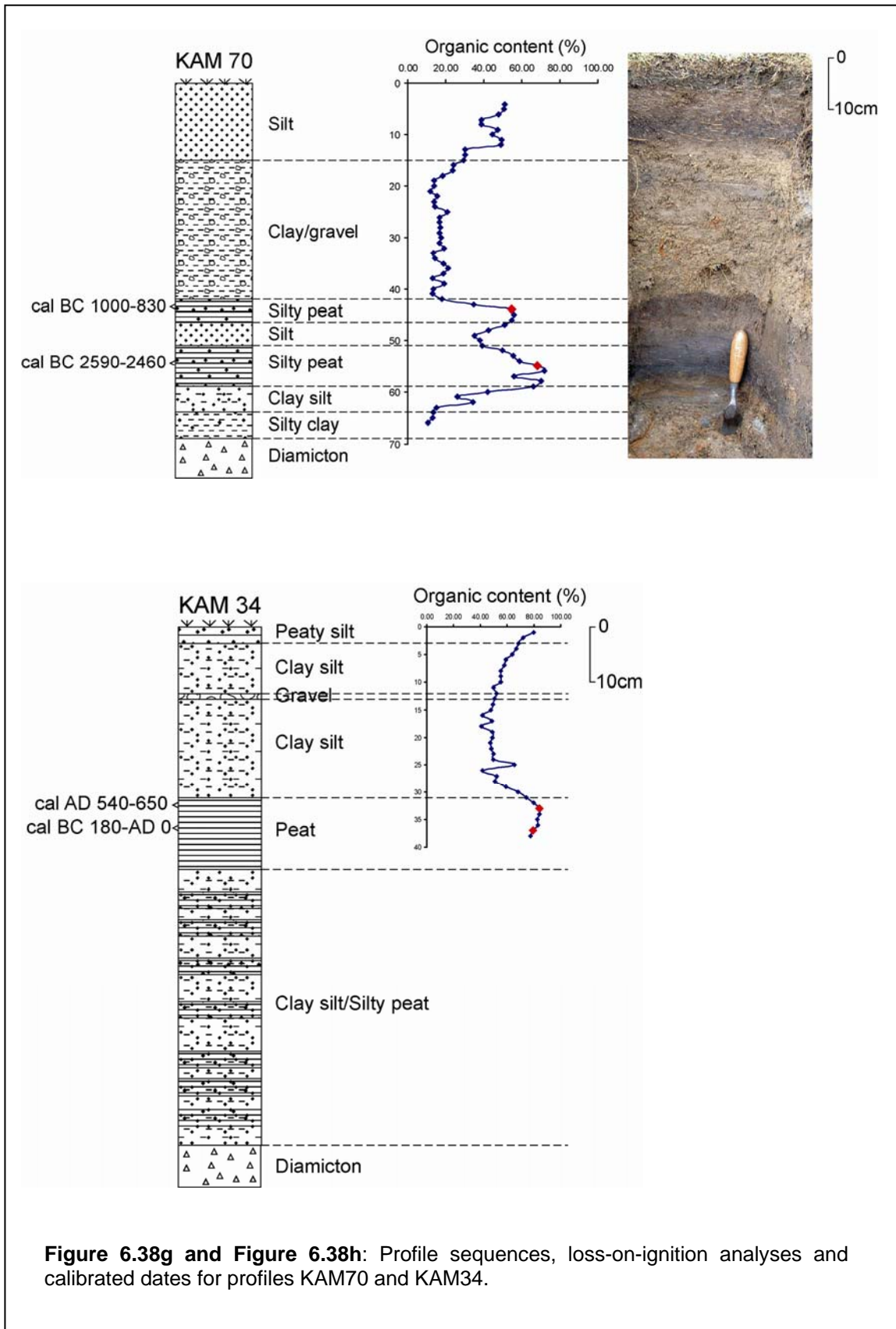


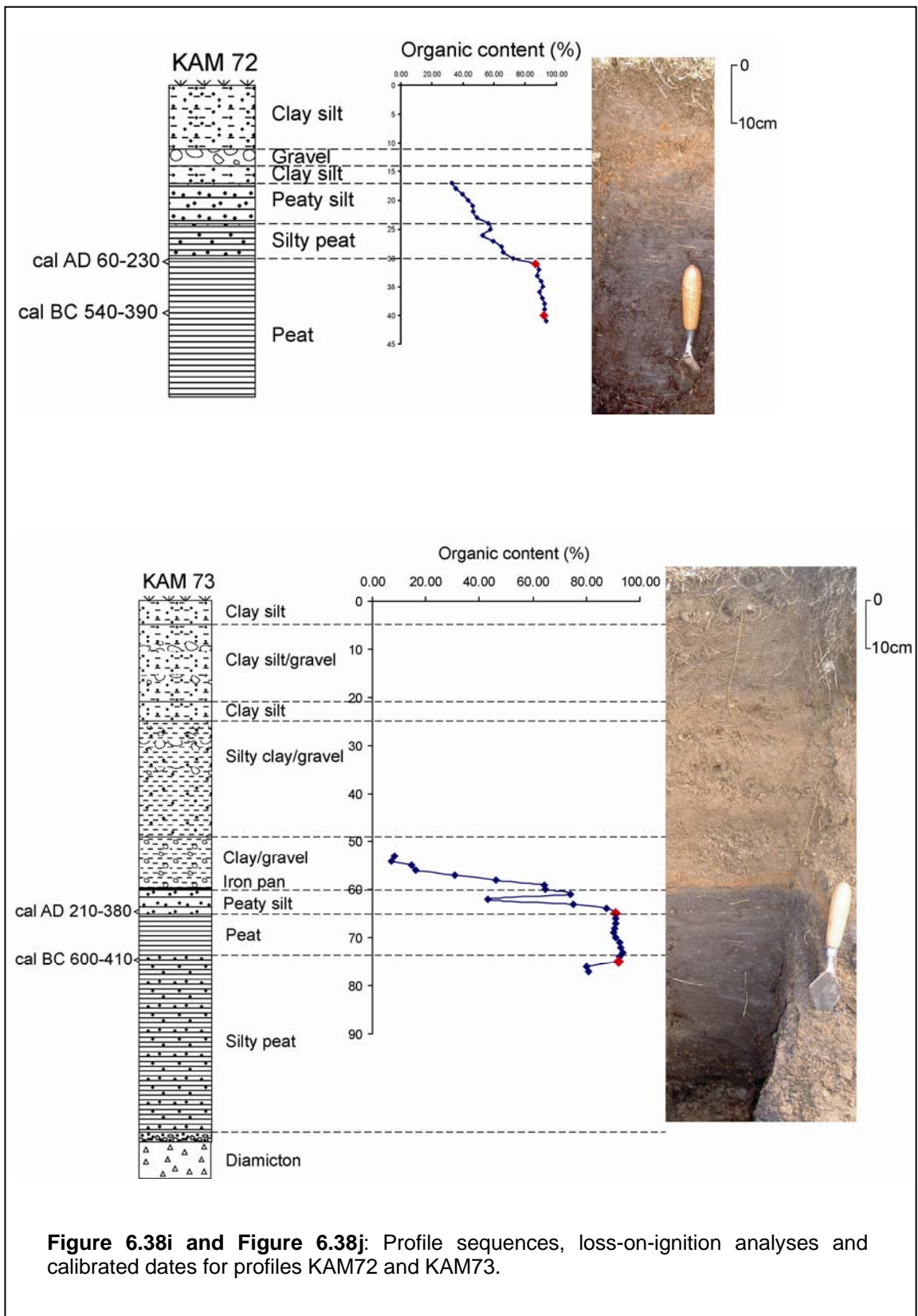


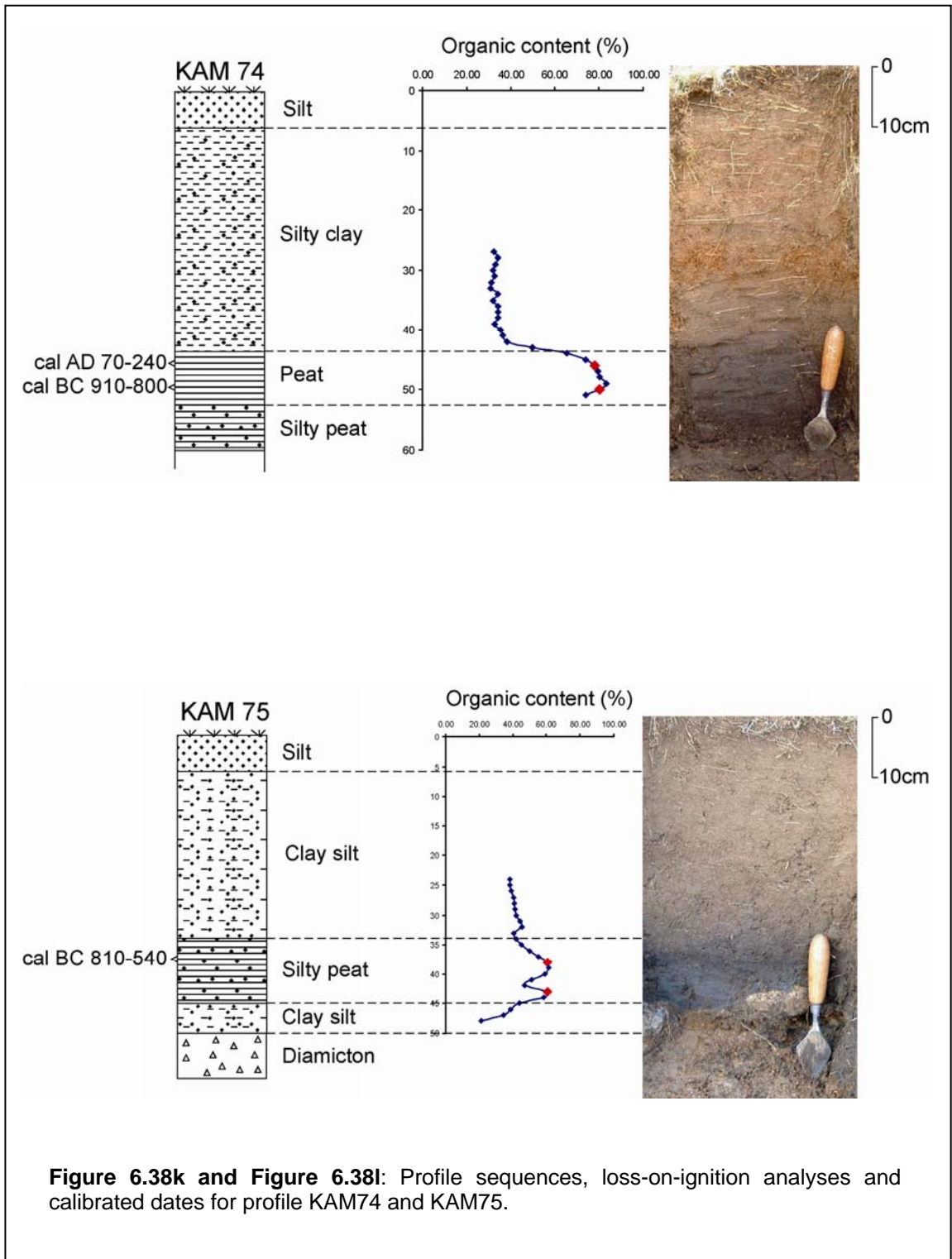
**Figure 6.38c and Figure 6.38d:** Profile sequences, loss-on-ignition analyses and calibrated dates for profiles KAM63 and KAM64.



**Figure 6.38e and Figure 6.38f:** Profile sequences, loss-on-ignition analyses and calibrated dates for profiles KAM67 and KAM68.







Site and <sup>14</sup> C Lab no.	Depth (cm)	<sup>14</sup> C age (year BP)	Calibrated dates (2σ)	Highest probability	Δ <sup>13</sup> C
<b>KAM3</b>					
GU-13768	9-10	1040±35	cal BP 911-1014 (cal AD 940-1040)	0.896	-28.9
GU-12094	12-13	1540±35	cal BP 1520-1360 (cal AD 430-600)	1.000	-28.5
GU-12095	21-22	2090±35	cal BP 2150-1990 (cal BC 200-40)	0.982	-28.1
GU-12096	30-31	3995±35	cal BP 4530-4410 (cal BC 2590-2460)	0.984	-28.0
<b>KAM9</b>					
GU-11661	24-25	1120±35	cal BP 950-1090 (cal AD 858-996)	0.939	-28.1
<b>KAM13</b>					
GU-12097	51-52	3225±35	cal BP 3370-3490 (cal BC 1540-1420)	0.900	-28.9
GU-12098	72-72	1115±35	cal BP 930-1090 (cal AD 860-1020)	0.976	-28.9
GU-12099	95-96	3125±35	cal BP 3260-3409 (cal BC 1460-1311)	0.966	-28.5
<b>KAM15</b>					
GU-11662	[ <i>Juniperus</i> log]	380±35	cal BP 510-420 (cal AD 1440-1530)	0.612	-25.2
GU-13769	46-47	2625±35	cal BP 3260-3410 (cal BC 1460-1310)	0.966	-28.6
GU-13770	71-72	3635±35	cal BP 3850-4010 (cal BC 2060-1900)	0.846	-28.8
<b>KAM20</b>					
GU-12100	28-29	970±35	cal BP 940-790 (cal AD 1010-1160)	0.995	-28.6
GU-12101	35-36	1150±35	cal BP 1150-970 (cal AD 800-980)	0.946	-28.2
GU-12102	49-50	1440±35	cal BP 1390-1290 (cal AD 560-660)	1.000	-27.7
<b>KAM26</b>					
GU-12103	12-13	55±35	cal BP 30-140 (cal AD 1810-1920)	0.726	-29.1
GU-12104	15-16	65±35	cal BP 30-140 (cal AD 1810-1930)	0.725	-29.3
GU-12105	54-55	6995±40	cal BP 7730-7930 (cal BC 5980-5780)	1.000	-28.3
<b>KAM27</b>					
GU-12106	30-31	2980±35	cal BP 3060-3270 (cal BC 1320-1110)	0.946	-28.3
GU-12107	53-54	1410±35	cal BP 1280-1370 (cal AD 580-670)	1.000	-28.4
<b>KAM28</b>					
GU-12090	[ <i>Juniperus</i> fragment]	2395±35	cal BP 2340-2500 (cal BC 550-390)	0.876	-26.9
GU-13771	16-17	140±35	cal BP 169-281 (cal AD 1669-1781)	0.450	-28.0
GU-13772	16-17 (humin)	125±35	cal BP 53-151 (cal AD 1799-1814)	0.450	-28.0
GU-12091	18-19	190±35	cal BP 136-244 (cal AD 1726-1814)	0.539	-29.0
GU-12092	57-58	2470±35	cal BP 2430-2620 (cal BC 670-480)	0.605	-28.4
GU-13773	57-58(humin)	2635±35	cal BP 2720-2800 (cal BC 850-770)	0.959	-28.1
GU-12093	78-79	1540±35	cal BP 1360-1520 (cal AD 430-600)	1.000	-28.4
GU-13774	78-79 (humin)	1595±35	cal BP 1400-1550 (cal AD 400-550)	1.000	-26.6
GU-13775	124-125	2755±35	cal BP 2770-2930 (cal BC 980-820)	0.981	-27.8
GU-13776	124-125 (humin)	2665±35	cal BP 2740-2850 (cal BC 900-800)	1.000	-27.7

**Table 6.7:** AMS radiocarbon uncalibrated and calibrated dates obtained from Hov samples. Unless otherwise stated, sample type was 1 cc of wet peat. Humic fractions were dated unless otherwise stated. Calibration to calendar years were performed using Calib 5.0.2 (Stuiver *et al* 2005) using the highest probability value with dates rounded to the nearest ten years. The location of the individual dates within the soil profiles is illustrated by the loss-on-ignition data for sampled profiles (Figure 6.37a-e).

Site and <sup>14</sup> C Lab no.	Depth (cm)	<sup>14</sup> C age (year BP)	Calibrated dates (2σ)	Highest probability	Δ <sup>13</sup> C
<b>KAM34</b>					
GU-13802	32-33	1475±35	cal BP 1300-1410 (cal AD 540-650)	1.000	-28.0
GU-13803	36-37	2070±35	cal BP 1950-2130 (cal BC 180-AD 0)	1.000	-28.6
<b>KAM61</b>					
GU-13778	25-26	1595±35	cal BP 1400-1550 (cal AD 400-550)	1.000	-28.0
GU-13779	33-34	4025±35	cal BP 4420-4580 (cal BC 2630-2470)	0.989	-28.0
<b>KAM62</b>					
GU-13780	33-34	2325±35	cal BP 2310-2370 (cal BC 420-360)	0.811	-27.8
GU-13781	40-41	5000±35	cal BP 5650-5770 (cal BC 3820-3700)	0.714	-27.1
<b>KAM63</b>					
GU-13782	32-33	1720±35	cal BP 1550-1710 (cal AD 240-400)	1.000	-28.9
GU-13783	51-52	2760±35	cal BP 2780-2950 (cal BC 1000-830)	1.000	-27.7
GU-13784	58-59	4160±40	cal BP 4570-4830 (cal BC 2880-2620)	1.000	-28.1
<b>KAM64</b>					
GU-13785	18-19	775±35	cal BP 670-740 (cal AD 1210-1290)	0.992	-29.1
GU-13786	42-43	3485±35	cal BP 3680-3850 (cal BC 1900-1730)	0.963	-28.4
GU-13787	63-64	5490±35	cal BP 6260-6320 (cal BC 4380-4310)	0.692	-28.2
<b>KAM67</b>					
GU-13792	21-22	270±35	cal BP 280-340 (cal AD 1620-1670)	0.433	-29.0
GU-13793	40-41	995±35	cal BP 890-970 (cal AD 980-1060)	0.618	-28.6
<b>KAM68</b>					
GU-13794	17-18	2290±35	cal BP 2300-2350 (cal BC 410-350)	0.612	-28.1
GU-13795	24-25	3025±35	cal BP 3140-3350 (cal BC 1400-1190)	0.963	-27.8
<b>KAM70</b>					
GU-13796	43-44	2760±35	cal BP 2780-2950 (cal BC 1000-830)	1.000	-28.0
GU-13797	54-55	4000±35	cal BP 4410-4530 (cal BC 2590-2460)	0.979	-27.7
<b>KAM 72</b>					
GU-13788	30-31	1880±35	cal BP 1720-1890 (cal AD 60-230)	1.000	-28.2
GU-13789	39-40	2385±35	cal BP 2340-2490 (cal BC 540-390)	0.915	-27.8
<b>KAM73</b>					
GU-13790	64-65	1760±35	cal BP 1570-1740 (cal AD 210-380)	0.932	-28.1
GU-13791	74-74	2450±35	cal BP 2358-2550 (cal BC 600-410)	0.599	-27.6
<b>KAM74</b>					
GU-13798	45-46	1860±35	cal BP 1710-1880 (cal AD 80-240)	1.000	-28.5
GU-13799	49-50	2695±35	cal BP 2750-2860 (cal BC 910-800)	1.000	-28.2
<b>KAM75</b>					
GU-13800	37-38	2550±35	cal BP 2680-2750 (cal BC 800-730)	0.463	-28.0
GU-13801	42-43	Failed			

**Table 6.8:** AMS radiocarbon uncalibrated and calibrated dates obtained from Sandoy samples. Sample type was 1 cc of wet peat and humic fractions were dated. Calibration to calendar years were performed using Calib 5.0.2 (Stuiver *et al* 2005) using the highest probability value with dates rounded to the nearest ten years. The location of the individual dates within the soil profiles is illustrated by the loss-on-ignition data for sampled profiles (Figure 6.38a-6.38l).

### **Chapter summary**

This chapter has presented data collected for the thesis including spatial mapping data of landscape units, geomorphic features and land cover classifications, mapping and description of archaeological structures in the Faroese outfields, thematically arranged data from in-depth interviews, descriptions of the stratigraphic data and details of loss-on-ignition analyses and radiocarbon dating of the sediment profiles. Although the data is separated here according to its methodological collection, the interpretation and discussion of results is conducted around specific topics in chapters 7 and 8, where data from several of the sources are incorporated, along with additional climatic, palaeoecological and archaeological data.

The following chapter discusses the extent and causal mechanisms of human impact in the Faroe Islands, according to a combined understanding of the data analysed above.

## Chapter 7

### Discussion: Historical human-environment interactions in the southern Faroe Islands

#### Introduction

Chapters 7 and 8 discuss the significance of the collected data presented in chapter 6. The discussion in chapter 7 assesses the extent to which people have impacted the Faroese environment (or not) according to the results of the site-specific, hypothesis-led research conducted on Suðuroy and Sandoy. The discussion in chapter 8 examines the circumstances whereby people put unsustainable demands on island environments more generally, by integrating original and secondary research from Iceland and Greenland.

Chapter 7 is composed of four parts. Part one outlines the structure of the chapter in more detail and parts two and three discuss the pre-colonisation/*landnám* and post-colonisation/*landnám* landscape of the Faroes respectively, from which assumptions regarding the significance of the human impact in the southern Faroes can be drawn. To conclude, part four examines the causes behind the specific outcomes of human impact in the Faroe Islands.

#### 7.1 Historical human-environment interactions in the southern Faroe Islands

In order to begin to understand the impact made by settlers on the localised Faroese environment, and whether or not that impact was sustainable over millennial timescales, the form and processes operating in the environment prior to the arrival of people (i.e. from the mid-late Holocene to colonisation) need to be assessed. Understanding longer-term trajectories of landscape change and their direction in relation to potential thresholds of change, and how sensitive or robust, dynamic or stable, the natural environment is, helps to separate anthropogenic impacts from natural environmental changes in the post-colonisation landscape record. Secondly, the timing of the arrival of people needs to be identified, along with the extent to which initial settlement had an impact on the natural landscape, as early impacts may affect the way in which consequent impacts develop. Thirdly, to understand the demands people make on the environment, the diversity of these activities and their impact requires analyses over longer timescales, which can be compared and contrasted with the outcomes of initial impact. On the one hand, early impacts may be significant as settlers experiment with an unfamiliar environment, but diminish as people adapt to the conditions over the long-term. On the other hand, environmental degradation may increase with little

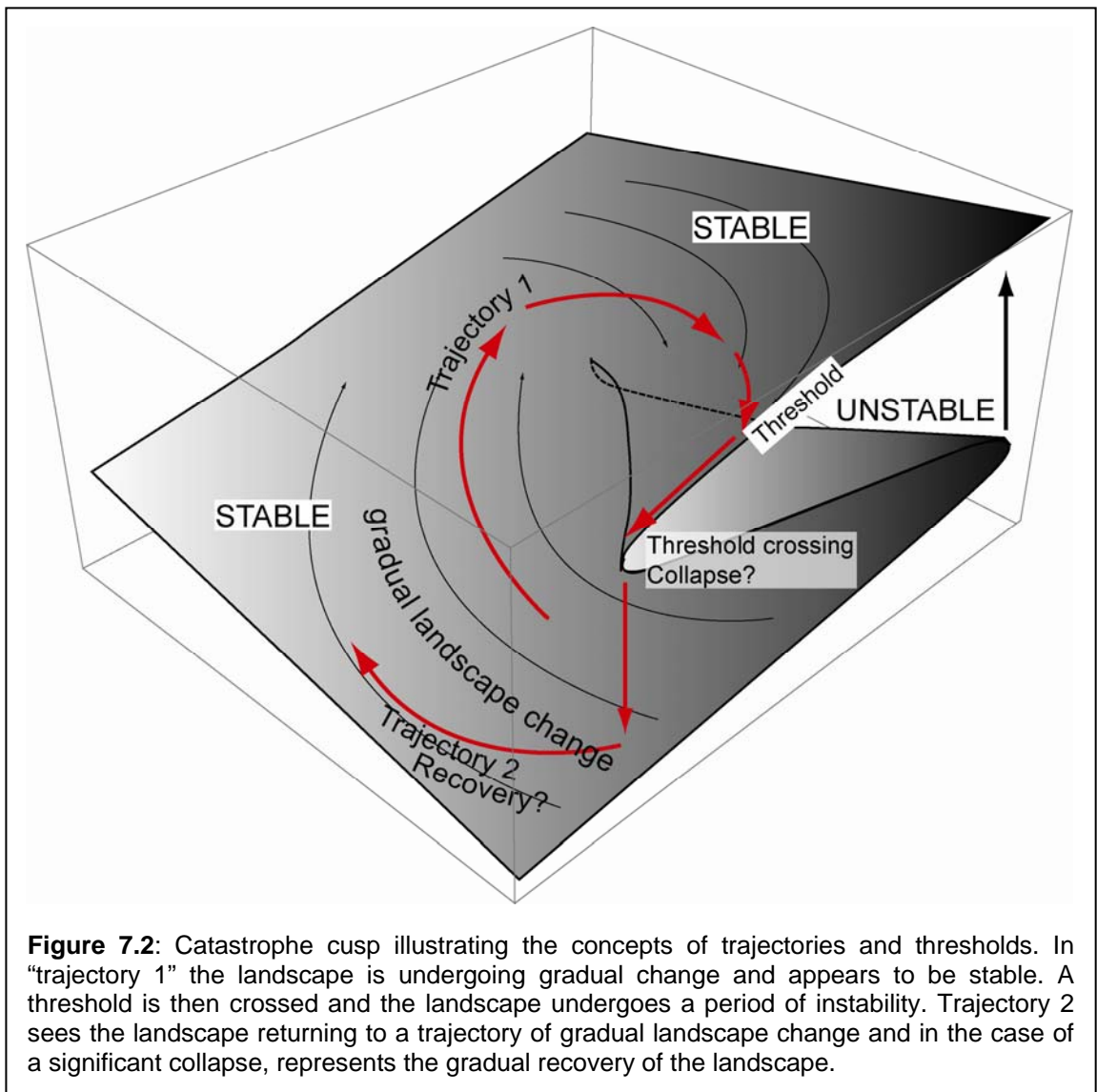
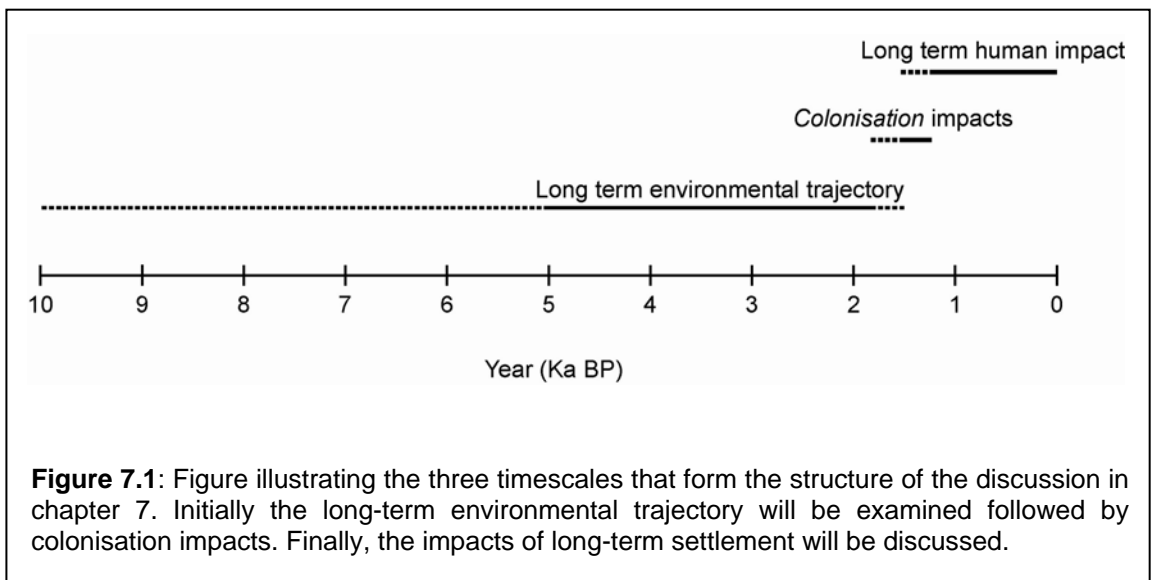
evidence of adaptation, either from the influence of natural factors such as climatic deterioration, or through cultural factors, such as ineffective human decision making (refer to hypothesis 5 in Table 1.1). An illustration of the timescales over which the thesis discussion will take place is presented in Figure 7.1. Although collected data is specific to the Faroe Islands, these issues relate to wider questions of island colonisation, and whether major environmental thresholds are crossed prior to the arrival of people, with the arrival of people, or over long-term settlement. The extent to which outcomes were constrained and the extent to which other scenarios were likely or possible are key issues for both the Faroes and other North Atlantic islands.

## **7.2 The pre-*landnám* landscape of the southern Faroe Islands**

### **Long-term trajectories and thresholds: soil stratigraphic and landform evidence**

In order to understand the degree to which the Faroese environment was impacted by people and contemporary natural perturbations, the longer-term trajectories of the Faroese environment and the processes operating are addressed. The longer-term trajectory is dependent on the degree to which the landscape is sensitive or resilient, in other words why, when, where, how often and how quickly landscapes undergo change (sensitivity) and how easily those landscapes recover following external perturbations (resilience). Sensitivity and resilience are related to the concept of thresholds, which in this context refers to a point whereby the environment changes from one phase or trajectory to another (Schumm 1979, Phillips 2003). Geomorphic thresholds result from intrinsic or extrinsic factors, but at the landscape scale considered here, most threshold crossing events are caused by external variables, by climatic change or anthropogenic impact.

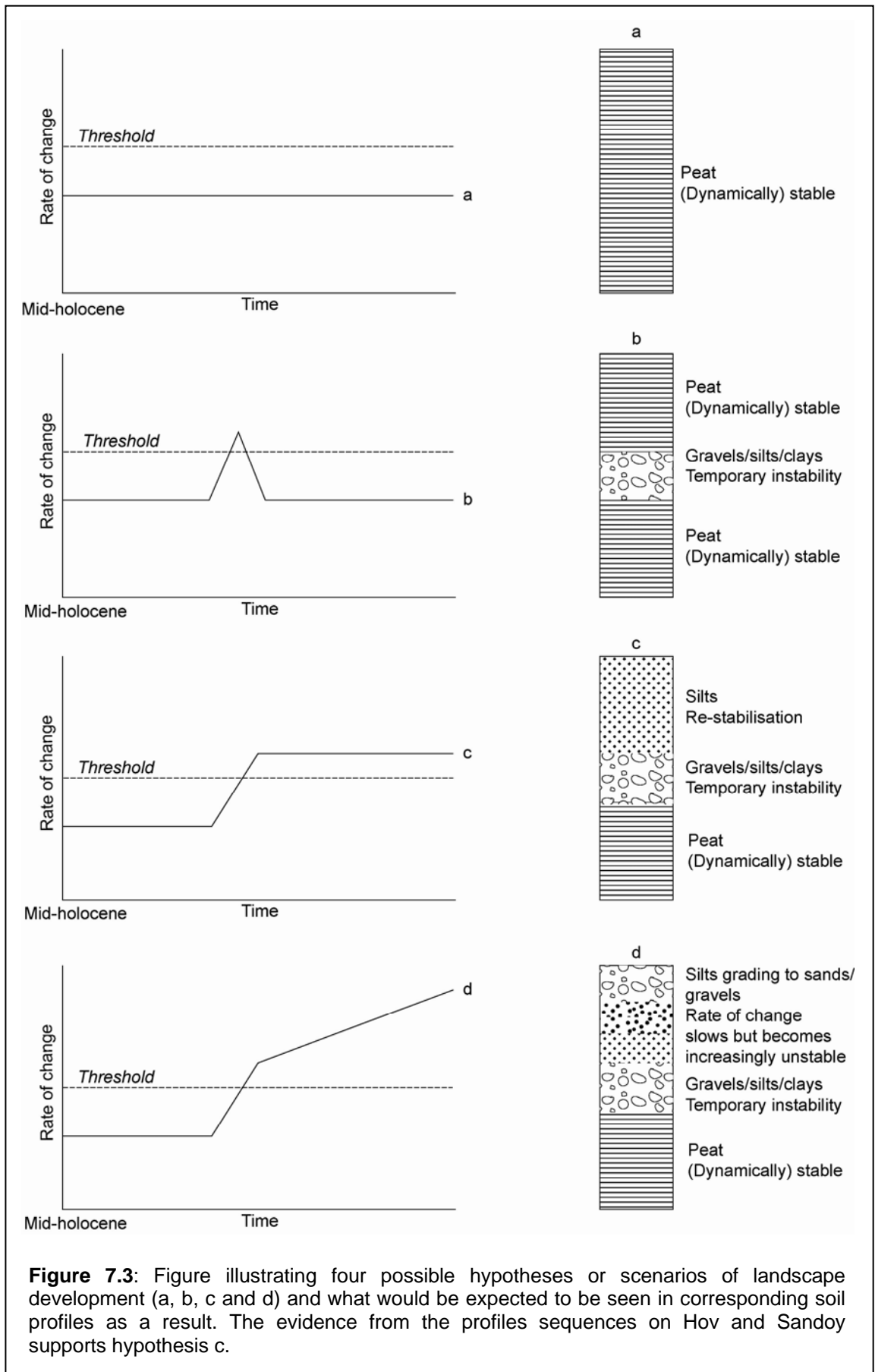
After a threshold has been crossed, the longer-term trajectory may return to its pre-perturbation level or is irreversibly altered to a new trajectory. This is dependent on the response and resilience of the landscape. Environmentally marginal landscapes such as those with nutrient poor, shallow or easily eroded soils, or landscapes with limited environmental or ecological buffers, which are more susceptible to change, may be irrevocably altered and pursue a new environmental trajectory. More environmentally resilient landscapes may recover from external perturbations and return to the pre-perturbation trajectory. The degree of landscape recovery is also dependent on the length of the perturbation. For example, extreme events, such as floods or *jökulhlaups*, occur over a relatively short period, and although devastating, the local environment can resume its recovery soon after. Persistent anthropogenic impact may, however, continue to affect the environment for decades or centuries, hindering landscape recovery. People also influence the extent of environmental resilience and recovery. For example, anthropogenic soil erosion



reduces the ability of the environment to recover from an unrelated external perturbation, such as a hazard event.

The notion of a catastrophe cusp, although originating from mathematics, is applicable to illustrating ideas of landscape deterioration and recovery (Figure 7.2). Following a trajectory along the catastrophe cusp, the landscape can be changing and adapting gradually to anthropogenic change but appearing outwardly stable. Although a landscape may have been undergoing a process of gradual deterioration, in what in isolation may be a small external (or internal) trigger, can cause a massive environmental deterioration (a threshold crossing event), leaving the system in an unstable state. Stability is then regained through a process of landscape recovery. The catastrophe cusp can also be applied to biological changes on islands, firstly to the extinction of species, and secondly, to the introduction of species, which represents a threshold that under some circumstances is difficult to reverse.

Thresholds can be identified in the late Holocene Faroese landscape by examining changes in sediment profiles and surface landforms. The form of a particular landscape will reflect different geomorphic processes (both high-magnitude, low frequency and high frequency, low magnitude), the historical trajectory of environmental drivers of those processes (dominantly climate and vegetation and tectonics) and any specific contingencies (such as extreme events and human activity) (Bracken and Wainwright 2006). Stratigraphic sequences are effectively a preserved account of how landscape processes have varied through time, although records can be intermittent and only exist in areas where there has been sediment deposition. Threshold crossing events or geomorphic perturbations are manifested by distinct changes in the sediment record (where these records are available), and by the existence of specific landforms that demonstrate that the landscape has undergone a significant change from one phase to another. For example, incidences of erosion, such as slope wash, are demonstrated by gravel units in the profile, while silt influxes imply increasing aeolian erosion. Gravel and highly minerogenic units are deposited over a shorter time period than the accumulation of peat, which conversely represents a period of relative landscape stability. Changes in soil stratigraphy can be linked to a breaching of the vegetation cover, climatic changes, e.g. increased rainfall, autogenic changes, e.g. increased leaching, and human activity, e.g. grazing and compaction. Figure 7.3 illustrates the hypothetical units of the stratigraphic profile according to four trajectories of landscape development. In the Faroes, a homogenous peat unit is the outcome of a constant rate of change from the mid-Holocene with no significant external perturbations or threshold crossing events (a). If a perturbation is introduced and the landscape undergoes a threshold crossing event followed by recovery, a short lived influx of silts/sands/gravels or clay will be illustrated by the stratigraphic profile, followed by the re-establishment of peat (b). In trajectory c, the stratigraphic profile illustrates an influx of gravels/silts representing a



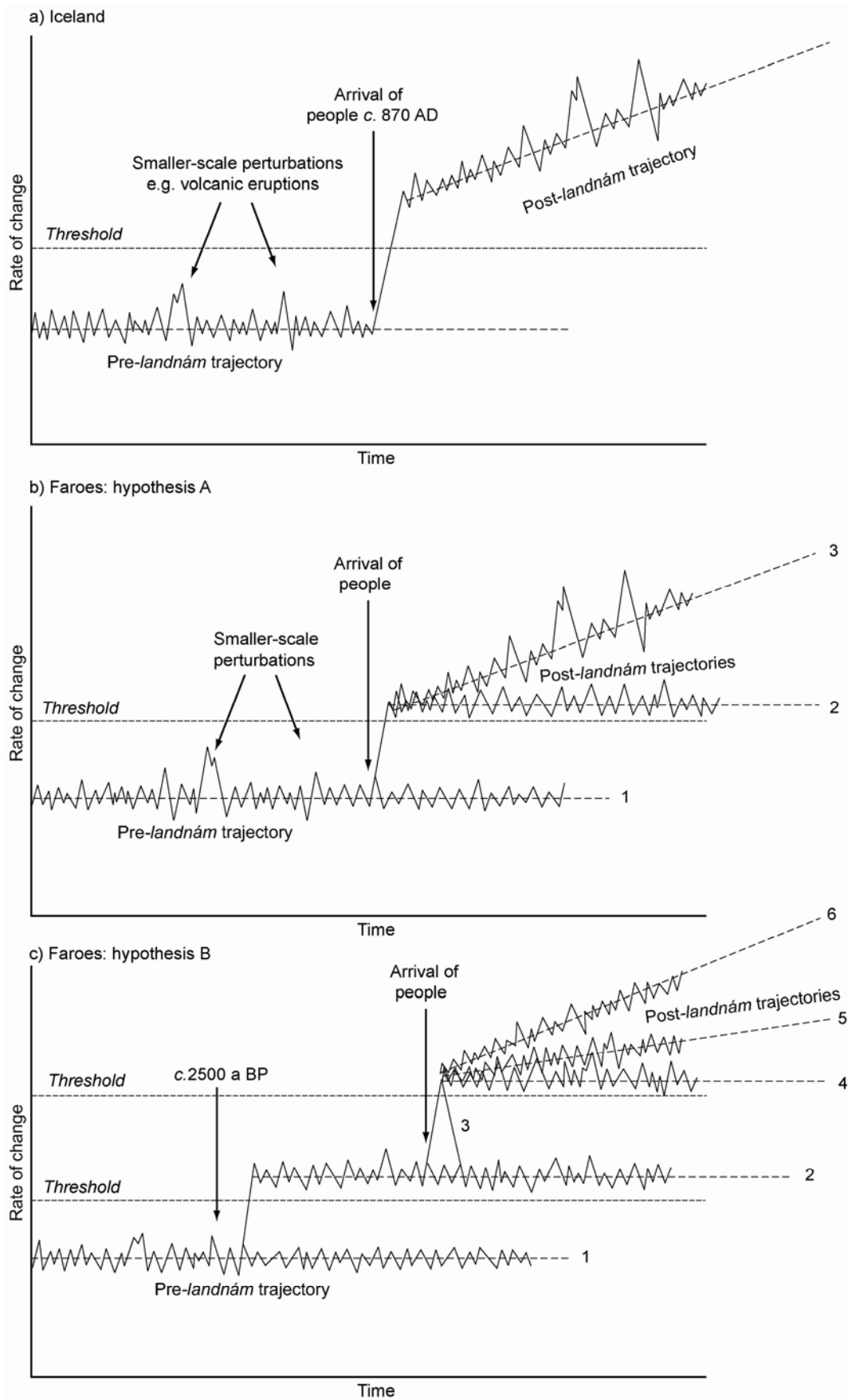
**Figure 7.3:** Figure illustrating four possible hypotheses or scenarios of landscape development (a, b, c and d) and what would be expected to be seen in corresponding soil profiles as a result. The evidence from the profiles sequences on Hov and Sandoy supports hypothesis c.

threshold crossing event, followed by a homogenous silt unit, representative of landscape re-stabilisation at a new rate of change. In trajectory d, the landscape continues to deteriorate after a threshold crossing event, represented in the soil profile by the influx of increasingly coarse sands, silts and gravels.

Surface geomorphological features and the boundaries between certain landforms or land units also illustrate natural mechanisms of landscape change and periods of landscape destabilisation. Gullying, cryoturbation, solifluction, peat formation and alluvial fan development have been active processes over the Holocene and represent the landscape response to changing climate, extreme weather events, ecological changes and also anthropogenic impact. These processes can be analysed through the mapping of landforms such as gullies, active and inactive fans, high and low altitude peat deposits, scree slopes and active, semi-active or inactive cryoturbation surfaces. Analyses of these different geomorphic data, in terms of how, when and where they developed, allows the historical environmental trajectory, and the form of the landscape at the time of settlement, to be determined. For example, relic periglacial surfaces at altitudes lower than affected by current periglaciation, indicate periods of colder climate in the past, and/or the removal of an inhibiting factor such as vegetation. Periglaciation in the Faroe Islands has been discussed by Humlum and Christiansen (1998a; 1998b), who record that during cold intervals of the Little Ice Age, the lower limit for periglacial activity may have temporarily approached sea level with permafrost sporadically established in the Faroese highlands.

### **Hypotheses regarding the timings and causes of thresholds**

The initial mapping of landforms and recording of stratigraphic profiles in Hov and Sandoy was followed by assessing a second stage of hypotheses, which determined a radiocarbon dating protocol for landscape change. Figure 7.4 depicts three conceptual models that illustrate the idea of trajectories and thresholds, from which a dating protocol was developed. Figure 7.4a illustrates a generalised trajectory of the Icelandic landscape system, which was in a state of dynamic equilibrium in the late Holocene, prior to the arrival of people. In general, across Iceland, the impact of colonisation causes a threshold crossing event in the 9<sup>th</sup> century. The inherent sensitivity of the Icelandic environment, for example, the limited biota and friable volcanic soils, as well as continuing human impact, volcanic eruptions and climatic changes, e.g. the Little Ice Age, prevented landscape recovery to a pre-colonisation trajectory. The switch from a pre-colonisation to post-colonisation environmental trajectory is illustrated by stratigraphic evidence detailing the pattern of soil erosion and accumulation in Iceland. Following settlement, the sediment accumulation rate increases, often by one order of magnitude, and sometimes by several orders of magnitude (Dugmore *et al* 2000).



**Figure 7.4:** Conceptual figures illustrating the trajectory of landscape change and threshold crossing events in Iceland (a), based on data from Eyjafjallahreppur in south Iceland, and two contrasting hypothesised trajectories of change and threshold crossing events for the southern Faroe Islands (b and c - also refer to hypothesis 1 in Table 1.1). See text for a detailed explanation of figure.

Based on observations of sediment stratigraphies and landform evidence from fieldwork on Suðuroy and Sandoy, two hypotheses were proposed to explain the generalised trajectory of late Holocene landscape change (refer to hypothesis 1 in Table 1.1). The first hypothesis, illustrated by Figure 7.4b resembles, and is based on, the Icelandic model, **whereby the major landscape threshold in the Icelandic Holocene environment was crossed at the time of settlement**. This could be represented in the Faroese sediment stratigraphy, by the contact between the organic peat context and influx of gravels and silts, implying erosion. After a threshold is crossed, the environment may continue on a new trajectory at a similar rate of change to that of the pre-colonisation environment (2), or embark on a new course of trajectory at a more rapid change than previously (3). Alternatively, the enhanced aeolian sediment dispersal represented by the top silt may be related to post-colonisation climatic change and the onset of cooler and/or stormier conditions (Meeker and Mayewski 2002, Dugmore *et al* 2007a). This hypothesis agrees with evidence that is available for other islands colonised relatively recently, such as Iceland, which experienced significant environmental changes after colonisation.

Hypothesis B offers an alternative trajectory, **whereby a significant threshold was crossed some time prior to colonisation and hence major landscape change was initiated by an external perturbation not related to people**. This hypothesis is supported by initial observations of landforms such as the Hov box gullies (refer to Figures 6.3a and 6.3b), which had probably already developed and stabilised some time prior to the arrival of people. If a perturbation prior to colonisation caused a switch from one trajectory to another, the scale of consequent human impact needs to be understood. A scenario whereby people have no significant impact is illustrated by trajectory 2 (Figure 7.4c). Alternatively, people may have had a discernable impact on the landscape, but the environment was quick to recover (i.e. was resilient) and continued on its prior trajectory of change (3). This hypothesis proposes that the impact of people was negligible in the long term, although limited impact can be identified in contemporary landscape evidence. In scenario 4, a threshold crossing event occurs, but the landscape consequently stabilises. Trajectories 5 and 6 suggest that the environment follows a new trajectory at a more rapid rate of change than previously. The latter trajectories would be unsustainable over mid- to long-term scales. The resolution of these hypotheses, in relation to the evaluation and dating of the stratigraphic profiles and supporting evidence, is discussed below.

### **Environmental thresholds in late Holocene Faroes**

#### *Evidence of environmental thresholds in surface landforms*

The following approaches were used to assess geomorphic events and change; analyses of relict forms, changes in activity within landforms, and shifting boundaries. Geomorphic and landscape analyses and mapping indicate that some landforms are essentially relict and have formed during a more dynamic or unstable geomorphic regime. This suggests past episodes of change and threshold crossing events. For example, the slopes above the village of Hov are dominated by conspicuous box gully features, now stable, which formed under a different geomorphologic regime from today. The extensive scale and extent of the gullies are such that they could not have formed within the infield areas of Faroese settlements, without compromising both occupation sites and the viability of settlement in the area. The steep headwalls of the gullies imply that the geomorphic phase in which the gullies were formed was limited in its temporal extent, which prevented further development of the gullies. The implication is that the gullies formed pre-colonisation, a hypothesis consistent with lithostratigraphic evidence (refer to Figure 6.3b). The capping of the gully systems and slopes by the top silt unit, shows that the gullies pre-date the influx of top silt. At present, the gullies, although with slopes as steep as 70°, have stabilised, are well vegetated and do not contain significant (or any) channels. This indicates that they have experienced little modification since their formation. The gullies could have been formed by a peat slip or debris flow, whereby long periods of rain, short intense storms, or snow accumulation and melt, caused the surface peat context to liquefy into a flow. There are examples of such slips occurring in peat dominated regions/islands, including the Shetland Isles, mainland Scotland, Ireland and the Falkland Islands. The existence of the Hov gullies implies that recent geomorphological change is more limited than that occurring in the pre-“top silt” period (pre-colonisation). The simplest explanation is that the gullies formed during the period of significant geomorphological activity demonstrated by the silt/gravel influx in the stratigraphic profiles. The Faroese environment displays signs of instability, supporting the existence of a threshold crossing event at this time.

Relic cryoturbation features at lower elevations than currently active indicate a colder climate. Cryoturbation features are present in Hov, on the plateau area of the south facing slopes above Hov village, and at a lower altitude further up-valley in Hovsdalur. On Sandoy, stone stripes were common on un-vegetated high altitude plateaux above c.320 m, e.g. at Knúker (c.320 m) and Eiriksfall (c.350 m) in north Sandoy and at Bøllufjall (c.300 m) and Tindur (c.350 m) in central Sandoy (Figure 7.5). To the south east of Bøllufjall, stone sorting was observed at c.180 m and therefore measurements are not altogether consistent with the present periglacial boundary of 250-450 m proposed by Humlum and Christiansen (1998a; 1998b) (Figure 7.6).

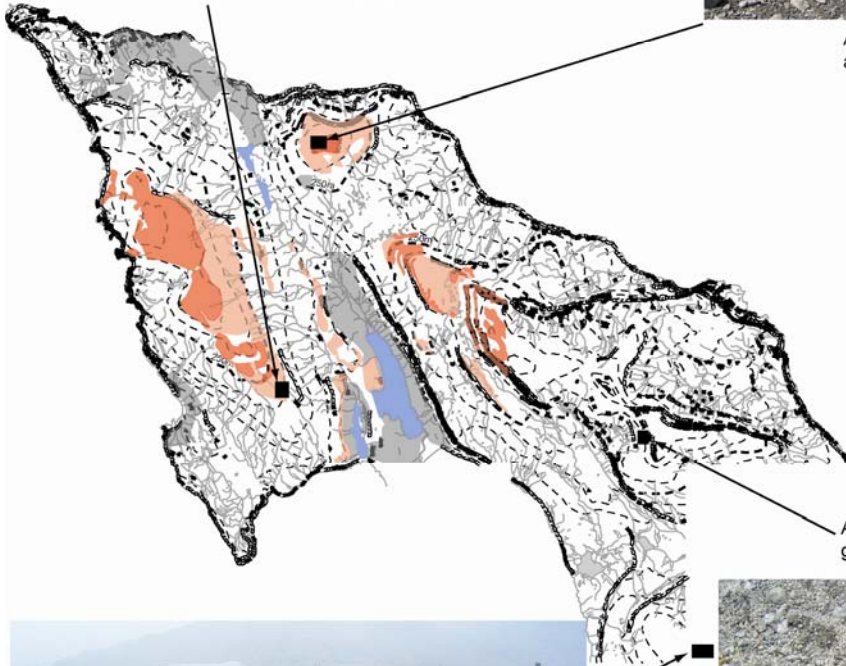
Scree slopes and talus aprons are found on slopes across both islands, but rock faces show few signs of recent block detachment or movement of talus down slope, and profiles



Active small-scale patterned ground at 181 m a.s.l.



Active stone striping at 320 m a.s.l.



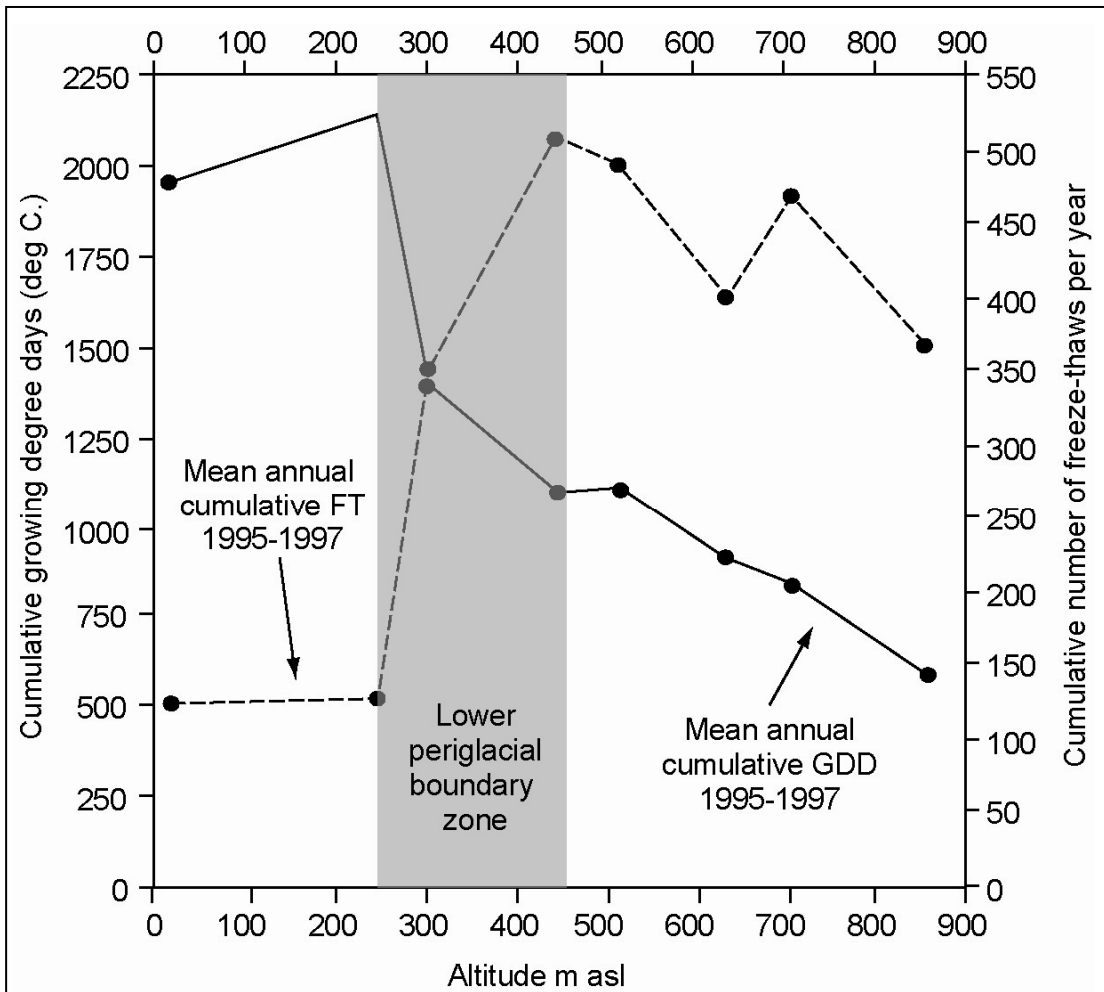
Active small-scale patterned ground at 350 m a.s.l.



Active stone striping at 303 m a.s.l.



**Figure 7.5:** Examples of active stone sorting from different areas on Sandoy.



**Figure 7.6:** Altitudinal distribution of the mean annual cumulative number of growing degree days (GDD, left scale) and the mean annual cumulative number of freeze-thaws (FT, right scale) May 1995-1997 in the Slættaratindur massif, northern Eysturoy. The lower periglacial boundary is marked by grey shading. After Humlum and Christiansen 1998a; 1998b).

immediately down slope from the edges of talus aprons show no indication of recent scree expansion. This suggests stability over the settlement period.

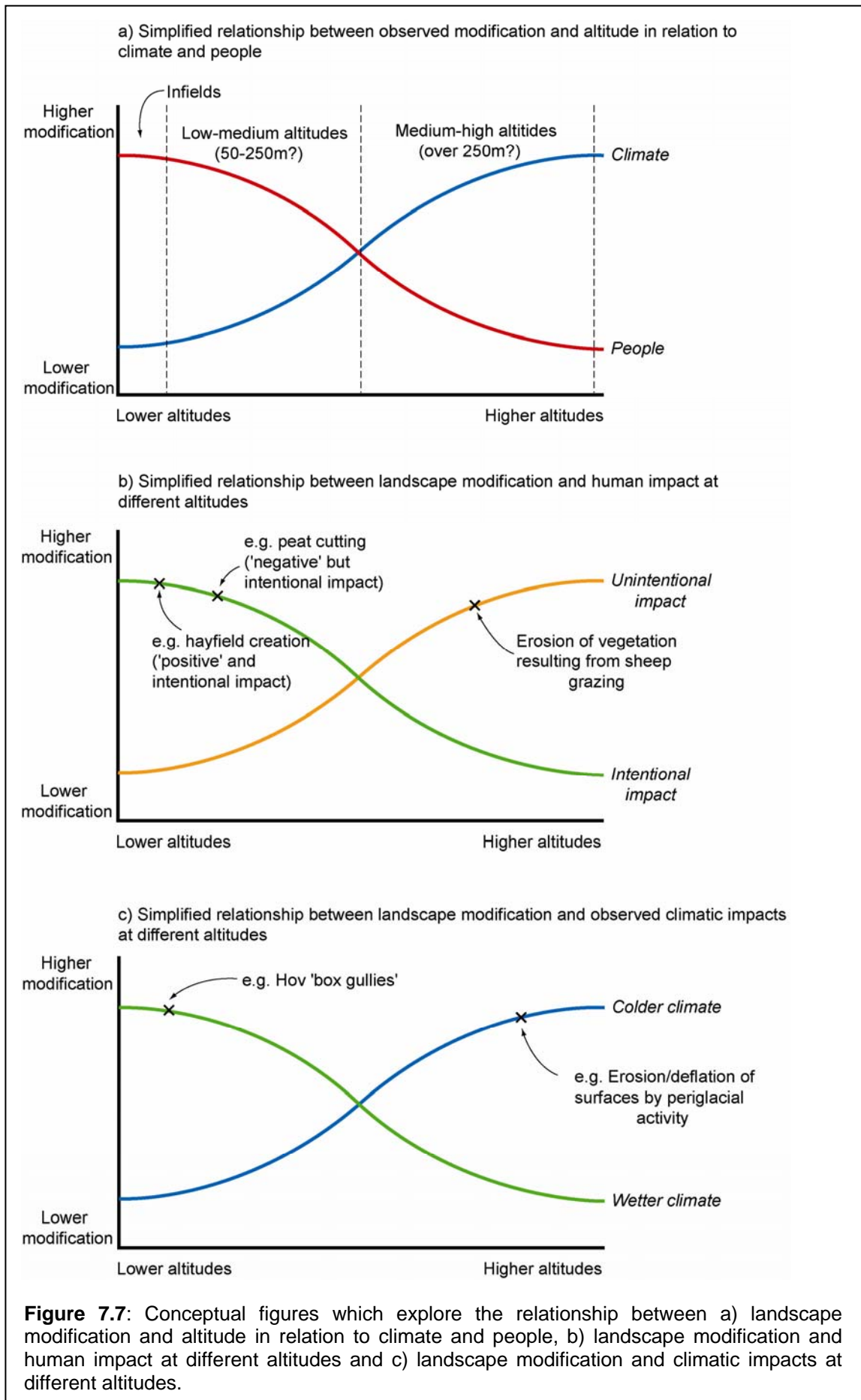
Stream and river channels and margins display comparatively limited evidence of contemporary aggradation. Channel systems in Sandoy are characterised by their absence of aggrading sediment and by stable river terraces and stable meandering channels. The implication is that limited sedimentary material has been liberated from the slopes, which suggests relatively limited erosion over the settlement period.

The limited recent influx of sediment into fluvial systems, the pre-settlement formation of major gullies and the comparative stability of fan surfaces and scree extent suggest that many key landscape boundaries in the surface geomorphological landscape were probably defined prior to colonisation, implying that geomorphological impacts directly attributable to human activity and Little Ice Age changes are restricted.

#### *Thresholds and spatial factors in relation to surface cover*

Spatial factors, in relation to the causes and timing of the threshold phases as discussed above, and in relation to the patterns of land degradation highlighted by the maps depicting the extent of vegetation cover, can also be considered. Climate, weather and human impacts will be represented to differing degrees at contradictory locations in the Faroese landscape, because different altitudes and locations are more or less sensitive to modification by people or climate (Figure 7.7). Landscapes at high altitudes and with steeper slopes are more sensitive to both climate and human impact and, therefore, more sensitive to threshold crossing events than slopes at lower altitudes where the vegetation cover is more robust and less easy to breach. Human impact will be most influential within an infield landscape, village or on gentle slopes at low to moderate altitudes. Climate and weather impacts will be dominant on steep slopes, gullies, cliff faces and at high altitudes where geomorphic activity is greater, with or without the influence of people, due to exposure, slope angles and temperature.

With regards to the spatial extent of vegetation/sediment cover, degradation of higher altitude hilltops would be expected as a result of their relative altitude and exposure. This is evident on the map depicting extent of land cover on northern Sandoy (refer to Figure 6.9). However, there are other spatial patterns highlighted by the map which do not conform to a simple altitude/exposure model, and in this case other factors that influence the spatial patterns of degradation need to be considered. Affects of altitude and aspect may also change the circumstances under which threshold crossing events occur across the landscape. Aspect, which influences the number and intensity of sunlight hours and wind



direction, might also have an affect on the sensitivity of a landscape to changes and the timing and intensity of thresholds. North facing slopes receive less sunlight rendering vegetation on north facing slopes more sensitive to climatic perturbations and resulting in greater freeze-thaw activity. Slope gradient may also influence the sensitivity of a slope to anthropogenic and natural changes. General observations from Sandoy and Hov suggest that slopes with a moderate to steep gradient are better vegetated than slopes of a slighter gradient. Moderate to steep slopes also tend to be favoured for crop growing such as barley (aside from the village of Sandur, where soils are more sandy and free draining) as a result of their better drainage. Gentle slopes with poor drainage are more subject to water logging which can lead to a breach in vegetation cover and increased susceptibility to erosion. Slope gradient may also influence the relative impact from wind on the vegetation surface. A level plateaux location will be more subject to wind erosion than a valley slope that is more sheltered.

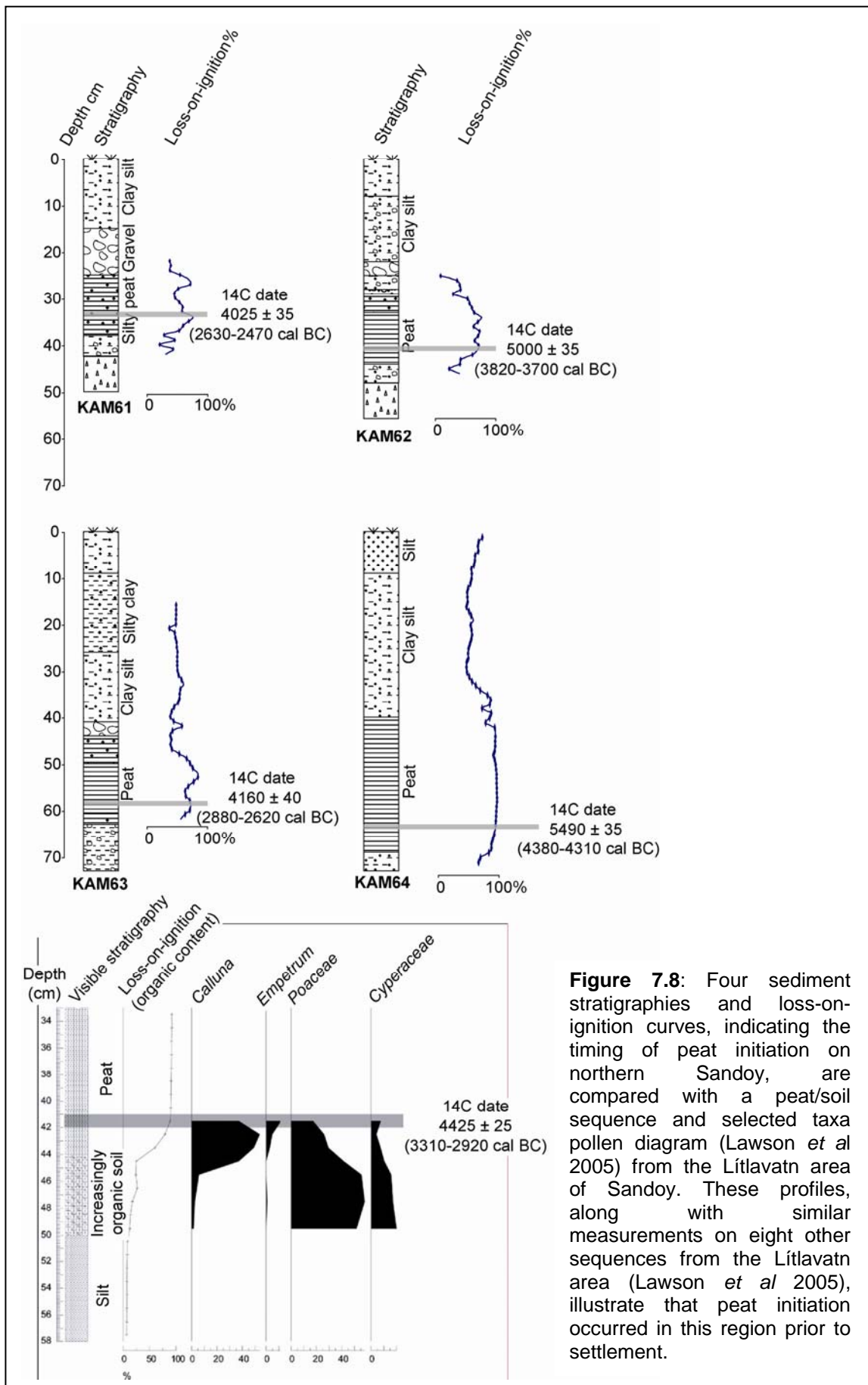
A major inconsistency in spatial patterns of degradation was observed between ENE and WSW facing slopes in north Sandoy (refer to Figure 6.12). The underlying substrate appears to be different on both slopes, with the ENE slopes characterised by a till-like substrate and littered with loose boulders, and WSW facing slopes characterised by a finer-grained substrate. The degradation of these surfaces is dependent on two processes; those that initiate the break-up of surface material or vegetation, and those that exacerbate erosion after the initial break-up of the surface. These processes are influenced by a combination of factors that might explain the difference in substrate and surface character. The degree of exposure affects both initial break up and subsequent exacerbation of erosion. With a prevailing south westerly wind, the initial expectation is that the WSW facing slopes, which are more exposed, should be more degraded. The landscape mapping evidence illustrates that the opposite is the case. This could be explained by anthropogenic factors or by natural factors such as variations in aspect, exposure and gradient. For example, the ENE facing slopes have generally shallower gradients than the WSW facing slopes. Steeper slopes are relatively well drained and less likely to become saturated leading to an initial break-up of vegetation. Steeper slopes may also be less exposed to wind erosion, although in the Faroe Islands, the extent of wind erosion may be inhibited by the damp climate and relatively stable soils. A further explanation could be that the supply of material to the contrasting slopes is different, as slopes of a moderate gradient may be more amenable to the build of fine material than more exposed areas. An alternative to the natural factors cited above is that different human influence caused contrasting patterns of erosion. This would have to be the result of a different human activity taking place in each location or that human activity was carried out more intensively at one location than another. Sheep grazing has been carried out at both locations but there is no evidence to suggest that grazing would have been more intense on the ENE facing slopes. Regardless of the cause of the slope characteristics, the

more eroded nature of the ENE facing slopes might imply that a threshold was crossed earlier than on WSW facing slopes. Transect 2, located on ENE facing slopes of Sandoy, does display evidence of earlier impact than at transect 1, although similar early changes are also noted on WSW facing slopes at KAM63.

*Evidence of environmental thresholds in sediment stratigraphies*

At sites on Suðuroy and Sandoy, peat accumulation has in the past been extensive and characterises many of the recorded profiles except for at high altitudes (above c.300-350 m). Mid-Holocene landscape stability is suggested by the widespread formation of peat on slopes of up to 40°, particularly observed around Hov on Suðuroy. Radiocarbon dating from close to the base of the oldest peat contexts on Sandoy, for example at KAM61, 62, 63 and 64, yielded dates of 4420-4580 cal yr BP, 5650-5770 cal yr BP, 4570-4830 cal yr BP and 6260-6320 cal yr BP respectively, indicating a mid-Holocene timing for the onset of peat accumulation at these sites. Initiation of peat development elsewhere in Sandoy has been dated to c.3200-5700 cal yr BP (Lawson *et al* 2005), which corresponds with the dating of peat initiation from transect 1a (Figure 7.8). The timing of peat initiation in the Faroes, occurring prior to the known arrival of people, contrasts with many situations elsewhere in the North Atlantic region, where human agency is implicated in peat initiation (e.g. Bennett *et al* 1997, Bunting 1996, Charman 1992, Moore 1975; 1993, Solem 1989). It is therefore presumed that the formation of peat at Faroese sites was facilitated by a relatively cool, wet climate leading to the progressive leaching of nutrients and acidification as the soils matured through the Holocene (Lawson *et al* 2005).

During the late Holocene, the peat accumulation begun in the mid-Holocene is disturbed by the influx and deposition of silts and gravels that reduce the organic content of sediments from around 80 % to around 40 % (e.g. KAM 61, 62, 63 and 64). This change is represented in some profiles by a clast rich layer but at other profiles by an influx of silts, sands and clays, crudely bedded at a centimetre scale. Although the sediments are locally variable, a relatively abrupt change from peat to silt/gravels exists in many sites on both Suðuroy and Sandoy, in a variety of geomorphic locations, implying regional scale disturbance as opposed to site specific or micro-topographic instability. The deposition of clast and minerogenic material implies that surfaces upslope of recorded profiles were stripped of their surface cover allowing inorganic material to be liberated. For destabilisation to occur on the scale recorded in the profiles, the bare sediment or peat needs to be exposed to the surface. This requires an initial breach in the surface vegetation cover, which can be caused by water logging, prolonged snow cover, or compaction and grazing by domestic animals. If unprotected by vegetation cover, peat is vulnerable to frost action and desiccation, and can be readily degraded by wind, rain wash and biochemical oxidation (Bragg and Tallis 2001).



**Figure 7.8:** Four sediment stratigraphies and loss-on-ignition curves, indicating the timing of peat initiation on northern Sandoy, are compared with a peat/soil sequence and selected taxa pollen diagram (Lawson *et al* 2005) from the Litlavatn area of Sandoy. These profiles, along with similar measurements on eight other sequences from the Litlavatn area (Lawson *et al* 2005), illustrate that peat initiation occurred in this region prior to settlement.

Where surfaces have been previously exposed, further degradation and the removal of loose material may be caused by wind, rain, snowmelt or frost action.

The distinct change in the profile from peat to silts/gravels represents a threshold crossing event in the Faroese landscape, after which the landscape was fundamentally altered. It may be that this change was an inevitable geomorphic development given the established natural conditions resulting from the island's history of deglaciation and predominantly cool wet maritime climate. Alternatively, this development could result from a specific perturbation such as anthropogenic impact. It is therefore key to determine whether this threshold crossing event was induced by natural or anthropogenic factors, in order to assess the extent to which people have impacted the Faroese environment, or not.

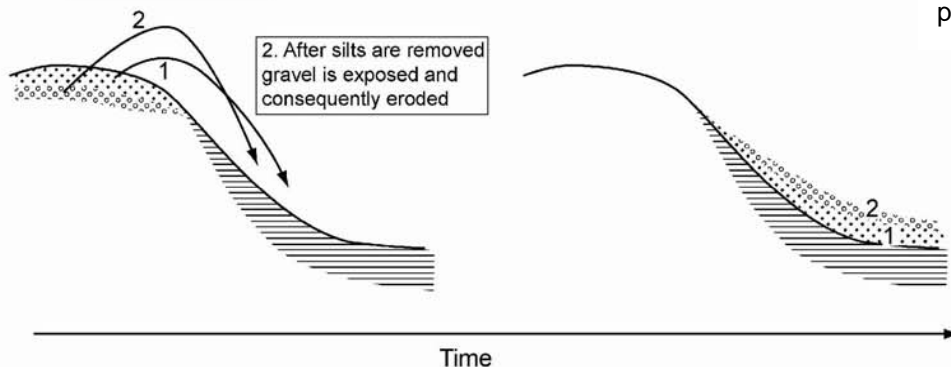
A second significant change in the near-surface stratigraphy and landscape is represented by a silt unit which lies directly over the older formations of peat and silts/gravels, and frequently forms the most recent unit in the Faroese soil stratigraphy. The top silt is widespread on both Suðuroy and Sandoy, as a discrete cm-scale, predominantly inorganic layer, and as a major minerogenic component in peats, and therefore marks a distinctive phase of geomorphological activity in the Holocene. The source areas for this unit are likely to be the highland silts formed on nunataks. Although upland silt deposits are most common in the north of the Faroes (Christiansen 1998), remnants also exist in northwest Sandoy (refer to Figure 6.13).

A key question about the top silt is whether this influx represents a new phase of geomorphic activity, i.e., the crossing of an environmental threshold, or whether the influx of fine silt represents a continuation of the phase of erosion and deposition initiated by the earlier influx of silts/gravels. Crucially, it is important to establish whether the formation of the top silt has been influenced by climatic factors such as the Little Ice Age or by anthropogenic activity. Two possible explanations are illustrated in Figure 7.9 (refer also to hypothesis 2 in Table 1.1). If gravels and (high-altitude) silts are triggered by a single geomorphic event, it is most likely that the silt would be eroded first from mountaintops/plateaux followed by the underlying gravel. In this case, the sediment profile would show silts overlying the peats and capped by gravel. Alternatively, the influx of gravel and later silt, may be the result of two separate processes. Initially, mid-high altitude slopes may be affected by peat erosion, exposing underlying gravels which are washed down slope, while glacial-age silts formed at high altitudes on nunataks are relatively unaffected. The second, and later process, would be the erosion of silts at high altitudes and deposition on slopes/at lower altitudes, capping the underlying peat and gravel layers. The sediment sequence evidence supports the latter process.

Hypothesis 1: single threshold crossing event

1. Silt is eroded from high altitude nunataks and deposited down slope

2. After silts are removed gravel is exposed and consequently eroded



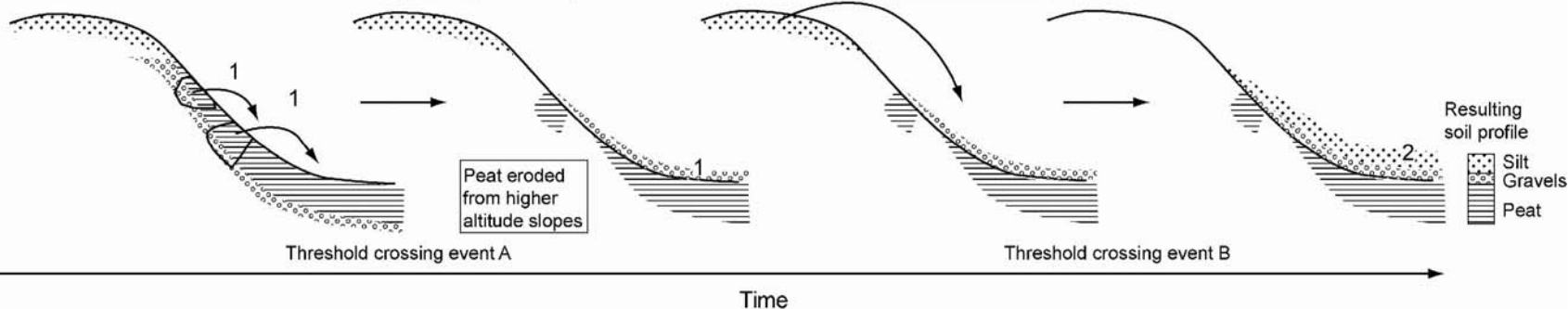
**Figure 7.9:** Figure illustrating two hypotheses to explain the formation of the “top silt” context, which is found capping the majority of profiles in both Hov and Sandoy. According to the profile evidence, the second hypothesis is the more probable process of formation.

Hypothesis 2: two threshold crossing events?

1. Peat is eroded from slopes and underlying gravels are exposed and consequently eroded

Silt deposits at high altitudes remain relatively stable

2. Erosion of silt from higher altitudes and deposition downslope

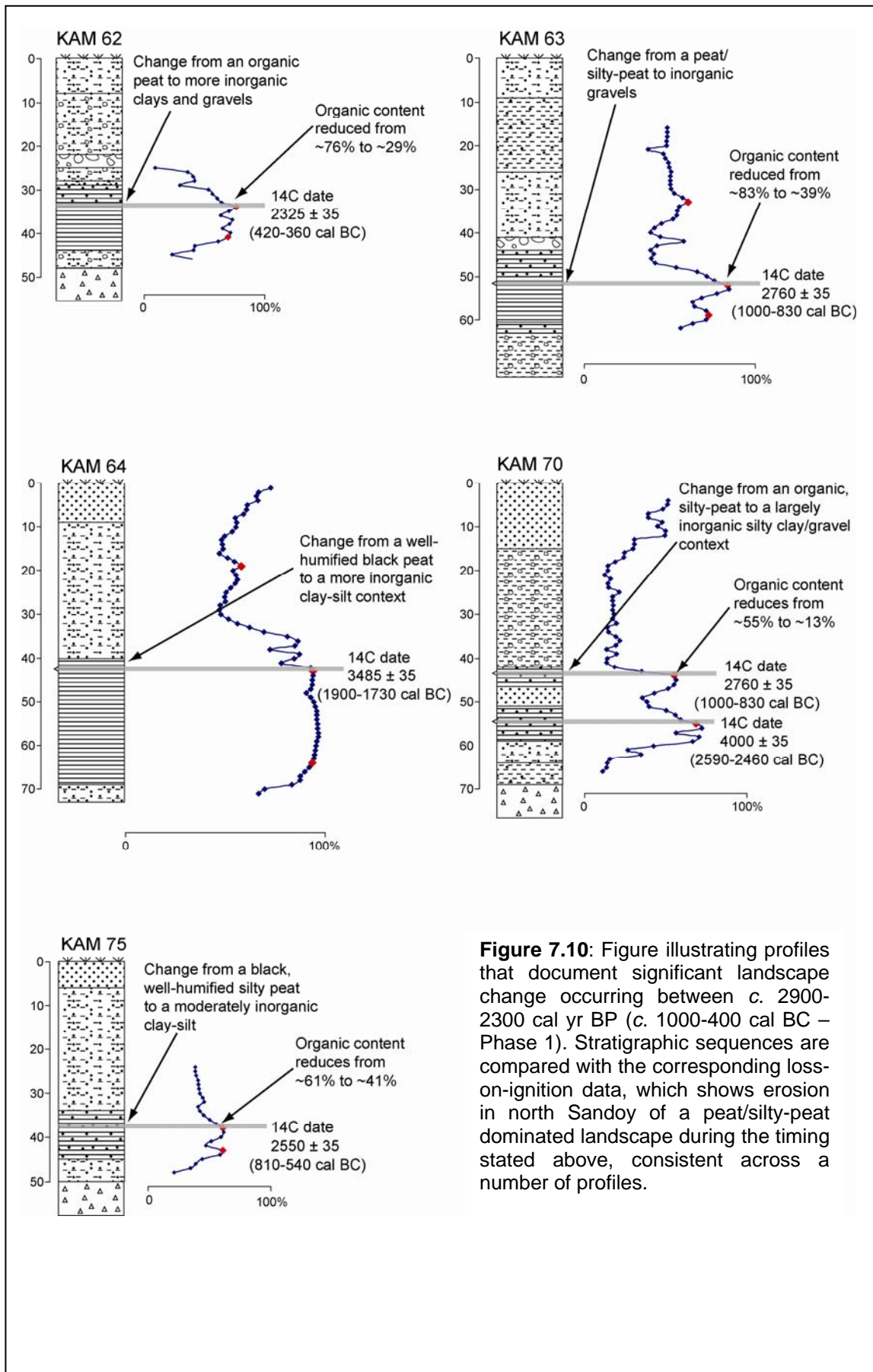


### Timing of thresholds and possible causal relationships

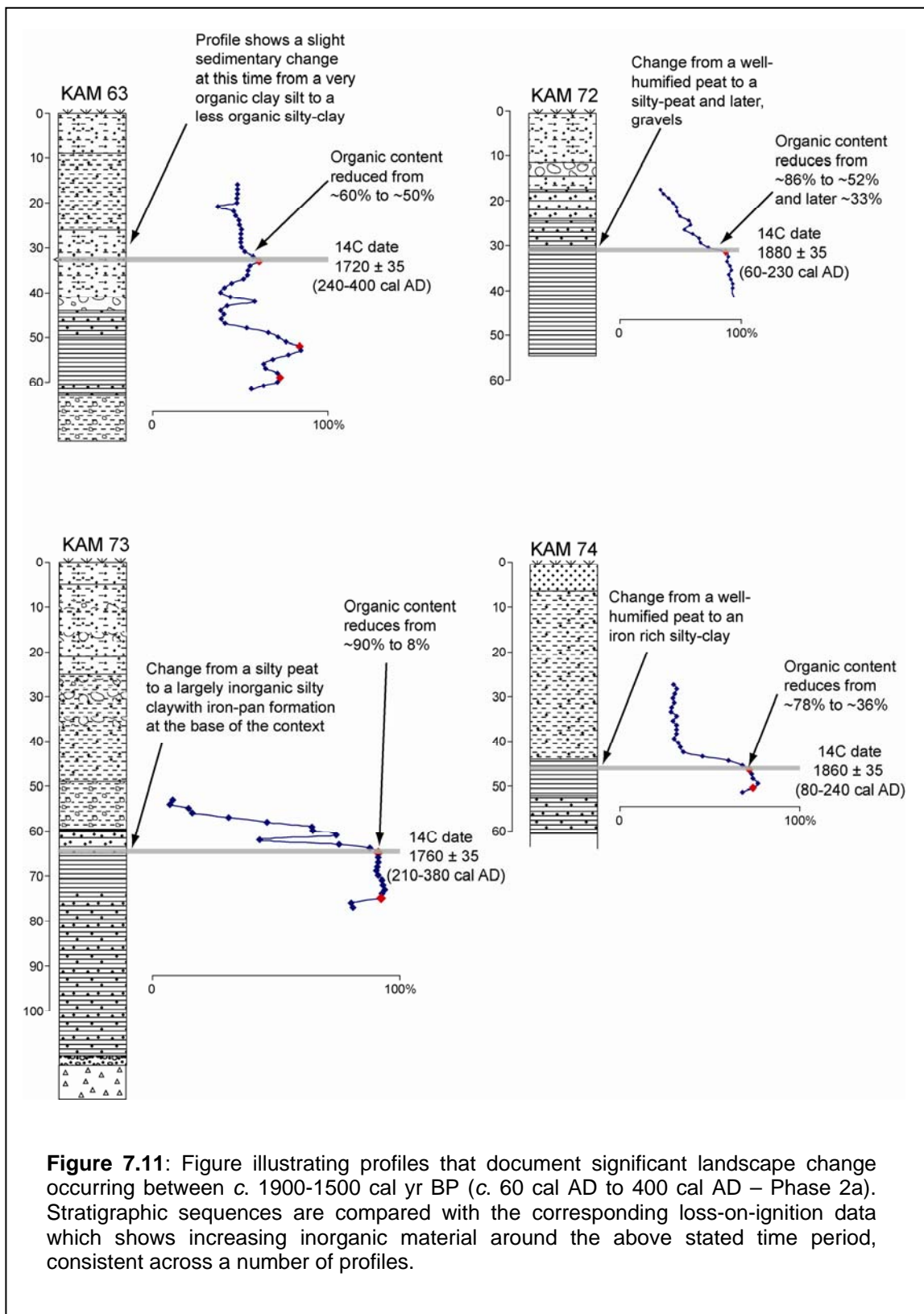
To assess the hypotheses, radiocarbon dating was used to determine the timing of the major stratigraphic and landscape changes indicated by the sedimentary change from peat to silts/gravels and the initiation of the top silt layer. Three distinct phases, where the organic content of the profiles is reduced, were dated according to loss-on-ignition analyses and stratigraphic data. The proposed phases and accompanying dates are summarised in Table 7.1. The first phase (Phase 1), illustrated most distinctly at sites KAM 62, 63, 64, 70 and 75, occurs between c.2900-2300 cal yr BP (c.1000-400 BC) (Figure 7.10). A second phase (Phase 2a) of significant landscape change occurs less extensively than Phase 1, but is evident at sites KAM 63, 72, 73 and 74 and varies in timing from c.1900-1500 cal yr BP (60-400 AD) (Figure 7.11). Phase 2b occurs at profiles KAM 3, 20, 34, 61 and 62 and ranges from c.1500-1300 cal yr BP (c.400-660 AD) (Figure 7.12). Profiles KAM27, 28 and 67, which have alluvial locations, contain a different although complimentary, record of change that is consistent with the dates on profiles recorded from exposures on slopes. Alluvial profiles are characterised by stratigraphic sections of at least 1 m deep, with the base of the profile composed of clays, sands or gravels underlying a thick and rapidly formed poorly humified peat. The change from clay/sand/gravels to peat is abrupt, both in the profiles and the LOI curves of the aforementioned profiles. The abrupt transformations in LOI measurements occur at c.1280-1370 cal yr BP (c.580-670 AD) at KAM27 and at c.1360-1520 cal yr BP (c.430-600 AD) at KAM28, although peat formation begins some time prior to this and may be a response to changes occurring c.2900-2300 cal yr BP (c.1000-400 BC). Therefore, although the alluvial and slope profiles are different and are subject to different processes, they are probably responding to a similar external trigger.

Phase	Calibrated <sup>14</sup> C dates	Calendar dates	Change in sediment stratigraphies
<b>1</b>	c.2900 – 2300 yrs BP	c.1000 - 400 BC	Distinct decrease in organic material and an increase in the movement and deposition of silts and gravels.
<b>2a</b>	c.1900-1500 yrs BP	c.60 – 400 AD	Increased slope wash and deposition of silts, gravels and clays, similar to changes in Phase 1. Phase 2a changes not observed in Hov.
<b>2b</b>	c.1500 -1300 yrs BP	c.400 – 660 AD	Increased slope wash and deposition of silts, gravels and clays, similar to changes in Phase 1. Change from clay/sand/gravels to peat in alluvial profiles.

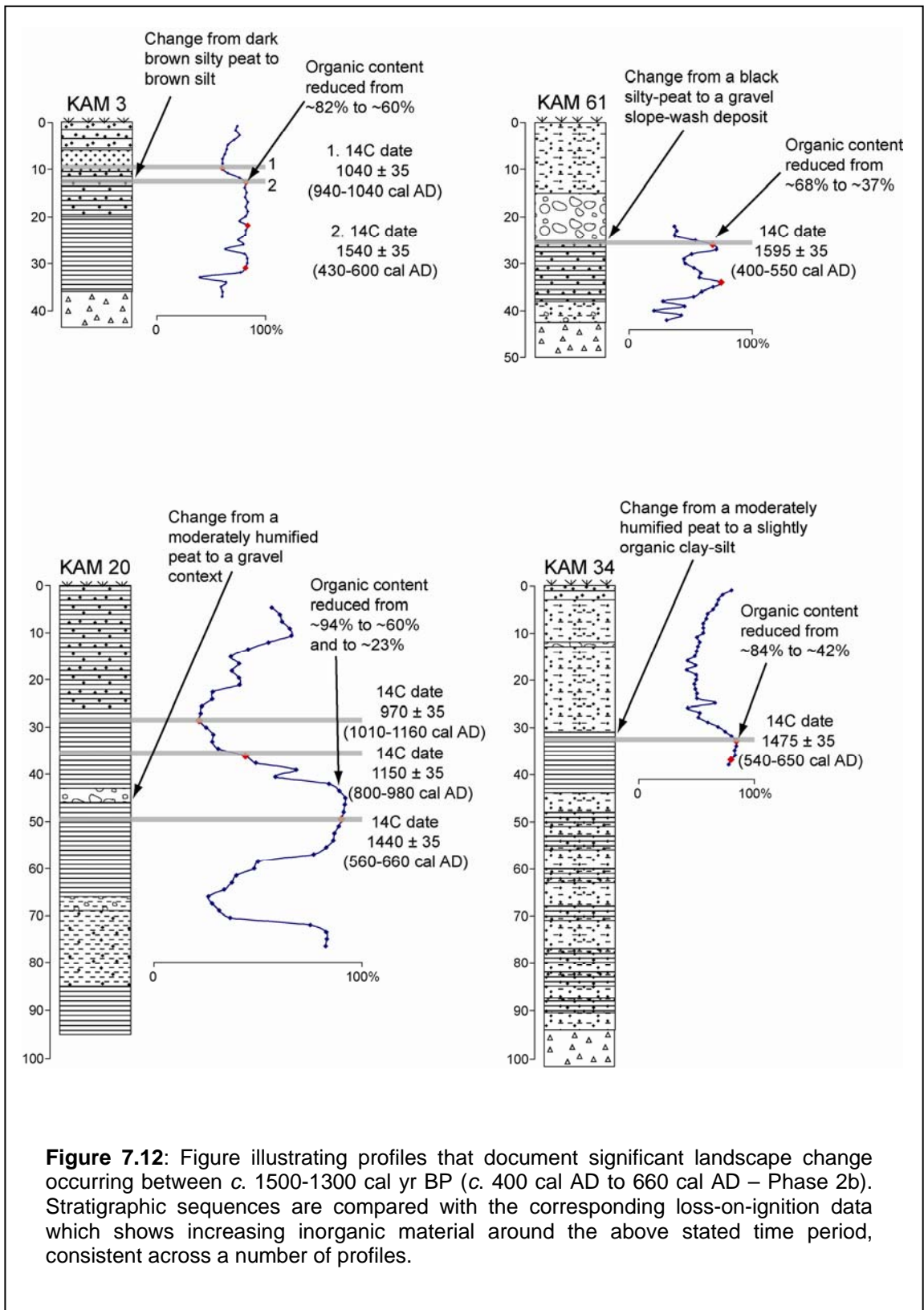
**Table 7.1:** Summary of the three phases of change as identified from the stratigraphic profile data, with key dates and associated changes in the sediment profiles.



**Figure 7.10:** Figure illustrating profiles that document significant landscape change occurring between c. 2900-2300 cal yr BP (c. 1000-400 cal BC – Phase 1). Stratigraphic sequences are compared with the corresponding loss-on-ignition data, which shows erosion in north Sandoy of a peat/silty-peat dominated landscape during the timing stated above, consistent across a number of profiles.



**Figure 7.11:** Figure illustrating profiles that document significant landscape change occurring between c. 1900-1500 cal yr BP (c. 60 cal AD to 400 cal AD – Phase 2a). Stratigraphic sequences are compared with the corresponding loss-on-ignition data which shows increasing inorganic material around the above stated time period, consistent across a number of profiles.



**Figure 7.12:** Figure illustrating profiles that document significant landscape change occurring between c. 1500-1300 cal yr BP (c. 400 cal AD to 660 cal AD – Phase 2b). Stratigraphic sequences are compared with the corresponding loss-on-ignition data which shows increasing inorganic material around the above stated time period, consistent across a number of profiles.

Phase 2a and 2b appear in the profiles as two discrete episodes of landscape impact. The earlier phase characterises some profiles and the later phase characterises others, but the two phases do not occur together in the same profile. Due to the resolution of the radiocarbon dating, it is difficult to ascertain if the two phases are related to a single external impact that is affecting different areas at different times, or whether the two phases are influenced by two distinct perturbations. The fact that both phases are not evident in the same profiles, and as there is no evidence of the earlier Phase 2a (c.60-400 AD) disturbance from any of the profiles sampled at Hov, might suggest that the two phases are the result of the same impact affecting different areas at different times, with impacts first occurring on Sandoy, and secondly at Hov.

*Climatic, ecological and environmental changes coinciding with the timing of Phase 1 (c. 2900 – 2300 cal yr BP/ c. 1000-400 BC)*

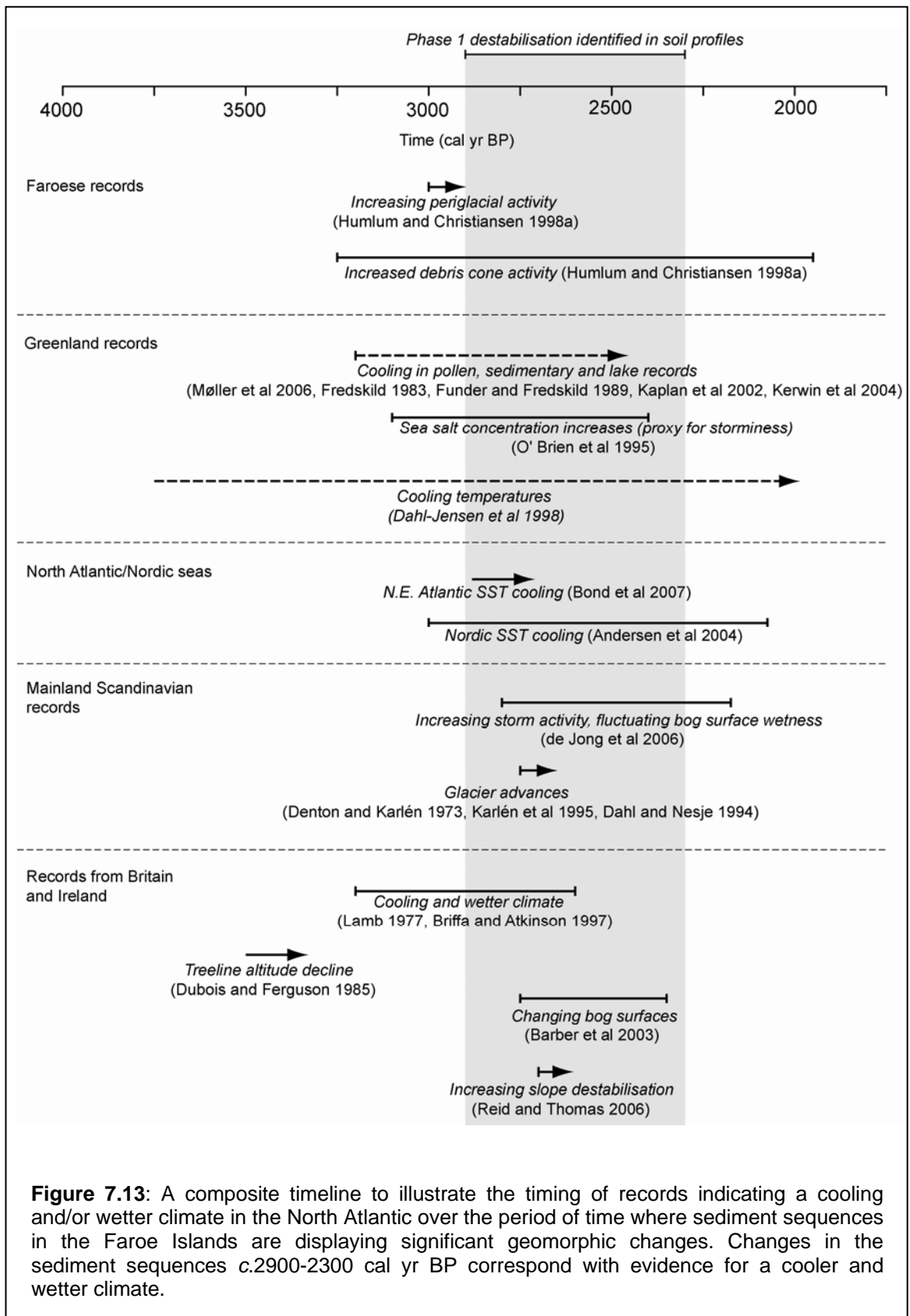
Phase 1 in the profiles indicates a pre-colonisation phase of landscape change, which is consistent with a pre-colonisation threshold crossing event indicated by hypothesis B in Figure 7.4. The timing of this change corresponds with some existing, albeit limited geomorphological and palaeoecological data from elsewhere in the Faroe Islands. Humlum and Christiansen (1998a) note that from about 8500-3000 cal yr BP, periglacial activity appears to have been relatively low, but increases in intensity after c.3000 cal yr BP. For example, increased debris cone activity occurs between c.3250-1965 cal yr BP, indicating increased periglacial activity and cooler temperatures. In Iceland, slope destabilisation and the inception of solifluction occurs after 2900 yr BP (Kirkbride and Dugmore 2005).

Significantly, at the time that the profiles are displaying signs of widespread geomorphic instability c.2900-2300 cal yr BP, there is widespread evidence for a pronounced period of cooling and more variable climate in the North Atlantic, although this period has been much debated (van Geel *et al* 1996; 1998). High resolution past surface temperature changes, applicable to the high-latitude North Atlantic region in the late Holocene, are indicated from ice core data. GRIP and Dye 3 reconstructions indicate that following a Climatic Optimum between c.8000 and 5000 yr BP, temperatures began to slowly cool, reaching a minimum around 2000 yr BP (Dahl-Jensen *et al* 1998). This correlates with the evidence of increased periglacial activity in the Faroes, as noted above (Humlum and Christiansen 1998a). A marked cooling around 3200 yr BP has also been recognised from other data sources in Greenland, including ocean sedimentary records (Møller *et al* 2006), pollen records (Fredskild 1983) and lake records (Funder and Fredskild 1989, Kaplan *et al* 2002, Kerwin *et al* 2004). Although air temperature change data can not simply be translated to areas outside Greenland (Dawson *et al* 2003), there is evidence supporting climatic changes at this time from elsewhere in the North Atlantic, which would suggest that deteriorating climate affected

much of north-west Europe. For example, a repeated southward incursion of ice-rafted debris associated with sea surface cooling of up to 2° C in the eastern North Atlantic as far south as northern Scotland, occurred about 2800 cal yr BP (Bond *et al* 1997). In the Nordic seas a cooling in sea-surface temperature (SST) of 1.5° C is recorded, starting at around 3000 cal yr BP and culminating in a SST low around 2100 cal yr BP (Andersen *et al* 2004). In south west Sweden, an increase in storm activity, indicating a dominance of cold and stormy winters and strongly fluctuating bog surface wetness, is identified between 2800-2200 cal BP (de Jong *et al* 2006). The storm activity increase in Sweden coincides with increases in sea-salt concentration, which are documented for the period 3100-2400 yrs BP in the Greenland GISP2 record (O'Brien *et al* 1995) and has been used as a proxy for storminess in the North Atlantic (Dugmore *et al* 2007a). Correlating with cooling SSTs are glacier advances at c.2750 yrs BP, reported from northern Sweden (Denton and Karlén 1973, Karlén *et al* 1995) and southern Norway (Dahl and Nesje 1994).

There is also an established view in the British Isles that at c.3200-2600 cal yr BP there was a marked change from a relatively warm, dry climate to a relatively cool, wet climate (Lamb 1977, Briffa and Atkinson 1997). This is supported by both pollen research that has highlighted evidence for deteriorating conditions after 3200 cal yr BP and tree line data (Birks *et al* 1996). Evidence from the Cairngorms in the Scottish highlands infers a marked decline in the treeline altitude after around 3500 cal yr BP, suggesting an onset of cooler, windier conditions (Dubois and Ferguson 1985). Vegetation reconstructions from three profiles spanning 425 km from western Ireland to northern England have been related to changing bog surfaces and phase shifts to a wetter and/or cooler climate, which occur in all three profiles at 3200 cal yr BP and 2750-2350 cal yr BP (Barber *et al* 2003). Recent geomorphological research in the Scottish highlands (Reid and Thomas 2006) also implicates climate forcing to account for increasing magnitude and frequency of slope destabilisation after 2700 cal yr BP, consistent with the timing of slope destabilisation in Iceland (Kirkbride and Dugmore 2005), with similar effects to that recorded in the stratigraphic and landscape data of the Faroe Islands. A timeline summarising the timing of these changes and comparing them with the Phase 1 changes observed in this research is presented in Figure 7.13.

It would be expected that the Faroe Islands would respond to climatic changes at this scale because of their position, situated at the meeting of warm and cold ocean currents which makes them particularly sensitive to the effects of temperature changes of the surrounding water (Hansen 1996). Therefore according to the stratigraphic and surface geomorphological evidence, combined with data from other research, it is proposed that a period of climatic variability, more specifically cooling temperatures and increased winter storminess and wetness, around 3000 yr BP, caused increased periglacial and other climate-related



geomorphic activity at high altitudes. This led to the breaching of the vegetation cover and consequent liberation of aeolian and fluvial sediments and gravels, resulting in deflation of high altitude plateaux. The influx of highly minerogenic material fragmented the uniform peat layer, transforming the previously peat dominated landscape into a more varied soil and vegetation surface.

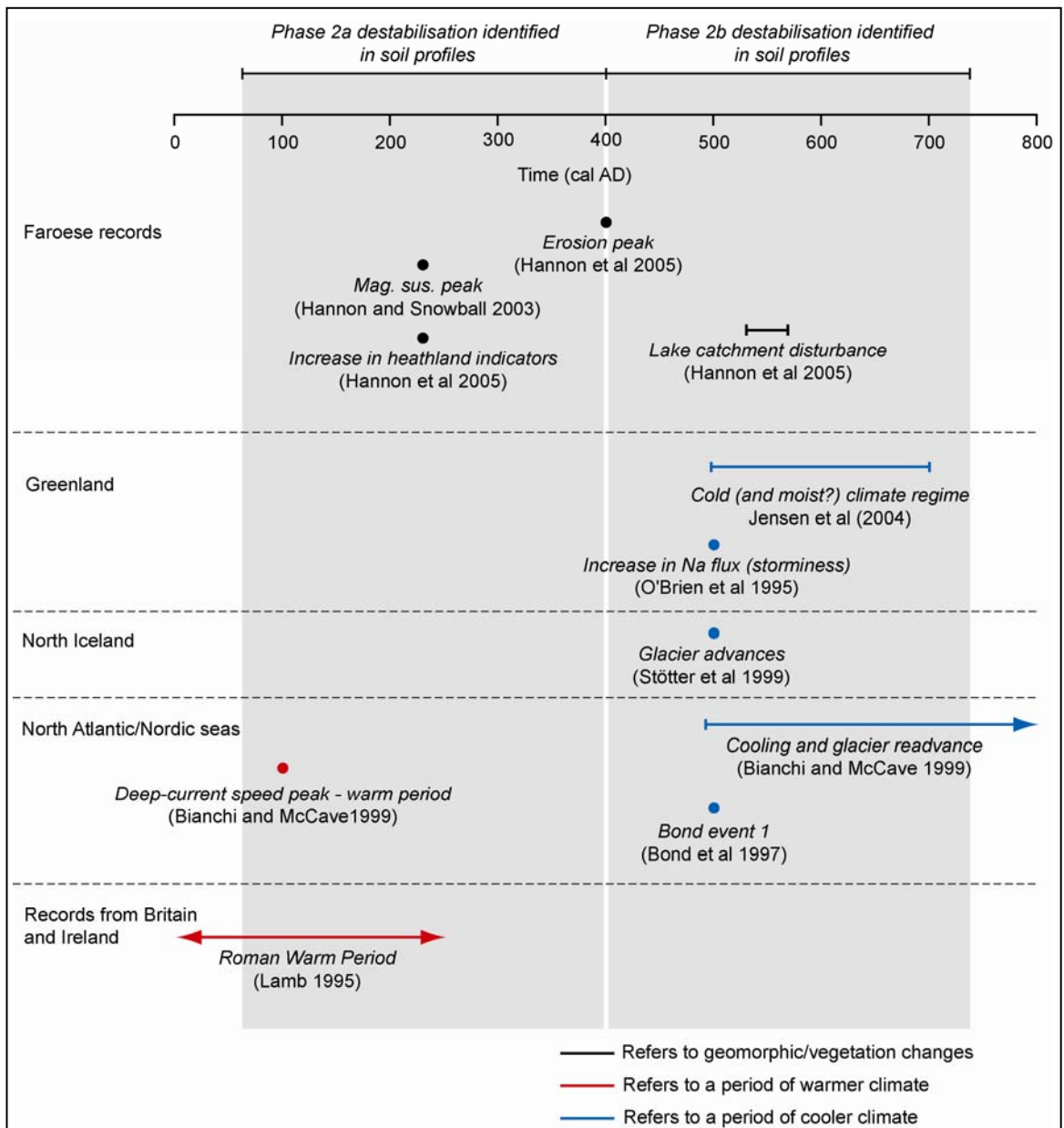
*Climatic, ecological and environmental changes coinciding with the timing of Phases 2a (c.1900-1500 cal yr BP/60 AD to 400 AD) and 2b (c.1500-1300 cal yr BP/400 AD to 660 AD)*

Evaluating the timing and causes of the landscape change represented by Phases 2a and 2b is more difficult because the timing of Phase 2b, in particular, is coincident with the first indications of settlement as suggested by palaeoenvironmental data (Jóhansen 1979, Hannon and Bradshaw 2000, Edwards *et al* 2005). It is therefore more difficult to separate out those impacts that might be climatically influenced from those that might be associated with the initial impacts of people. In Iceland, tephrochronology allows both precise and accurate dating control to correlate cultural impact with landscape change (e.g. Simpson *et al* 2001, Dugmore *et al* 2000; 2006, Mairs *et al* 2006), but in the Faroe Islands, this is problematic. Firstly, although at least six Icelandic Holocene tephra layers are present in the Faroes, the majority are microscopic deposits of limited volume (Dugmore and Newton 1998, Persson 1966; 1967, Jóhansen 1975; 1982, Mangerud *et al* 1986), which makes it difficult to determine if the particles have been deposited *in situ* or have been reworked, therefore complicating the identification and application of the time-parallel marker horizons that make tephrochronology so effective in Iceland. Secondly, volcanic particles arrive in the Faroe Islands by routes other than fallout from volcanic plumes. The gradual rise in a background flux of tephra grains of mixed compositions in recent Faroese peats is probably due to the erosion of Iceland's soils, local erosion of Faroese peats containing older tephra, and reworking of pre-Holocene volcanic sediments from within Faroese tuffs (Dugmore and Newton 1998).

The lower resolution of radiocarbon dating techniques, combined with the relatively short profiles, complicates our understanding of the chronology of Phase 2a and 2b. However, several coincident dates confidently place Phase 2a to c.60-400 AD (c.1500-1900 cal yr BP). Phase 2a is unlikely to be a disturbance exclusive to Sandoy (although, to date, the best evidence is from here), because there is other evidence for environmental changes at this time elsewhere in the Faroes. For example, the reduction of organic matter in the stratigraphic profiles corresponds with a phase of heathland spreading and an associated peak of erosion dating from 250-400 AD, recorded from a lake core at Heimavatn on the island of Eysturoy in the northern Faroe Islands (Hannon *et al* 2005). A comparable peak in magnetic susceptibility dating to c.230 AD was also recorded at Gróthúsvatn lake on Sandoy

(Hannon and Snowball unpublished 2003, cited by Hannon *et al* 2005). Heathland spread, involving a shift from *Juniperus* and *Cyperaceae* to *Ericaceae*, has also been recorded around this time at various sites in the Faroes including Tjørnuvík on Streymoy in the northern Faroes (Hannon and Bradshaw 2000), Korkadalur in Mykines in the far west of the archipelago (Hannon 1997 unpublished, cited by Hannon *et al* 2005) and Argisbrekka on Eysturoy (Hannon and Bradshaw 2005). Although elsewhere in Europe the spread of heathland is most often associated with anthropogenic impact, such as in Shetland (Bennett *et al* 1992) and Norway (Kaland 1998), in the Faroes the local spread of heathland changes and a corresponding peak in slope erosion have been associated with a climatic driver (Hannon *et al* 2005). Heathland vegetation is influenced by differences in climate, geology, topography and soil type. Cool, wet impoverished conditions that inhibit the complete decomposition of organic material, and accumulations of acid humus that further accelerate leaching, may influence heathland vegetation, however, the development of heathland in the Faroes in the absence of anthropogenic interference would be a unique situation in Europe in the Holocene.

At the time these changes are recorded in the lake sediments (Hannon *et al* 2005), however, there is a lack of evidence for a climatic driver, such as decreasing air temperatures, increased storminess or increased precipitation, which is required to cause the spread of heathland and increased slope destabilisation. The period around 100 AD is notable for its warm rather than cold climate (Bianchi and McCave 1999) and has been referred to as the Roman Warm Period in the literature (Lamb 1995). A relatively abrupt incidence of climatic cooling is recorded around 450-500 AD (c.1500 cal yr BP), which has been identified by several palaeoenvironmental records, such as tree ring data from Finland (Eronen *et al* 1999), sea-surface temperatures based on diatom stratigraphy in the Norwegian sea (Jansen and Koç 2000, Andersson *et al* 2003, Bianchi and McCave 1999), Bond's event 1 in North Atlantic sediments (Bond *et al* 1997) and rising lake levels, increased bog growth and a peak in lake catchment erosion in Scandinavia (Berglund 2003) (Figure 7.14). However, the timing of this climatic deterioration occurs up to three centuries after environmental and vegetation disturbance indicated by Phase 2a is recorded in the Faroe Islands. Although the response of vegetation to climatic change can be rapid, as has been illustrated by vegetation response following the Younger Dryas (e.g. Kneller and Peteet 1999, Peteet *et al* 1990), a lag time of some sort would be expected between the onset of a cooling climate and the response of vegetation and soils. To account for the spread of heathland in the Faroes at c.250 AD, therefore, the climate would be expected to be deteriorating prior to this, yet the evidence is that the North Atlantic climate was relatively warm at this time. Therefore climatic deterioration is not easily reconciled with the geomorphic and vegetation evidence during this period and without more consistent high resolution dating and new evidence,



**Figure 7.14:** A composite timeline to illustrate the timing of geomorphic and vegetation records in the Faroe Islands and records indicating a cooling or warming climate in the North Atlantic, over the period of time where sediment sequences in the Faroe Islands are displaying significant geomorphic changes (phase 2a and phase 2b). Changes in the Faroes sediment sequences c.60-400 AD do not correlate with any periods of known climate cooling.

temperature changes cannot be definitively correlated with the observed landscape changes of Phase 2a.

With no clear indication of deteriorating climate at this time, other drivers that could be involved in the spread of heathland and the incidences of increased erosion, recorded by Hannon *et al* (2005) and in stratigraphic evidence from Sandoy, need to be considered. Naturally increasing acidification, which is related to a particular local combination of bedrock, soil and vegetation, is a possibility, but such changes would be difficult to distinguish from those arising from increasing rainfall. Furthermore, increased leaching does not account for the evidence of increased soil and slope erosion, which requires an external perturbation to breach the vegetation cover. Natural vegetation dynamics can also disrupt the balance between bedrock, soil and vegetation, but with the Faroes being largely devoid of trees in prehistory, this is unlikely to account for changes at an inter-island scale. Likewise, with a lack of indigenous grazing animals or mammals, natural dynamics within pre-colonisation animal populations such as birds, are unlikely to have contributed to the vegetation disturbance indicated at this time. Fires may induce vegetation change but are unlikely to have taken place on such a regional scale in the Faroe Islands and there is no evidence for significant and regional incidences of naturally caused burning.

A remaining alternative driver of this type of landscape change is human impact, and anthropogenic activity has been indicated as accounting for a similar spread of heathland elsewhere in Europe. At present, there is no firm evidence of settlement prior to the 6<sup>th</sup> century AD, but the fact that people were present in the islands before the Viking Age, as detailed by recent palaeoenvironmental research (Hannon *et al* 2005), suggests that an even earlier human presence may be possible. There are other interpretations of the palaeoenvironmental data that also suggest human occupation could have occurred earlier than the 6<sup>th</sup> century, in particular, the wide spatial extent of anthropogenic-related palaeoecological evidence from sites across the Faroes, including Tjørnuvík on Streymoy, Eiði on Eysturoy, Hov on Suðuroy and Mykines. The dispersed site locations producing environmental indications of early settlement reflect an extensive occupation of the islands by the 6<sup>th</sup> century AD. Therefore, pre-6<sup>th</sup> century human presence, either as a periodic exploitation of resources or through the introduction of livestock as a provisioning strategy, is a possibility. Without more precise and accurate dating and associated archaeological and climate evidence, the nature of increased erosion and vegetation change around 100-200 AD can not be conclusively determined. However the prevailing view that these changes are forced by increased storminess and declining atmospheric temperatures (Hannon *et al* 2005) does not confidently fit the chronology of climate change as is presently understood. The simplest alternative explanation is the early presence of people or livestock.

Phase 2b is dated to c.400-660 AD, and again this phase is contemporaneous with the limited evidence of vegetation and landscape disturbances recorded elsewhere in Faroe Islands in the 6<sup>th</sup> and 7<sup>th</sup> centuries (Hannon *et al* 1998; 2001; 2005, Hannon and Bradshaw 2000, Jóhansen 1971; 1979; 1985; 1995, Edwards *et al* 2005a) (refer to Figure 7.14). Some of the changes detailed can be unequivocally related to the presence of people, such as the appearance of cereal-type pollen and domestic animal bones (although the absence of these elements does not prove that people were also absent). Other palaeoenvironmental impacts at this time are not dependent on the presence of people, such as increases in erosion, but their occurrence in conjunction with unequivocal anthropogenic evidence is suggestive of human influence. The timing of the Phase 2b changes is also coincident with the timing of an abrupt climatic deterioration around 500 AD (1500 cal yr BP), which is identified by several sources that are referenced above. With awareness of the longer-term landscape trajectory for the Faroes and of the extent of geomorphic changes occurring c.2900-2300 cal yr BP, which may have de-sensitised later impacts, a smaller scale climate cooling in the 6<sup>th</sup> century AD may not have been significant enough to have caused the changes seen in the environmental record; high altitude areas most susceptible to climatic changes had already been deflated by changes pre-colonisation.

#### **Conclusions: how did pre-colonisation landscape change affect settlement?**

Within the relatively dynamic Holocene history of landscape change in the Faroes, there have been two significant thresholds crossed in the southern Faroe Islands of Sandoy and Suðuroy, occurring in the late Holocene. The most significant of these occurred prior to colonisation, between c.2900-2300 cal yr BP (c.1000-400 BC), and is characterised in soil stratigraphies by a distinct decrease in organic material and an increase in the movement and deposition of silts and gravels, indicating an increase in slope erosion. The timing of this landscape change correlates with widespread evidence for cooling air and sea temperatures, increased storminess, and an increase in extreme precipitation and wind events with climatic shifts in Greenland and the North Atlantic region. A second, less distinct threshold crossing, occurs later in the Holocene, c.1900-1300 cal yr BP (c.60-660 AD), as two different phases; an earlier phase c.1900-1500 cal yr BP (c.60 - 400 AD), and a later phase c.1500-1300 cal yr BP (c.400-650 AD). Both phases are typified by increased slope wash and deposition of gravels, silts and clays, similar in character to Phase 1. Significantly, Phases 2a and 2b may comprise a single threshold, which is crossed at different times in different places, as profiles are only characterised by one phase or the other, with Phase 2a not observed at Hov at all. The two phases are probably manifestations of a response to an equivalent trigger which affects the sites examined at different times, and in particular affects sites at Sandoy earlier than those at Hov. Climatic deterioration is proposed as the causal mechanism in existing research, but a period of climatic deterioration is not identified in North Atlantic

palaeoenvironmental records until c.500 AD, several centuries after the earliest dating of the Phase 2a landscape disturbance. The later erosion phase, c.400-660 AD, does correspond with this documented period of climatic deterioration but is also coincident with the timing of human settlement as illustrated by palaeoenvironmental evidence. Human occupation is the simplest alternative explanation for the documented increases in erosion but as yet there is no firm evidence of human occupation in the Faroes prior to the 6<sup>th</sup> century. The issue to be resolved, therefore, is whether people could have arrived on the Faroe Islands earlier than the 6<sup>th</sup> century AD. To account for the timing of landscape change, people or domestic animals would have needed to have arrived on the islands by at least c.200 AD.

The landscape impacts sustained c.2900-2300 cal yr BP (c1000-400 BC) were the most significant in terms of landscape change in the late Holocene. There is evidence that vegetation cover was stripped from higher altitudes and mountaintop locations so that these surfaces were already exposed to erosion prior to colonisation. As well as a landscape disturbance at this time being noted in the profiles, distinctive landforms such as the box gullies at Hov also indicate that geomorphic change took place on a greater scale prior to colonisation, while indications of geomorphic changes since colonisation are less significant in terms of landscape impact. With regards to the question of whether human or natural impacts have been the major determinant of the present day surface landscape, several key elements of the present landscape were already well established by the time of the arrival of people in the islands. In addition, pre-colonisation landscape changes would have reduced the sensitivity to settlement, as widespread pre-colonisation erosion at high altitudes and on slopes to some extent desensitised the environment to consequent anthropogenic change. The destabilisation of slopes could also have been beneficial in breaking up monotonous peats and creating areas more suitable for grazing.

### **7.3 Human impact in the southern Faroe Islands**

#### **The impact and geomorphic significance of *landnám***

The term *landnám* meaning “land taking” is used to refer to the Norse colonisation of the North Atlantic Islands. Identifying the nature and timing of Norse *landnám* or earlier colonisation is therefore crucial to our understanding of the extent to which people influenced the Faroese environment and in a wider context, crucial to our understanding of the nature and extent to which landscapes in general are influenced by human activity.

A typical response of landscapes to human settlement is an increase in erosion (Edwards and Whittington 2001), often as a result of the destruction of vegetation that binds together the top soil, caused by deforestation, cultivation, overgrazing or trampling. Although research

suggests that settlement impacted Faroese vegetation, resulting in the final removal of most woody vegetation, particularly birch and juniper (Hannon *et al* 2005, Edwards *et al* 2005), deforestation is unlikely to have been geomorphologically significant because pre-colonisation woodland densities were low. Pollen data from Sandoy indicates that anthropogenic impact on vegetation was both subtle and gradual (Lawson *et al* 2005) with a lack of evidence for abrupt vegetation change. The impact of early cultivation on the wider Faroese landscape is also negligible, as the extent of land that can be cultivated is severely limited by the mountainous and sloping topography, the small-scale island geography and a cool, wet climate. Erosion and significant *landnám* or colonisation impacts resulting from deforestation and cultivation are therefore restricted, but erosion caused by the introduction of domesticated livestock would be expected to have been more significant. The islands at the point of settlement would have been well suited to grazing, because of the open grassy slopes and plateaux (the former which provided excellent grazing because of guano nourishment by the abundant sea birds) and the lack of predatory mammals.

Over-grazing, is a considerable cause of soil erosion, as has been shown to have been the case not only in North Atlantic and other island environments, but in countries and continents around the world. The introduction of grazing animals to the Faroes with the first settlement is, therefore, likely to be the key element of colonisation impact. The impact of grazing is dependent not only on the absolute numbers of livestock introduced, but also on how that livestock is managed, taking into account factors such as the quality of shepherding, where livestock is allowed to graze, and at what times of the year grazing takes place. Livestock introduced by the first Faroese settlers may have only been in limited numbers as they are likely to have had boats with limited cargo capacity. Furthermore, the number of cattle introduced to the Faroes is limited by the extent of fodder that can be grown, although sheep and goats could be over-wintered in the outfields. There is also the possibility that the introduction of livestock may have been a precursor to permanent human settlement.

In the soil profile it is difficult to identify the specific impacts of *landnám* while the dating of *landnám* remains disputed. What is evident from the soil stratigraphy is that no specific geomorphic disturbance, such as an abrupt deposition of gravel or initiation of a longer-term influx of silt material, is evident in the profiles around the 9<sup>th</sup> century. This is, however, what would be expected if *landnám* was significant, and if the islands were settled in the 9<sup>th</sup> century, as is generally accepted. This has various implications; firstly that landscape evidence for 9<sup>th</sup> century changes exists, but that the profiles were recorded from locations where that impact wasn't identifiable. This is unlikely given the range of profiles and the varied locations at which they were recorded. Secondly, it is possible that there are dating errors, but again this is unlikely given the number of dates taken on a wide range of samples and considering the range of corresponding dates from other palaeoenvironmental research,

both in the 6<sup>th</sup> century and earlier. Colonisation, or at least human interference in the islands through the introduction of livestock, therefore either occurred at an earlier date, in the 6<sup>th</sup> century or earlier, which is endorsed by geomorphic impact recognised in the sediment profiles, or alternatively, *landnám* disturbance in the 9<sup>th</sup> century was not significant enough to cause an impact recorded by the sediment profiles. The latter outcome would, however, be contrary to most other island colonisation research where settlement impacts are recognised in the environmental record by an increase (even if limited) in soil and slope erosion.

The formation of the top silt illustrated by the sediment profiles (refer to Figure 7.9) is crucial to understanding the geomorphic significance of colonisation/Norse *landnám*. If the colonisation of the islands by people caused the erosion of silts from higher altitudes and their deposition at lower altitudes, then colonisation has had a significant impact, enough to cause a threshold crossing event. If the formation of the top silt is the result of natural factors, such as a deteriorating climate in the Little Ice Age, then colonisation has had a limited impact. The stratigraphic data indicates a second disturbance following the initiation of peat erosion and deposition of gravel occurring c.2900-2300 cal yr BP, which supports the second hypothesis illustrated by Figure 7.9 and the alternative hypothesis 2 in Table 1.1. Plausible triggers for the erosion and deposition of silt are human impact in the 6<sup>th</sup> century or earlier, or deteriorating climate in the Little Ice Age beginning around the 13<sup>th</sup> century (Grove 1988, Mann *et al* 1998, Jones *et al* 1998, Bradley and Jones 1993, Hughes and Diaz 1994, Crowley and Lowery 2000, Lassen *et al* 2004). The onset of the Little Ice Age is, however, inconsistent with dating of the profiles which indicates silt influx in the profile and formation of the top silt prior to the onset of the Little Ice Age.

Therefore early colonisation impacts, although more limited than previously climatically driven impacts, are significant in terms of the wider Holocene Faroese landscape and represent a second threshold crossing event in the longer-term environmental trajectory. There is, however, little environmental evidence for a significant Norse *landnám* in the 9<sup>th</sup> century.

### **The geomorphic significance of post-*landnám* anthropogenic impact**

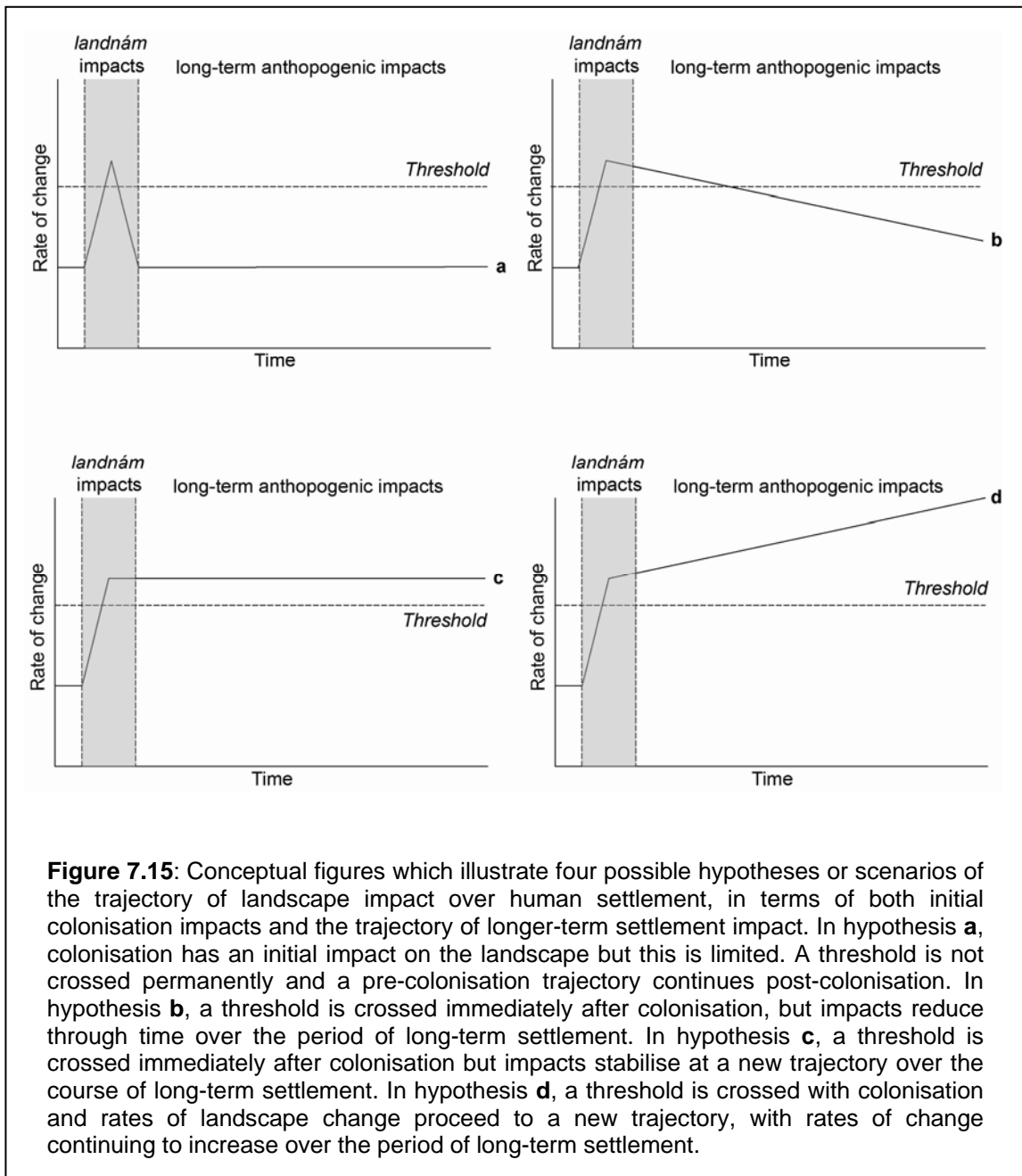
When previously uninhabited islands are first colonised by people, initial impacts may be considerable as the environment initially responds to new and additional pressures. Initial impacts are generally characterised by a relatively abrupt and significant increase in sediment erosion and accumulation. Long-term anthropogenic impact, although of lower magnitude, is also significant, because impacts are able to accumulate over a longer period, shaping the landscape gradually but continuously. It is therefore useful to consider how anthropogenic activities and their impacts accumulate over the course of settlement. One

hypothesis is that human impacts diminish through time as people adapt their subsistence practices to the specific landscape, geographical and climate conditions of the islands. An alternative hypothesis is that human impact accumulates and increases because populations grow and people continue to carry out activities that may be environmentally unsustainable over millennial scales. Natural factors, such as climate, may also exemplify human impacts unless subsistence strategies are amended (refer to hypothesis 5 in Table 1.1). Figure 7.15 illustrates four hypothetical landscape trajectories showing how impact may change over human settlement, in terms of both initial colonisation impacts and longer-term settlement. Figure 7.16 conceptually explores the range of outcomes of human impact based upon the initial natural capital available to the settlers in the Faroe Islands.

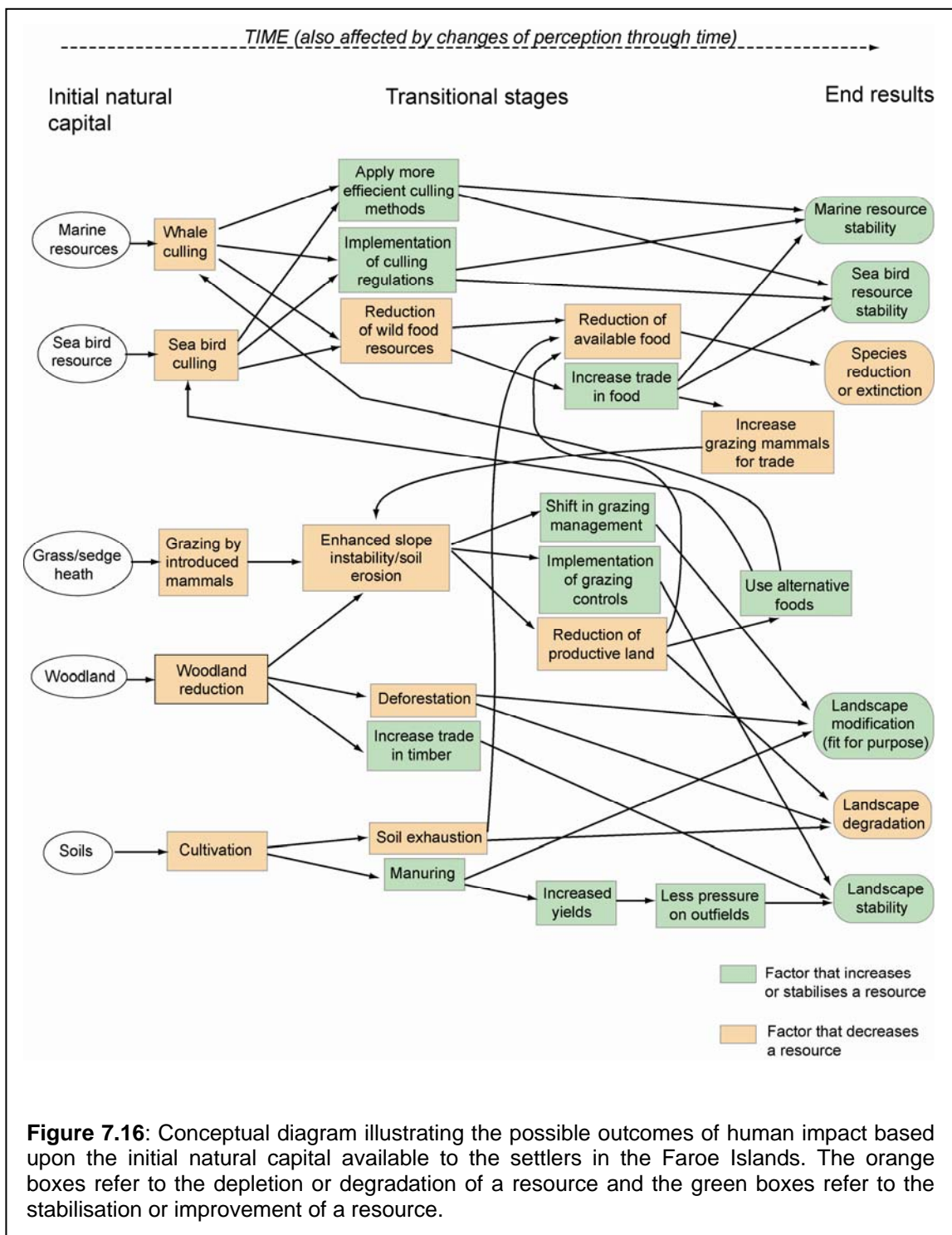
Due to the resolution of the stratigraphic profiles over the timing of human interaction in the Faroes, and because these activities have accumulated slowly over a longer-term period and cannot be observed as abrupt changes in the sediment profiles, it is difficult to identify specific changes that may be associated with anthropogenic impact. However, by addressing alternative scales of landscape change, such as the spatial pattern of degradation indicated by vegetation cover, landscape change at a localised scale is highlighted. Archaeological and ethnographic data also illustrate evidence of human activity and their possible effects on the landscape and can be used to develop an understanding of how cultural activity may have been environmentally significant at different landscape scales. As deforestation and cultivation impacts over a longer-term period are unlikely to have been significant in terms of environmental change and impact, the following discussion will focus on impacts of grazing and resource exploitation, particularly that of peat.

#### *The significance of long-term grazing impacts*

Sheep have been the dominant form of livestock in the Faroes since settlement, and although cattle and pigs also comprised a significant percentage of domestic animals in the Norse period (Church *et al* 2005), sheep grazing has been the most important cultural and economic activity prior to the rise of the modern fishing industry. Sheep have been important economically, with wool the most important Faroese export prior to the rise of the Faroese fishing industry in the 19<sup>th</sup> century. Sheep also provide a continuity of cultural meaning as they are present in nearly all aspects of Faroese life. For example, economic and legal order since the 13<sup>th</sup> century have been near synonymous with rules and regulations concerning sheep management and the raising of hay for sheep (Gaffin 1996). With such an emphasis on sheep, and with sheep-related activity so dominating Faroese culture and economy, it would be reasonable to suggest that grazing of livestock, particularly sheep, would also dominate the post-colonisation landscape record. Grazing has the potential to affect a wide geographical area and spectrum of altitudes, sparing only the more inaccessible peaks and



**Figure 7.15:** Conceptual figures which illustrate four possible hypotheses or scenarios of the trajectory of landscape impact over human settlement, in terms of both initial colonisation impacts and the trajectory of longer-term settlement impact. In hypothesis **a**, colonisation has an initial impact on the landscape but this is limited. A threshold is not crossed permanently and a pre-colonisation trajectory continues post-colonisation. In hypothesis **b**, a threshold is crossed immediately after colonisation, but impacts reduce through time over the period of long-term settlement. In hypothesis **c**, a threshold is crossed immediately after colonisation but impacts stabilise at a new trajectory over the course of long-term settlement. In hypothesis **d**, a threshold is crossed with colonisation and rates of landscape change proceed to a new trajectory, with rates of change continuing to increase over the period of long-term settlement.



**Figure 7.16:** Conceptual diagram illustrating the possible outcomes of human impact based upon the initial natural capital available to the settlers in the Faroe Islands. The orange boxes refer to the depletion or degradation of a resource and the green boxes refer to the stabilisation or improvement of a resource.

gullies, and would impact across a long time continuum beginning with initial settlement. If not effectively managed, sheep grazing can lead to compaction and breaching of the vegetation cover, reduced infiltration and increased runoff. This results in increased soil erosion and long-term landscape degradation, which has been demonstrated in the environmental records of other North Atlantic environments, particularly Iceland (e.g. Arnalds 1987, Simpson *et al* 2001). The continuing influx of silt forming a top soil in sediment stratigraphies may be related to the impact of grazing, but rather than the organic content of the soil decreasing, which would be expected if grazing intensified over settlement, LOI profiles in Hov show an increasing soil organic content from around the 12<sup>th</sup> century (e.g. KAM3 and KAM20).

Geomorphic mapping of surface degradation also illustrates the extent of erosion potentially attributable to grazing. Although surface erosion is not visible on the same scale in the Faroes as it is in Iceland, altitudes above 350 m on north Sandoy, which are subject to periglacial activity, are heavily degraded. Underlying till or bedrock is exposed and less than 10 % vegetation and soil cover, in terms of area, remains. Between altitudes of around 100-350 m, vegetation cover generally comprises around 40-60 % of the landscape surface, although at certain locations especially on south west facing slopes, slopes are well vegetated to altitudes of 350 m. Except for a few exceptions close to the settlement of Sandur where surface degradation has occurred, low altitude locations (i.e. <100 m) are 90-100 % vegetated (refer to Figure 6.9).

The sediment stratigraphic and surface landscape evidence suggests that although grazing probably triggered an initial increase in soil erosion, this remained on a small scale, and may even have decreased through the settlement period. Other research conducted on this subject in the Faroes is limited, but has concluded that grazing pressure was probably insufficient to contribute to major and rapid change in vegetation cover and therefore would not have contributed significantly to historic soil erosion (Thompson *et al* 2005, Humlum and Christiansen 1998a). Modelling of livestock rangeland areas in the outfields of Hov, Sandur and Leirvík (Eysturoy) indicates low numbers of stock relative to the carrying capacity. This suggests that although usable biomass declined with the onset of grazing activity, it was not at a level that would cause major changes in vegetation cover or contribute to soil erosion, even under climatically determined poor growth conditions (Thompson *et al* 2005).

There is also geomorphological evidence within the field site locations to suggest that early on, the settlers made improvements to the landscape to increase productivity, although this had mixed results. Relic drainage ditches were observed in the outfields of both Porkeri, close to Hov, and on Sandoy. In Sandoy, one of these drainage ditches extends from an altitude of c.274 m to c.180 m at a diagonal to the slope, cutting through a landscape which

is now in places almost completely degraded (refer to Figure 6.23). This suggests that at the time the ditch was created, this area of the landscape was still vegetated and required drainage, implicating erosion since colonisation. A more detailed study was made of a relic drainage ditch and associated gully system on north facing slopes in the Porkeri outfields near Hov. The base of the ditch cutting (refer to profile KAM9 and Figure 6.4) has been dated to  $1120 \pm 35$  yr BP (858-996 AD) (GU-11661), indicating that drainage as a system of land management was underway comparatively soon after settlement. Although the existence of the ditch indicates that the settlers tried to improve the quality of land for grazing, a series of small gullies that run into the ditch and that have therefore developed after 858-996 AD are evidence of some small scale landscape impact that has occurred since the cutting of the ditch. It is probable in both of the above cases that although the draining caused localised landscape degradation, the landscape was improved for grazing by the replacement of a peat/moss cover with a more bio-diverse grass dominated cover.

*The significance of landscape impact related to resource exploitation*

With a lack of wood in the Faroe Islands to use as fuel or building material, peat cutting can be assumed to have taken place since initial settlement. Peat has provided a principle source of fuel in many Atlantic island environments where woodland has been limited, for example in the Shetland Isles, the Western Isles of Scotland, Ireland and the Falkland Islands. Impact from peat exploitation would be expected to be manifested differently in the landscape record from grazing impacts. The effects of grazing are assumed to be more or less ubiquitous across the outfield landscape, with higher altitudes more vulnerable because of their increased sensitivity to impact. Peat cutting, on the other hand, was carried out within spatially explicit areas, firstly according to where peat had developed, and secondly dependent on locations with easy access from nearby settlements (either overland, or near a suitable landing place for transportation by boat). As a result, peat cutting would not be expected to cause such spatially widespread impacts as grazing, or to cause impact at high altitudes, and accordingly would only be illustrated in specific and localised sediment sequences.

There is evidence of peat erosion in the form of peat-hagged landscapes, for example, in Hovsdalur, and of former peat banks, especially in Sandoy. Peat erosion is influenced by topography, drainage, fire, slumping, bog bursts, wind and overgrazing as well as by peat cutting. However, peat erosion can be observed in conjunction with archaeological structures related to peat cutting activity thus implicating anthropogenic influence. In a walk-over archaeological survey undertaken in 2005, *kráir*, three or four sided roofless structures used for storing peat (refer to Figures 6.22b-c), were mapped in designated areas of the Sandoy outfields. When cut, peat was dried and stored *in situ* and only transported back to the

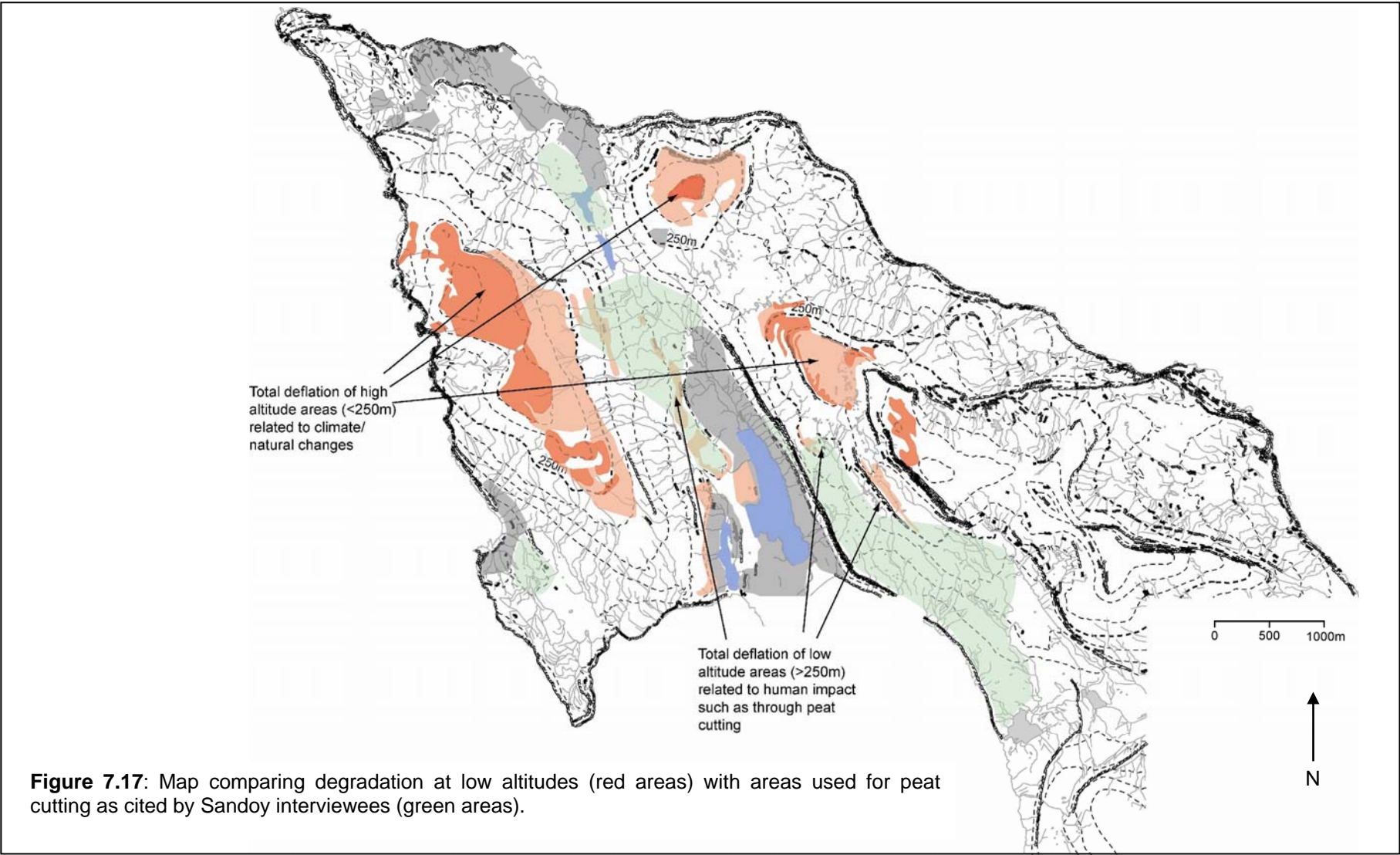
settlement in small batches every two or three days as and when it was required. Peat was therefore dried and stored in *kráir* in close vicinity to where it was cut. As a result, the deflation of the surface landscape directly surrounding *kráir* can be explicitly linked to the act of peat cutting.

Although over time, partial or total regeneration of former peat cut surfaces may occur, in some cases the turf as well as the peat beneath may have been stripped (G. Bjarnarson *pers. comm.*). This limited the re-growth of grass and may have caused complete degradation of localised areas of the landscape. Peat cutting can also cause pooling of water leading to water logging, which escalates the processes leading to landscape degradation. Although peat banks provide evidence of peat cutting over the last hundred years, earlier peat cutting has stripped entire areas of vegetation and peat down to bedrock resulting in small patchy areas of landscape deflation in specific locations. The place-name *Árnheiði*, found north of Gróthúsvatn, refers to an area used previously for peat cutting; *heiði* means "heath" and *Árn* is a personal name. The status of this location as a former peat cutting area was also confirmed in local interviews (G. Bjarnarson *pers. comm.*). Today the landscape around *Árnheiði* is eroded down to bedrock, despite its low altitude location at c.50 m. Significantly, there is limited degradation elsewhere on Sandoy at altitudes below 100 m (refer to Figure 6.9), suggesting that degradation of the wider *Árnheiði* area has been anthropogenically as opposed to climatically induced, in which case, a much larger area would be affected. Figure 7.17 illustrates the comparison and correlation between degradation at low altitudes with areas used for peat cutting as cited by Sandoy interviewees.

This suggests that other low altitude locations may also have been degraded by peat cutting. Comparison of the geomorphic map with the archaeological survey and data from interviews identifies the locations likely to have been affected and possibly degraded as a direct consequence of peat cutting. Therefore, although human impact is not ubiquitously obvious, at the localised landscape scale it has been significant.

### **Conclusions: how has human impact affected the Faroese landscape?**

In summary, human impact, both short-term caused by colonisation, and longer-term impact caused by continuous anthropogenic activities, have been limited in comparison to examples of settlement impact on other islands, e.g. Iceland, Easter Island. Colonisation impacts may be identifiable in the sediment profiles and probably contributed to the formation of top silt, which represented a fundamental change in the late Holocene Faroese landscape at a threshold crossing scale. Changes caused by colonisation were, however, overshadowed by earlier climatically induced impacts that were of a greater magnitude.



**Figure 7.17:** Map comparing degradation at low altitudes (red areas) with areas used for peat cutting as cited by Sandoy interviewees (green areas).

Longer-term anthropogenic impacts are more difficult to identify in the sediment profiles. LOI data illustrates that the organic content of the top silt increases as settlement develops, indicating that erosion did not necessarily increase with accumulating human impact and suggesting that the settlers were relatively well-adapted to their local environment. Surface landscape, archaeological and ethnographic data does however confirm that although limited, some small-scale, localised degradation has taken place over the course of settlement, as a result of peat cutting, as well as that of grazing.

Comparison between the spatial patterns of human activity (identified from the archaeological survey and interviews) and the extent of landscape degradation at low altitudes (i.e. where degradation is not principally determined by climate/exposure), illustrates a complex relationship between erosion and human activity. For example, areas with a high density of stone/turf dykes and *ból* (e.g. Zones 1a in Hov and Sandoy), are some of the best vegetated in the outfields. The predominant anthropogenic activity carried out in these areas was for keeping cattle, and the landscape was probably improved by manuring. By contrast, areas with a high concentration of *kráir* or that are known to have been used for peat cutting, are generally the most degraded areas in the lower-altitude outfields.

#### **7.4. Why might human impact in the Faroes have been limited?**

The lack of available evidence for major anthropogenic impact may be related to the collection of data from locations unlikely to have been impacted by anthropogenic activities or from where natural geomorphic processes dominate. However, as methods were used that targeted a varied range of activities, in areas of the landscape most likely to be affected by human activity, the absence of evidence is unlikely to be a factor limiting the evidence for human impact on the landscape. Secondly, considerable anthropogenic modification to the environment may not have been possible or necessary given the dynamic, natural pre-colonisation environment. In other words, the inherent properties of the landscape may have effectively minimised the environmental impact of the settlers. This may be in part due to characteristic features of the Faroese landscape, such as the relatively robust histosol and entisol soils, which, when considered in comparison to islands with more sensitive volcanic soils such as Iceland, would have been less sensitive to erosion. Vegetation may also have been relatively robust against settlement, as the predominant pre-colonisation vegetation consisted of grasses, sedges and ericaceous shrubs that are capable of tolerating grazing. Only the tall herbs and a small population of juniper and tree birch are likely to have been affected by the introduction of domesticates (Lawson *et al* 2005, Hannon *et al* 1998, Hannon and Bradshaw 2000). In addition, as trees only made up a very small percentage of vegetation cover in pre-colonisation Faroes, the landscape was predominantly open and already amenable to grazing. There was less of a requirement for the settlers to make

immediate alterations to the natural environment, such as the extensive forest clearance that led to high levels of soil erosion following the settlement of Iceland. In contrast, woodland reduction has had a comparatively minor impact on the Faroese landscape.

Although the open and dynamic environment of the Faroes may have limited anthropogenic impact in the outfields, the settlers themselves may have contributed to minimising their environment impact by inaugurating a subsistence strategy that minimised impact. Although in the Faroes colonisation has a regional impact, and local impacts cause significant degradation, human impact over the longer-period of settlement remains constant or diminishes. This suggests that the settlers to some extent adapted their subsistence routines to the specific landscape, geographical and climate conditions they encountered in the Faroe Islands. This is important because the Faroes were the first of the North Atlantic islands to be colonised by the Norse and were the first “pristine” landscape to face the Norse settlers on their westwards colonisation. The challenge was to adapt to this new environment, based on their experience of a traditional west Norwegian pastoral economy, so it could be asked this was achieved more effectively in the Faroes than in Iceland or Greenland, and why. Using archaeological, ethnographic and historical evidence, the following discussion will explore how, in the Faroes, adaptation to the local geography and effective resource exploitation may have minimised their influence on the landscape.

#### **How geography, topography and settlement factors may have influenced environmental and cultural trajectories in the Faroe Islands**

The geography and topography of the Faroe Islands, which are dominated by protected fjords and sounds, high sea cliffs, steep sloping mountains and rocky crags, would have influenced human activities by influencing the location of farms and villages, the nucleated settlement pattern, the arrangement of the infields and outfields, cultivation practices, access to the sea and communication across the islands including the mobilisation of people for communal activities such as the *grind* (pilot whale drive). The requirements of a typical settlement in the Faroes have been summarised by Small (1969) and include access to the sea with a reasonable place to pull up a boat, a patch of fairly flat, reasonably well drained land suitable for a farmstead and with the potential for some grain cultivation, and extensive grazing areas, as the poor vegetation would give a relatively low carrying capacity. Sheltered access to the sea would have been essential for subsistence fishing, access to marine resources such as whales, seals and seaweed and travel and communication with other villages, which were often more easily accessed by boat than by foot over the mountains. Locations favourable for barley growing were those that received the most sunlight and had good soil drainage, hence south and east facing slopes would have provided the best home

field sites during the settlement period. Grazing land quality differed between islands, which may also have been a factor in influencing early settlement locations (Thompson *et al* 2005).

Given these requirements and considering the general topography and geography of the islands, there appear to be relatively few sites in the Faroes favourable to settlement (refer to Figure 4.8). This would help explain why settlement patterns have changed so little over time. Comparison between the extent of present day settlement with the probable initial locations of settlements in the Norse and later medieval period illustrates that the two are remarkably consistent (Arge *et al* 2005). Evidence of farm abandonment is rare in the Faroe Islands, although in the 11<sup>th</sup>-12<sup>th</sup> centuries, a small number of what were probably inland shieling sites were abandoned (Mahler 1990, Edwards 2005). More recently, villages with poor coastal access that were probably initially settled because of good opportunities for growing barley have been abandoned. These have been relocated in areas with good coastal access, but would probably not have made good settlements in the Norse period because they receive little sunlight and would have been poor sites for barley cultivation. Therefore the limited abandonment that has taken place should be viewed not as a sign of “failure”, but as an adaptation to a changing subsistence and economy. Nineteenth century abandonment is related to the declining importance of agriculture and the increasing importance of fishing, while in the 11<sup>th</sup> and 12<sup>th</sup> centuries, shieling abandonment may have represented an increase in trade from cattle to sheep rearing and wool production (Mahler 1998). Alternatively, the shieling areas became less important because there was sufficient biomass for the numbers of livestock likely to have been utilizing the rangeland area without the need for summer shielings (Thompson *et al* 2005). Apart from this limited abandonment, individual settlements are on the whole enduring in the Faroes. This signifies that Faroese villages were either well adapted to the topography and the needs of the villagers from early settlement, in which case there was no need to move anywhere else, or that because of the particular Faroe Island geography there was simply nowhere else suitable to relocate to.

A particular feature with respect to Faroese settlements is their arrangement in a nucleated cluster, which contrasts with the pattern of individual and often isolated farms in Iceland, Norway and Shetland. Primarily this has probably been a consequence of geography and topography, but interviews conducted for this research and historical sources also refer to a social function performed by nucleated settlements. It was necessary for people to live in relatively close contact because so many of the activities that were fundamental to Faroese subsistence required the labour of a minimum number of people. Fishing, fowling and the *grind* also required the use of boats, which were often collectively owned by a village and required at least 5 men to handle. The *grind* would, in particular, necessitate a fast mobilisation of a large number of people, several boats and quick and easy access to a harbour and bay. As the *grind* provided such a significant proportion of the islanders’ diet,

particularly over the winter, it would have been crucial that people were quickly mobilised to take advantage of a *grind* opportunity.

Other resource utilisation strategies such as guillemot fowling, also required large numbers of people, e.g. a single fowler would be lowered by rope one or two hundred metres down the cliff, which would take 20 men or more to haul the fowler and his catch back up to safe ground (Nørrevang 1979). Another method of fowling was to ascend a cliff from below, requiring a party of between 4 and 12 men as well as enough hands to man a boat. As well as the *grind* and fowling, sheep gathering also took place communally.

### **How specific resource exploitation strategies may have limited human impact on the environment**

As well as taking advantage of the surrounding topography, there is evidence that the Faroe Islanders efficiently utilised the wide variety of pseudo-infinite resources that were available to them, which would have supplemented their domestic produce or may even have provided the mainstay of their diet. In particular, an emphasis on pilot whales and fowling is apparent from emerging archaeological and ethnographic data.

#### *The nature, methods and significance of fowling and egg collecting*

Excavation at Undir Junkarinsfløtti on Sandoy uncovered a conspicuously large proportion of bird bones in three phases of archaeobotanical remains dated from the 9<sup>th</sup> to 13<sup>th</sup> century AD. This indicates a greater dependency on birds and for a longer period of time than any other of the Viking Age settlers of the North Atlantic (Church *et al* 2005). For example, although the use of bird resources also has parallels in southern Iceland (McGovern *et al* 2001), birds provided only a relatively minor supplement to the diet of Icelanders after the initial *landnám* period, whereas in the Faroes the hunting of birds for food has continued into the 19<sup>th</sup> century. Interviewees emphasised how birds have traditionally been used for their meat, eggs and feathers, particularly puffins and guillemots, and the use of these species back into the Norse period has been confirmed by the archaeobotanical evidence, with puffins and guillemots making up the greatest proportion of bird bones at the Undir Junkarinsfløtti site (Church *et al* 2005). The importance of birds as a resource is indicated by the archaeology and interviewees, and is also supported by the historical literature concerning fowling. Although the literature does not date back further than the 18<sup>th</sup> century, it is probable that rules designated for each village exist from much earlier. The presence of Manx shearwater and fledging puffin chick bones in the Norse period suggests the exploitation of nesting colonies, which is widespread in the Faroes today, indicating a

continuity of fowling practices. A brief account of traditional fowling methods and ownership, as known from at least the 18<sup>th</sup> century, is now considered.

The varied geography of the cliffs around the Faroes and the different bird species that nest there has produced diverse catching methods and access to fowling (Nørrevang 1979). The most important species for fowling from the Norse period to the modern period has probably been puffins, which are most commonly caught using the *fleyging* method, where the birds are caught one at a time while in flight, using long-handled nets. This process requires between 1-6 people depending on the ease of accessibility to the cliffs. Guillemots have also been an important species, although guillemot fowling requires a much larger party of people because they breed on high sheer cliff walls, so a fowler has to be lowered and raised by a rope. The right to fowl on cliffs is based upon land ownership and cliffs are clearly demarcated between villages, however, specific systems of ownership are different from village to village and on different islands. The first complete registration of fowling rights, documented in the *Taxationsprotocol*, an official taxation of land tenure dating from 1873, documents that in some villages, fowling was a right shared by all landowning people in the village. In others, including Sandur on Sandoy, fowling rights are allotted according to individual lots, based on lots owned in the *bøur* or infield (Nørrevang 1979). In St Kilda, an island community to the west of the Outer Hebrides of Scotland, where fowling played an important subsistence role, records from the 18<sup>th</sup> century state that cliffs were also divided according to the proportion of land each man had and were reallocated every three years along with the arable land (MacAulay 1764).

According to the *Taxationsprotocol*, a series of special rules and agreements secured the bird population against over-exploitation, which is supported by the interviewees who referred to several local regulations regarding fowling and egg collecting. It is notable that despite the small geographical area of the Faroes there are a variety of different fowling regulations, land tenure, fowling rights and sharing of the catch, suggesting each may have been adapted to the local community and conditions. It is not known how long regulations concerning fowling and egg collecting have been in place and who they were set and enforced by, although the *grannastevna*, a village annual legal gathering, may have played a key role (G. Bjarnarsson *pers. comm.*). The *grannastevna* was a form of village council that consisted of the *sýslumaður* (district officer) sitting with the owners of freehold land in a *bygd* to deal with matters of a local nature, e.g. deciding upon the division of pilot whales or how many sheep might be kept by a farmer. It is not known when the *grannastevna* was first established but it has probably been in existence for hundreds of years, possibly dating back as far as the 11<sup>th</sup> century. Rules and regulations concerning fowling are also likely to be long-standing and must have been in place long before the 19<sup>th</sup> century. It may be significant that despite the numerous traditional regulations and the respect that the villages held for

longer-established regulations (G. Bjarnarsson *pers. comm.*), there were no controls put in place to prevent the over-exploitation of birds as a result of more recent developments and advances in technology. For example, in the 19<sup>th</sup> and 20<sup>th</sup> centuries, significant reductions in the number of birds such as guillemots have been related to modern fowling methods such as shooting, for which no regulatory process existed until a few decades ago. The recent introduction of multiple nooses on boards floating in the sea, are neither subject to land ownership regulations. Similarly, whereas guillemot and puffin fowling was related to land ownership, fowling for fulmars is unconnected to landownership and the collection of fulmar eggs is unregulated. Fulmars have only been present in the Faroes since the 19<sup>th</sup> century and there were no established regulations in place governing their exploitation.

Regulations in the Faroes differed according to the method of fowling. For example, an informant commented that the *fleyging* method, which was used to catch puffins and could be carried out by a single person in good conditions, was unregulated. The *fygla* method, which involved holding a large net to the edge of the cliffs where guillemots were nesting, and which allowed a much larger number of birds to be caught at any one time, was only to be practiced every three or four years to allow time for bird populations to recover. Distinct regulations existed for villagers in Dalur in the south of Sandoy who had access to the cliffs of Skorin on the southern tip of Sandoy. In Dalur, the annual *grannastevna* agreed upon a quota of how many puffins (one informant gave this figure as around 32,000) could be caught and this was divided for each person according to their land ownership. Each person could fowl for as long as their quota remained unfilled.

Collection of bird eggs was also regulated. One example referred to in the interviews was that eggs (not specified of what species) could only be collected up until the 8<sup>th</sup> of June each year, as this gave the birds time to lay another egg. Other specific controls existed regarding guillemot eggs; although guillemots would come to the cliffs three times each year to lay eggs, it was stipulated that only eggs from the first laying could be collected and those from the second and third laying had to be left. This works on a similar principle of allowing the birds to lay an additional egg, indicating an awareness of the importance and sustainability of the resource. Another interviewee specified that puffin eggs could be taken from burrows but because they were so easily obtained, three years should be left to elapse before any more eggs were taken from that burrow. Other customs are that puffins are taken in burrows early in the season when a mate can be replaced, while during the breeding season, any bird carrying fish is spared (Harman 1997). The plethora of regulations surrounding fowling suggests that the Faroese were careful to conserve the bird colonies that they relied on.

Regulations against the over-exploitation of sea birds and eggs appears to have been adapted to the breeding patterns and number and vulnerability of different bird species, and

also appear to have varied in different villages, which may support the idea that regulations were enforced locally. On the islands of St Kilda and Sula Sgeir off the northwest of Scotland, fowling procedures were also controlled by communal action (Serjeantson 2001). In St Kilda the inhabitants themselves acted to police the cliffs if strangers attempted to disturb the birds or to steal birds or eggs (Baldwin 1974, Harman 1997). There is evidence for similar contemporary community or village based measures elsewhere that have been successful in managing natural resources. For example, in the Oceanic island of Vanuatu, Johannes (1998) surveyed 26 villages and found that all but one village had village-based marine resource management measures, and that no village had exactly the same set as any other. The purpose of the village-based regulations in Vanuatu enabled a measure of flexibility and diversity, which allowed for effective adaptation to changes in the availability of the marine resources (Berkes and Folke 2002). It is possible that in a similar respect, a community or village-based approach to the regulation of sea bird and egg exploitation allowed for flexibility and proved beneficial to the success of long-term settlement in the Faroe Islands.

Seabird fowling is by no means unique to the Faroes and seabirds played an important role in the subsistence strategy of other North Atlantic island settlements for example, the Isle of Man (Fisher 1997), the Westmann Islands to the south of Iceland, St Kilda and Orkney. Seabirds have also been used for trade which persisted in Orkney (Fenton 1978) and the Hebrides (Baldwin 1974) into the 20<sup>th</sup> century, while in St Kilda the economy was almost entirely based on cliff-nesting birds (Serjeantson 2001). Seabird fowling was also important in other maritime and island communities, such as the Canary Islands where wild birds continued to be eaten into historical times, and at sites in Patagonia where wild birds were found to be a major source of food (Serjeantson 1997). In oceanic island communities in the southwest Pacific, fowling for marine birds also formed a prominent part of historical and traditional food procurement strategies (Anderson 1996). Particularly in islands in the southwest Pacific, seabirds declined massively in numbers with the colonisation of people. For example, on Henderson Island in the Pitcairn Island group, seabirds were overexploited to the extent that led one researcher to attribute abandonment of the island to the depletion of seabirds and pigeons which may have been the only food source (Steadman and Olson 1985). Over-exploitation of seabirds is also known from closer to the study site, for example in the case of the great auk, a North Atlantic flightless bird which failed to survive human predation and became extinct in 1844. Although its biology played a significant role in its decline, the lack of human management was also a factor “because the breeding colonies were not subject to controls either arrived at voluntarily or imposed by the state” (Serjeantson 2001: 54). The failure of prehistoric farming communities to evolve adequate voluntary control over an unfamiliar resource contributed to the decline of the great auk around the shores of the British Isles. According to the available evidence, it is suggested

that in the Faroes (at least prior to the advent of modern fowling methods), fowling was managed carefully enough to prevent a catastrophic decline in numbers and this has ensured the continuity of fowling practices to the present day.

*The nature, methods and significance of the grind (pilot whale drive)*

Interview respondents particularly stressed the importance of the *grind* for supplying not just meat and blubber for food, but blubber for oil, bones for fertiliser and boiled down whale meat as winter feed for cattle, especially after a poor hay harvest (Annandale 1905). Whale meat was particularly important to non-land owning individuals because the catch was distributed among the whole village, including those widowed or impoverished, not only the shore-owner and those participating in the hunt (Joensen 1976). It is probable that a form of pilot whaling has taken place for several centuries, even back to the time of early settlement (Joensen 1976, Gjessing 1955, Brøgger 1937), although the *grind* is not mentioned in historical records until 1592, with the first information about a slaughtered *grind* appearing in 1600 (Bjørk 1963). Whether the Faroese whale hunt began with the first settlements has been debated (Gjessing 1955, Høst 1875). Few whale bones were present in the early archaeological phases at Undir Junkarinsfløtti, but this does not signify that whales weren't being utilised then. Whale bone may have been disposed of away from the farm middens or it may have been used in other ways, such for fertiliser, as artefacts, in specific architectural contexts or even as fuel utility as there is evidence that fresh cetacean bone was used as an alternative to peat until the beginning of the 20<sup>th</sup> century (Clark 1947).

There are written records throughout Atlantic Europe for the historic period indicating that whales were highly prized and thoroughly used wherever they could be obtained (Gardiner 1997, Jenkins 1921, Evans 1996, Mulville 2002). The earliest reference to the utilisation of sea mammals come from Bede writing in 731 AD. Records also state that porpoises were caught off the coast of Ireland in c.827 AD by "foreigners" who may have been Vikings (Gardiner 1997). Similarities to the techniques and technology used in the Faroese pilot whale drive can also be found in other geographically widespread island communities, both modern and prehistoric. In a recent example in the Solomon Islands, north of New Guinea in the Coral Sea, dolphins are driven by hunters who utilise an armada of dugout canoes to locate and surround an incoming dolphin herd. The hunters then knock together 15 cm cobbles to disorientate the dolphins and force them into narrow passages where they can be captured by villagers, hauled into canoes, killed on shore and taken back to the villages (Takekawa 1996, Porcasi and Fujita 2000). This is similar to the traditional technique used for driving pilot whales in the Faroes whereby the whales were headed off from the open sea by boats, herded into a chosen inlet and driven ashore sometimes aided by dropping stones and beating the sides of the boat (Debes 1676). In late prehistoric Easter Island, dugout

canoes were also used for dolphin hunting, and large quantities of dolphin bone were found at archaeological sites up until 500 years ago when the island became completely deforested and dugout canoes could no longer be manufactured (Steadman *et al* 1994). In local coastal communities in the Western Isles, Shetland and Orkney, small pilot whale drives have persisted for centuries although these ceased in the latter half of the 20<sup>th</sup> century (Evans 1996, Mulville 2002). In Iceland, whale strandings are frequently mentioned in early historical sources, but lesser so organised hunts. In the Shetland Islands, pilot whales were driven into bays much in the same way as a *grind* is carried out in the Faroes, but the whales were utilised principally for their blubber which was rendered to oil and sold. The meat was almost always never eaten (Shetland Islands Museum 2007). In conclusion, although there is a tradition of whale hunting across the North Atlantic region, whales appear to have been utilised differently in the Faroes where pilot whales provided a considerable, perhaps even the most important, proportion of the Faroese diet.

### **Conclusions: why might human impact in the Faroes have been limited?**

In summary, there are several reasons why human impact in the Faroes might have been limited. The natural pre-colonisation characteristics of the Faroe Islands were insensitive to impact, dynamic elements of the landscape were already established prior to colonisation, and the extent to which people themselves acted by adapting to the local environment and utilising resources minimised environment impact. Erosion caused by overgrazing may, in particular, have been lessened by a reduced emphasis on animal husbandry and the diversification of subsistence strategies, including the exploitation of pseudo-infinite resources such as seabirds and pilot whales.

It is however difficult to identify the extent to which natural factors on the one hand, and cultural adaptation on the other played a role. This will be assessed in chapter 8 by comparing trajectories of natural and cultural change in the Faroes with those of Iceland and Greenland, also colonised by the Norse. These three islands were consecutively settled by a relatively well-known Norse population, whose experience was based on west Norwegian subsistence farming, but to what extent did cultural trajectories vary after initial settlement, and to what extent did the different landscapes and climate of the islands play a role?

### **Chapter summary**

This chapter has established an outline of late Holocene landscape development in the southern Faroe Islands, providing a baseline from which the extent of later human impact in the Faroe Islands can be calculated. Two significant environmental thresholds are apparent in Faroese environmental records and although the earlier threshold change can be

attributed to natural factors, there is no unambiguous evidence to suggest that the second threshold was a result of climatic deterioration or early settlement, i.e. earlier than attested to by existing archaeological and palaeoenvironmental research. Either way, landscape change prior to settlement of the Faroes appears to have desensitised the environment to consequent change and the significance of long-term human impact in the Faroes is apparently limited. To conclude, this chapter assessed why human impact in the Faroes might have been limited by natural factors such as the trajectory of the pre-colonisation landscape and ecology, and cultural factors such as a diversification of subsistence strategies and the importance of communal activities.

The following chapter compares the conclusions of the site-specific research in Suðuroy and Sandoy to original and secondary data from Iceland and Greenland, in order to assess the similarities and contrasts between outcomes of human settlement in the Faroes, Iceland and Greenland.

## Chapter 8

### Discussion: The Faroe Islands and the wider North Atlantic context

#### Introduction

The aim of this chapter is to incorporate the exploration of bold ideas with the focussed research presented in chapter 7. Data collection and analyses from the Faroe Islands has resulted in the presentation of a case study, which although can be interpreted in several ways, is based upon the collection of empirical data. However, a focus solely on the smaller scale limits the appreciation and understanding of the wider context. This chapter builds on the opportunity presented by the thesis to consider a number of bold ideas that are testable, in order to increase our knowledge of regional/inter-island scales and introduce ideas and hypotheses for consideration and debate.

The chapter consists of five parts. Parts one and two outline the importance and rationale behind a wider spatial context and how the natural and cultural landscapes of the Faroes, Iceland and Greenland have developed in different ways. Part three examines and compares the outcomes of colonisation and long-term settlement on Iceland with that of the Faroe Islands and evaluates why these outcomes might have been different using specific examples. Part four compares the outcomes of colonisation and long-term settlement on Greenland with that of the Faroe Islands and again evaluates why these outcomes might have been different using examples from Greenlandic research. Part five concludes the chapter by summarising the comparisons and contrasts between outcomes in the Faroe Islands, Iceland and Greenland and whether or not these were inevitable.

#### 8.1 The importance of a wider spatial context

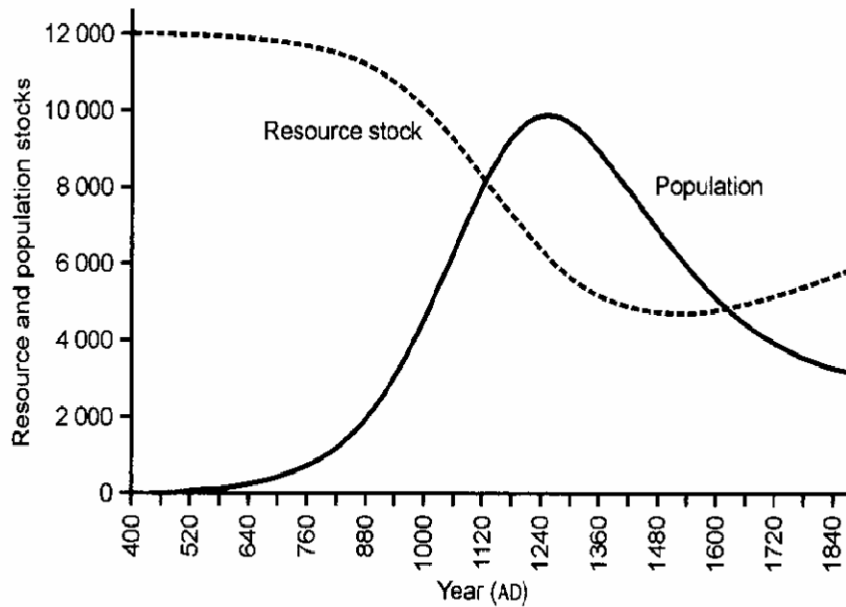
While research on human-environment interactions in Iceland and Greenland has been forthcoming in the last couple of decades, the Faroe Islands have attracted relatively limited academic research, particularly with regards to its historical ecology. Yet, as the Faroes were the first of the North Atlantic islands to be settled by the Norse, understanding the interactions between landscape and cultural history in the Faroes is important in terms of how the Norse adapted to a changing environmental gradient in the North Atlantic. The discussion in chapter 7 concludes that changes in the environment and subsistence practices of the Faroese have been relatively limited over the course of settlement. It is, however, important to focus on island environments within a wider context (in this case the other North Atlantic islands settled by the Norse). It is particularly important to focus on areas that are considered environmentally “less marginal”, e.g. the Faroe Islands, in order to

understand how thresholds affect what are considered to be environmentally “more marginal” areas, e.g. Greenland. Human-environment research is generally skewed towards understanding cultures and environments that have experienced the most severe threshold crossing events, which is verified by the relative abundance of academic research carried out on Easter Island, for example.

## 8.2 Summary of trajectories and thresholds in the Faroe Islands, Iceland and Greenland

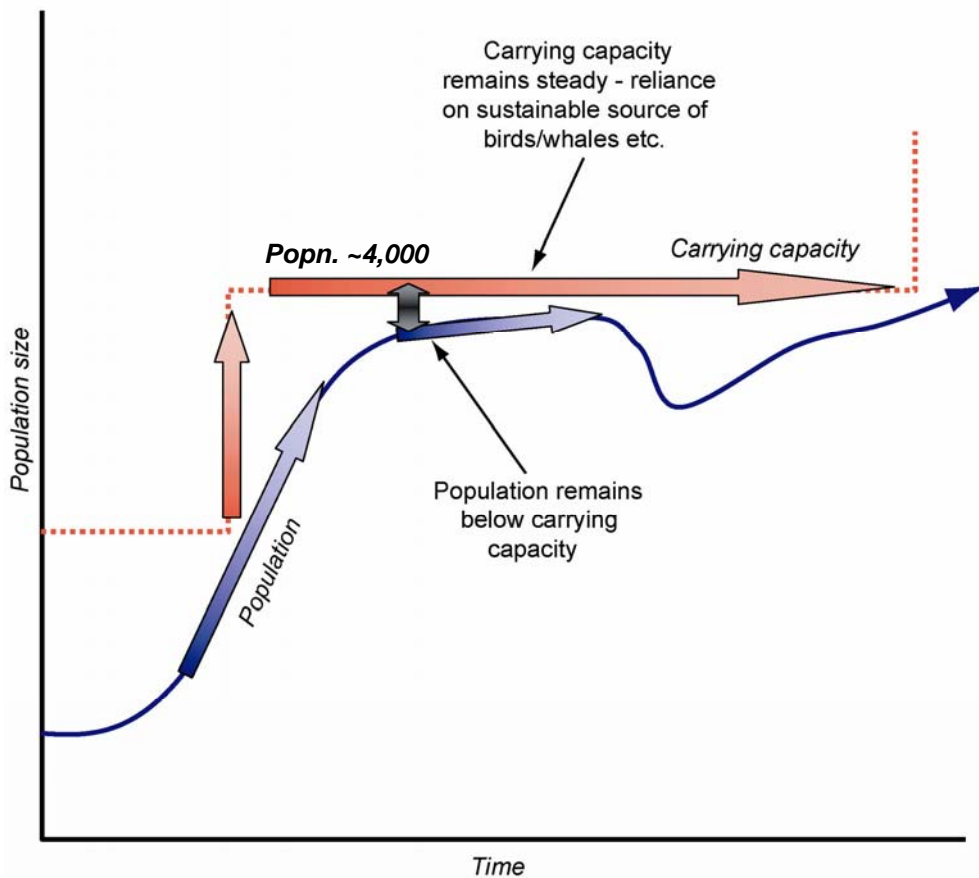
One way of understanding the trajectories of change and outcomes of settlement on the North Atlantic islands is to consider the dynamic relationship between population and carrying capacity, representative of an environmental threshold, and to speculate how this might change over time. For example, when the population increases over and above the carrying capacity, a population crash or decline may be triggered. If the population is very low to begin with, or is reduced over time, a lowering of the carrying capacity may also be induced, as a shortage of labour hinders the execution of activities and improvements that would otherwise stabilise the carrying capacity. Conversely, improvements in technology or a change in subsistence practices may raise the carrying capacity or threshold. Figure 8.1 illustrates a numerical output of the relationship over time between population and resources based on Easter Island. As the population increases after settlement, after an initial time lag, the resource stock begins to decline to a threshold around 1100 AD, at which point the population exceeds the carrying capacity. With fewer resources available, the population starts to decline rapidly. A smaller population may create less pressure on resources, which conversely begin to increase by 1600 AD, but by then the population has already reached a critical threshold and continues to decline. This model exemplifies a Malthusian relationship, which assumes that a population decline is inevitable. How, then, did population levels and resource stock interact in the North Atlantic islands, and to what extent did the relationship between population and resources differ between the Faroes, Iceland and Greenland?

The relationships between population and resources (and their outcomes) for the North Atlantic islands are hypothesised and are presented in Figures 8.2, 8.3 and 8.4. In the Faroes (Figure 8.2), no significant cultural or environmental thresholds have been crossed within the period of settlement, although plague probably reduced the population in the mid-14<sup>th</sup> century, and the 16<sup>th</sup> heralded a general period of decline as a result of Danish monopoly. Overall, the impact on the environment is limited and the population does not decrease at such a rate that the carrying capacity is critically lowered. In Iceland (Figure 8.3), demographic history follows an oscillatory trajectory. Initially the carrying capacity increases, in proportion to population, but a sequence of significant population declines, beginning in

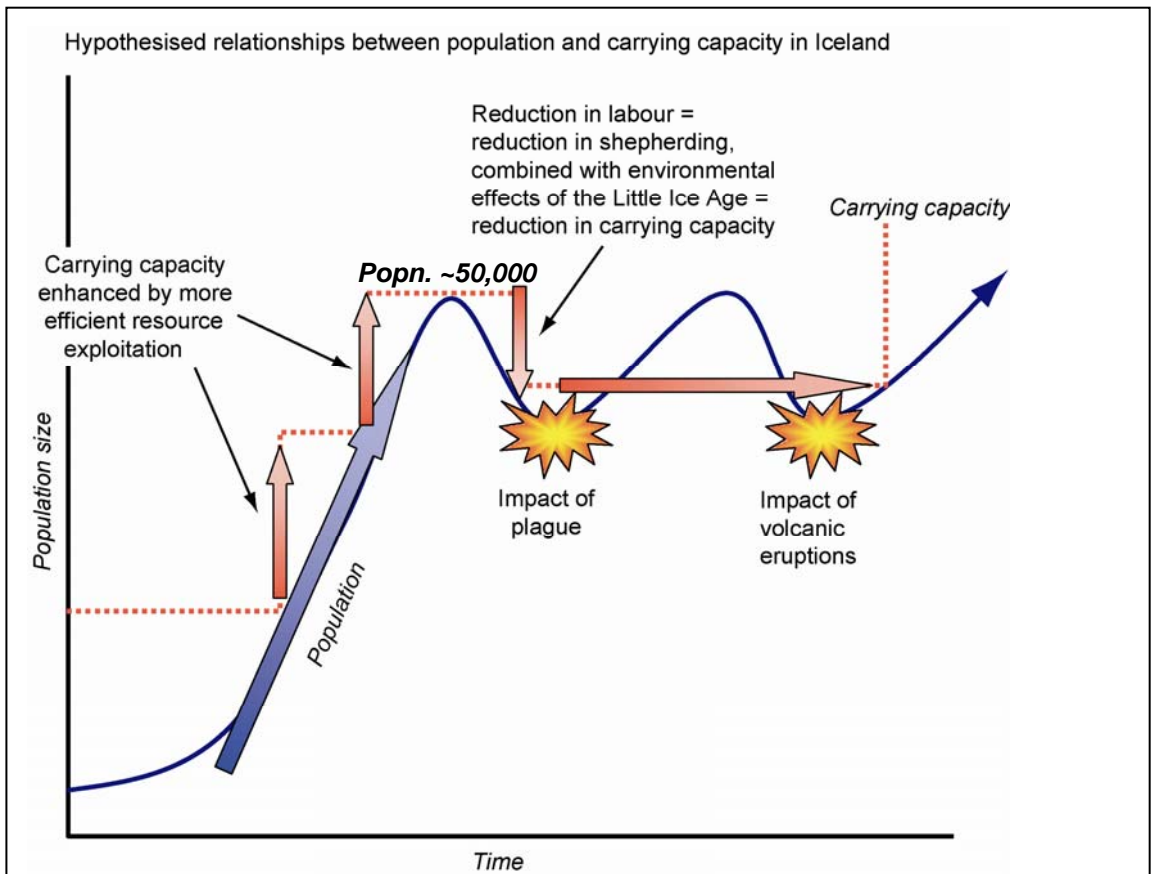


**Figure 8.1:** A Malthusian numerical model for Easter Island showing the relationship between population and resources, and illustrating that a population decline was inevitable. (After Brander and Taylor 1998).

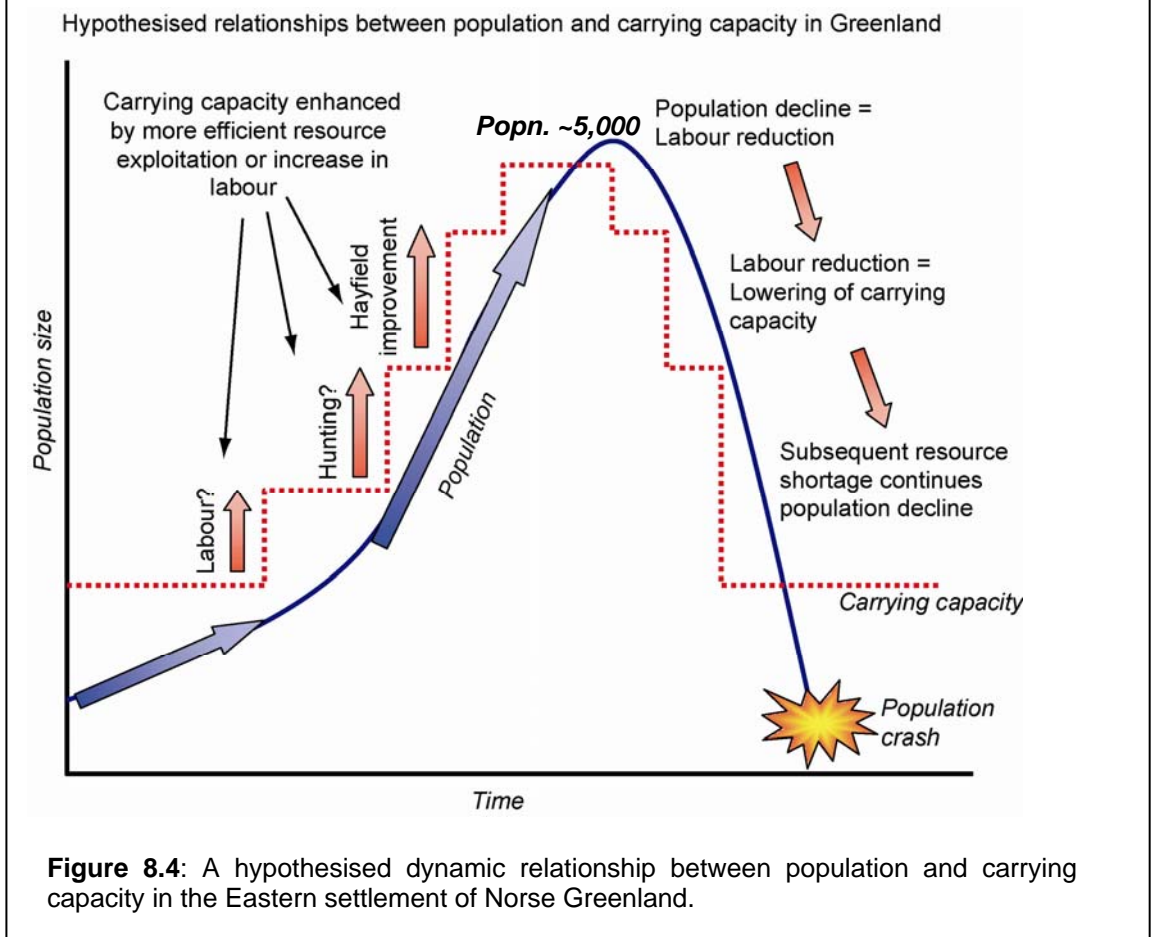
Hypothesised relationships between population and carrying capacity in the Faroe Islands



**Figure 8.2:** A hypothesised dynamic relationship between population and carrying capacity in the Faroe Islands.



**Figure 8.3:** A hypothesised dynamic relationship between population and carrying capacity in Iceland.



**Figure 8.4:** A hypothesised dynamic relationship between population and carrying capacity in the Eastern settlement of Norse Greenland.

the 15<sup>th</sup> century as a result of diseases, followed by volcanic eruptions in the 18<sup>th</sup> century, in addition to accumulating environmental problems caused by erosion and the cooling impacts of the Little Ice Age, may have increased landscape degradation. The carrying capacity was hence reduced to the extent that a threshold was crossed. In Greenland (Figure 8.4), despite initial increases in the population and carrying capacity as a result of, for example, increasing labour or hayfield improvements, at some point the population begins to decline to a critical level. Below this point, labour is reduced by enough to lower the carrying capacity and the population eventually collapses. What triggers the initial population decline is uncertain but there are several factors that influence when, and if, such a threshold is crossed, and any combination of these might have played a role in the collapse of the Norse Greenland population. These range from climate change, cultural conflict, isolation and disease to the non-sustainable use of the resource base and the inability to tap into available technology or knowledge to utilise available resources efficiently. The goals and aspirations of the settlers are also an important consideration. Table 8.1 outlines the main differences between the Faroes, Iceland and Greenland in terms of a range of natural and cultural factors and some of these differences are discussed in more detail below.

### **8.3 Comparisons between the Faroe Islands and Iceland**

#### **Why are trajectories between the Faroes and Iceland different?**

It is important initially to consider comparisons between the North Atlantic islands of the Faroe Islands and Iceland because these were both islands where Norse settlement endured. The present day environments of Iceland and the Faroes appear to be similar in some respects, as both landscapes are dominated by open pasture, yet there have been critical differences in landscape history that have been influenced by the contrasting physical and cultural characteristics of the two islands. Soil erosion, for example, has been more widespread in Iceland than in the Faroe Islands. Iceland has been referred to as the most eroded land in Europe (Bjarnason and Helgason 1990), with anthropogenically triggered erosion suggested as accounting for the removal of approximately half of Iceland's soil (Runólfsson 1978). Although precise patterns and causes of erosion are complex, the environmental trajectory of much of Iceland contrasts with that of the Faroe Islands, which have remained remarkably well vegetated. Differences in the environmental trajectories of the two islands are influenced to some degree by fundamental differences in the pre-colonisation environment, but also by contrasting settlement patterns, population dynamics and variations in subsistence strategies.

	Greenland	Iceland	Faroes	Norway
<b>Natural factors</b>				
<b>Climate</b>	Arctic/sub-arctic - cool summers, cold winters, sea ice	Maritime – mild windy winters, damp, cool summers	Maritime – mild winters, cool summers, foggy, windy	Temperate along coast, colder interior, wet all year on w. coast
<b>Physiography and topography</b>	Large landmass with large ice mass	Large land mass with ice caps and volcanic systems	Small islands with steep slopes, wet, periglacial	Mountain and fjord topography with ice caps
<b>Biodiversity and tree species</b>	c. 497 vascular plant species. Birch, ash, willow, evergreens, ferns and herb species	c. 485 vascular plant species. Dwarf birch, willow, heather, grasses and sedges	Mosses, grasses and bog vegetation, dwarf shrubs, no native trees	c. 1715 vascular plant species. Spruce, pine, birch, aspen, rowan
<b>Natural hazards and extreme events</b>	Continuous permafrost, plague?	Volcanic eruptions, catastrophic floods, earthquakes, plague	Plague?	Rockslides, avalanches, plague
<b>Environmental analogies with homeland</b>	Looked similar to homeland in some respects but more environmentally marginal	Looked similar to home (birch forest, shrub, grassland) but wasn't – friable soils, tephra	Looked similar to home except for lack of forest, and was – peaty soils, grassland	Homeland landscape: Forest and grassland, peaty soils
<b>Degrees of change with human impact</b>	Limited change?	Rapid change ( in less than 50 years in some cases) from extensive birch forest and scrub to grassland	Limited change – landscape predominantly open grasslands before settlement	Gradual change over c. 10,000 years of human impact
<b>Settlement patterns and location</b>	Extensive settlements, dispersed across fjord and inland locations	Dispersed individual settlements, coastal and inland	Coastal, nucleated settlements, multiple and individual farms	Coastal (fjord) and inland, multiple and individual farms
<b>Environmental resource potential</b>	Peat, driftwood, birch forests, scrub, heath	Peat, driftwood, birch forests, scrub, heath, wet meadow	Peat, driftwood, scrub, heath	Plentiful timber, peat, driftwood, scrub, heath
<b>Wild food availability</b>	Fish, migratory seals, walrus, birds, caribou, berries	Fish, seals, whales, birds, eggs, walrus (early period), berries	Fish, seals, whales, birds, eggs, berries	Fish, seals, whales, birds, eggs? berries
<b>Wild food resource utilisation</b>	No fishing, dependent on hunting, grazing	Reliance on domestic agriculture, grazing, fishing	Varied use of wild resources - whales and birds, grazing, fishing	Animal husbandry, fishing, hunting
<b>Domestic animals</b>	Cattle, sheep, goats, pigs	Cattle, sheep, goats, pigs, horses, geese, limited barley	Cattle, sheep, goats, pigs, horses, geese, limited barley	Cattle, sheep, goats, pigs, horses, geese, hens? barley
<b>Fodder requirements</b>	Require fodder and byres	Require fodder and byres	Less dependent on fodder and byres	Require fodder and byres
<b>Farming system</b>	Infield-outfield, limited shieling system	Infield-outfield, limited shieling system	Infield-outfield (secondary stage?), early shieling system	Infield-outfield and shieling system
<b>Outfield administration</b>	Individually owned, set grazing numbers?	Hreppur system: individually owned, set grazing numbers?	Partir system: community owned, set grazing numbers	Infield-outfield system
<b>Trade, distance and access to trading centres</b>	Trade in luxury goods, distant trading centres, access in summer only	Trade in wool and later fish, limited access in cold years	Trade in wool and later fish, year round access	Trade in fish. Year round access
<b>Cultural factors</b>				

**Table 8.1:** Comparisons and differences in natural and cultural factors between Greenland, Iceland, the Faroe Islands and Norway.

*Inherent physical and ecological differences between the Faroe Islands and Iceland*

Although some contrasting elements are highly visible in the landscapes of the Faroes and Iceland today, e.g. active volcanoes and glaciers in the Iceland, but not in the Faroes, other divergent elements are apparent from the palaeoenvironmental record, e.g. the greater extent of birch forest in pre-*landnám* Iceland than in pre-*landnám* Faroes. There are several geomorphic and ecological factors in the Icelandic environment that combine to create a landscape more vulnerable to human impact, than at locations such as the Faroe Islands where particular elements are absent. Volcanic eruptions emit tephra, which in Iceland has contributed to the development of andisol soils that have low organic carbon contents and low bulk densities making them highly susceptible to erosion (Arnalds *et al* 1995, Simpson *et al* 1999). The removal of forest has also been a factor in Iceland, but less so in the Faroe Islands. Research has shown Iceland to have been at least 25 % forested at the time of *landnám*, compared with a figure of 1 % today (Arnalds 1987).

The existence of forest, which was substantially utilised for fuel and charcoal production, also contributed to the magnitude of impact illustrated by Icelandic sediment accumulation records. In the early period of settlement, c.870-930 AD, there is evidence for rapid woodland clearance in some areas, e.g. south Iceland (Hallsdóttir 1987, Mairs *et al* 2006), as the land was cleared for farms and hayfields. The removal of vegetation acted to expose the volcanic soils to processes of erosion which initiated a long-term trajectory of landscape degradation. This immediate post-*landnám* trajectory contrasts with that of the Faroe Islands which, due to the predominantly open environment, were not subject to the same degree of impact caused by early anthropogenic deforestation. In addition, the geographical location of Iceland results in more substantial winter snow cover than that received in the Faroe Islands. This had substantial consequences concerning the requirement of fodder, for example. In most years in the Faroes, enough grazing was exposed for the sheep to over winter in the outfields. In Iceland, on the other hand, substantial fodder was required to over winter sheep as well as cattle.

*Differences in the utilisation of resources in the Faroe Islands and Iceland, and how these develop over time*

There are additional factors related to the physical environment that may have influenced the environmental trajectories of the Faroes and Iceland. The Faroe Islands consist of a series of small islands separated by sounds and fjords, with no location on the Faroes further than 5 km from the sea. This underlines the influence of the sea in the history of the Faroe Islands. Iceland, excepting the fjord landscapes in the northwest and east, is dominated by its landscape rather than seascape, and is characterised by wide and expansive sandur plains

in south Iceland and a vast semi-barren interior landscape. As the mountainous topography, sheer cliffs and island dominated geography made land communication in the Faroes difficult, the boat evolved as the principle method of communication. In Iceland, on the other hand, communication between farms and districts was predominantly made by horse.

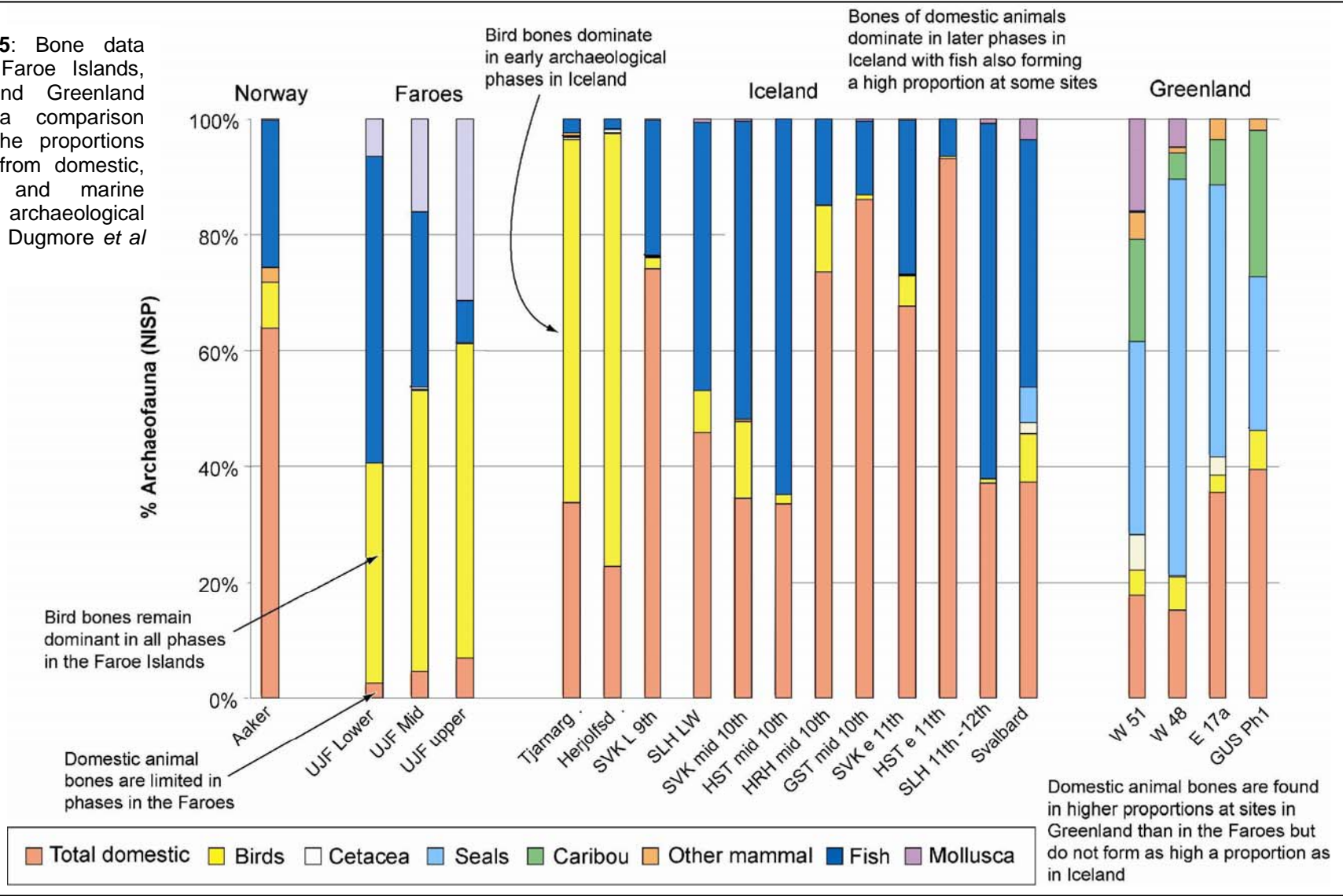
It is possible that the focus towards the sea on the one hand and to the land on the other may have influenced how the two islands approached their subsistence strategies. For example in the early Icelandic settlement period, archaeobotanical collections indicate that locally available wild resources, for example, seabirds were substantially utilised to subsidise the initially limited domestic animal component of the colonists' subsistence economy. However, by the 11<sup>th</sup>-12<sup>th</sup> centuries there was a general shift in species exploitation, after which domestic mammals dominate collections (McGovern *et al* 2006) (Figure 8.5). Fishing was carried out extensively in Iceland, from around the 15<sup>th</sup> century, but this was primarily for trade. In the Faroe Islands, the sea has provided for a more significant and varied proportion of the islander's subsistence, with fish as well as whales and seabirds contributing substantially to the Faroese diet, not just in the initial *landnám* period but more uniformly over longer-term settlement (Church *et al* 2005).

#### *Isolation, contact and disease in the Faroe Islands and Iceland*

An important consideration when dealing with island environments, which is especially obvious in Pacific island examples, is their degree of geographic isolation and how isolation might influence the extent to which unsustainable demands are made on environments. The issues of isolation and contact are important with regards to trading networks but also in relation to the spread of disease. In the Pacific, for example, the difference in population structures between the large archipelagos of the western Pacific and those of Remote Oceania corresponds closely to the geographic distribution of malaria in the Pacific (Kirch 2000). The more isolated islands of Remote Oceania lacked the disease causing micro-organisms that affected Near Oceania and as a result a key check to human growth rates was lifted. The lack of epidemiological or environmental constraints (most of the islands were rich in natural food resources and suited to planting food crops) on population increase led to high rates of population growth, which were often unsustainable. Over-population inevitably enhanced environmental impact on the Remote Oceanic islands, and may have been a contributing factor in some incidences of cultural collapse.

The contrasting role and timing of disease (e.g. plague and smallpox) in the Faroe Islands and Iceland, demonstrate how isolation and disease might have contributed to differing cultural and environmental trajectories in the North Atlantic. Although there is no direct evidence, plague is thought to have reached the Faroes c.1349-50 (Schei and Moberg 2003,

**Figure 8.5:** Bone data from the Faroe Islands, Iceland and Greenland showing a comparison between the proportions of bones from domestic, terrestrial and marine sources at archaeological sites. After Dugmore *et al* (2005).



Young 1979) and may have caused the death of about a third of the population. Oral traditions document that several villages suffered from the effects of plague, with some villages almost completely devastated, including Saksun (Streymoy), Husavík (Sandoy), Leirvík (Eysturoy), Hamrabyrgi, Vikarbyrgi and Sandvík (Suðuroy), and all but one of the population of Skúvoy (Schei and Moberg 2003, Young 1979). Apart from a reduction in population, the outbreak of plague must have had other effects, such as a change in the ownership of property. Landscape impacts as a direct consequence of plague or other sudden population reductions are also complex. It might be expected that a reduction in population (individuals or whole communities) would reduce impact on the landscape. Yet, grazing may still continue within a landholding even if cultivation is abandoned. It might be that the arrival of plague in the Faroe Islands c.1349-50 and the resulting population control contributed to the avoidance of threshold-crossing terrestrial environmental changes in the islands. As with malaria in the western Pacific islands, plague and subsequent incidences of disease might have provided a control on population growth. The impacts of plague may have also been influenced by regular contact between the Faroes and the mainland.

On islands with small populations, even if the absolute number of deaths is not large, the relative proportion of deaths might be significant, enough to reduce the population to very low numbers. For example, the population of St Kilda, a small island located 40 km off the Western Isles of Scotland, was devastated by an outbreak of smallpox in 1727, resulting in 94 deaths out of 113 people (although a further 11 people escaped as they had been marooned on a remote sea stack over the course of the outbreak) (Harman 1997). On St Kilda, the impact of smallpox was followed by 19<sup>th</sup> century emigration and an outbreak of infant tetanus. A combination of these factors affected the longer-term population trajectory, which never recovered to its pre-smallpox levels. While a single outbreak of disease might not compromise long-term population, multiple outbreaks, or other multiple events that reduce the population, such as volcanic eruptions or emigration, can affect longer-term population trajectories. Therefore, while the population of the Faroes recovered without any major change to the carrying capacity (refer to Figure 8.2), in Iceland, subsequent factors causing a decrease in population levels may have combined to create a different situation.

In Iceland there were two severe plague epidemics, the first between 1402 and 1404, where an estimated 50-60 % of the population died, and the second between 1494 and 1495 with the estimated death of 30-50 % of the population (Karlsson 1996). A smallpox epidemic occurred later, between 1707 and 1709. As a result of local settlement patterns, the impact of plague in Iceland caused abandonment of individual farm sites rather than whole villages as in the Faroes, although entire valleys may have been devastated. Although a severe period of farm abandonment was attributed to the epidemic by the local inhabitants, it was often shown to be misleading, and many settlements recovered to pre-epidemic levels after

about 60 years (Sveinbjarnardóttir 1992). Although the plague epidemics had a significant immediate effect on population in Iceland, it is difficult to identify the longer-term economic or social consequences. With regards to the environmental record, the late arrival of plague in Iceland comes after threshold crossing environmental changes in the mid-14<sup>th</sup> century, which have been identified by increases in sediment accumulation rates, and after the start of LIA impacts. Ironically, subsequent exacerbation of environmental impacts may have been influenced by a shortage of labour resulting from the plague. This could have encouraged unsustainable practises of uncontrolled (un-shepherded) grazing, and/or overgrazing in the outfields beyond the growing season due to less labour being available for fodder harvesting. These factors and others may have contributed to the crossing of an environmental threshold in the mid-15<sup>th</sup> century.

These examples illustrate some of the ways in which population dynamics may relate to cultural and environmental trajectories and carrying capacity. If the population exceeds the carrying capacity (which occurs more readily on islands which are isolated, with a limited spatial area and with limited access to marine resources), increasing demands may be made on the natural environment. Conversely, when the population falls below a critical threshold, environmental impact may also be enhanced by the deliberate adaptation of less than ideal practices as a result of labour shortages, and this may have been a factor in some island environments.

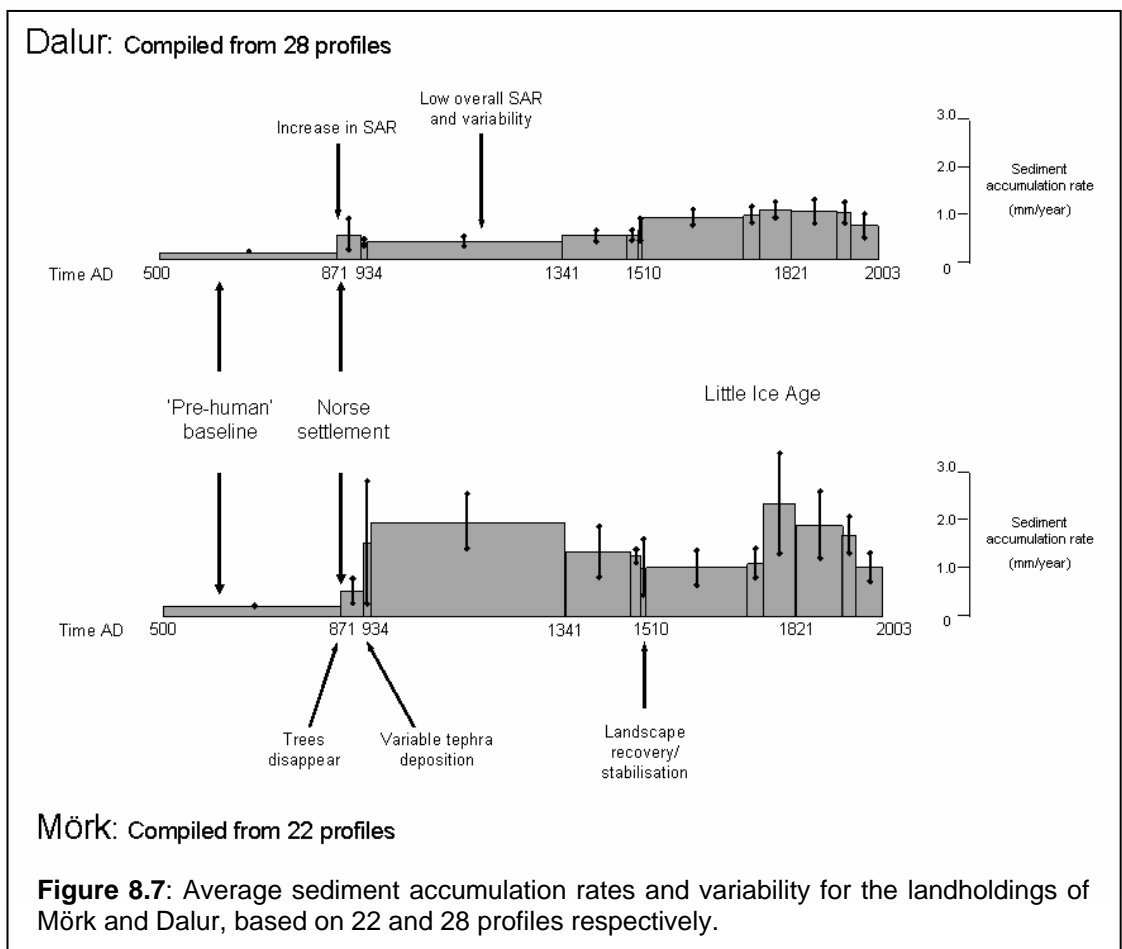
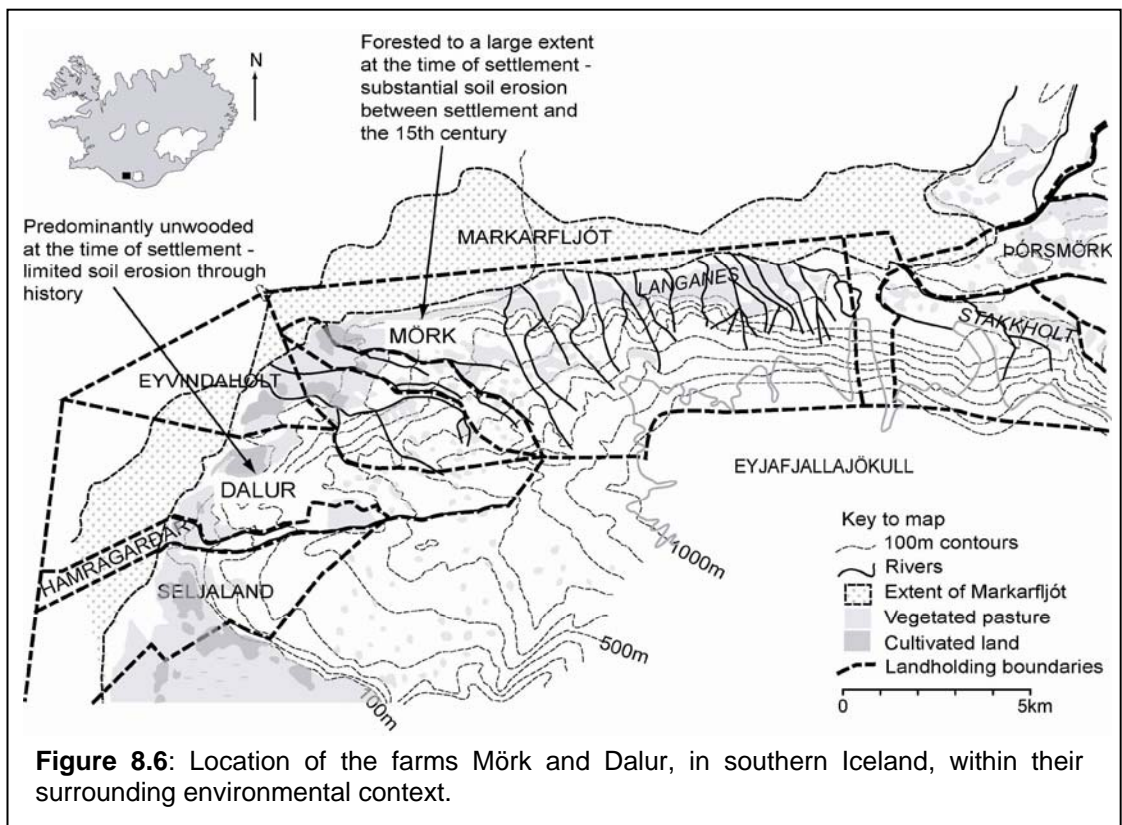
### **Why might human impacts in the Faroes have been limited? Insights from Iceland**

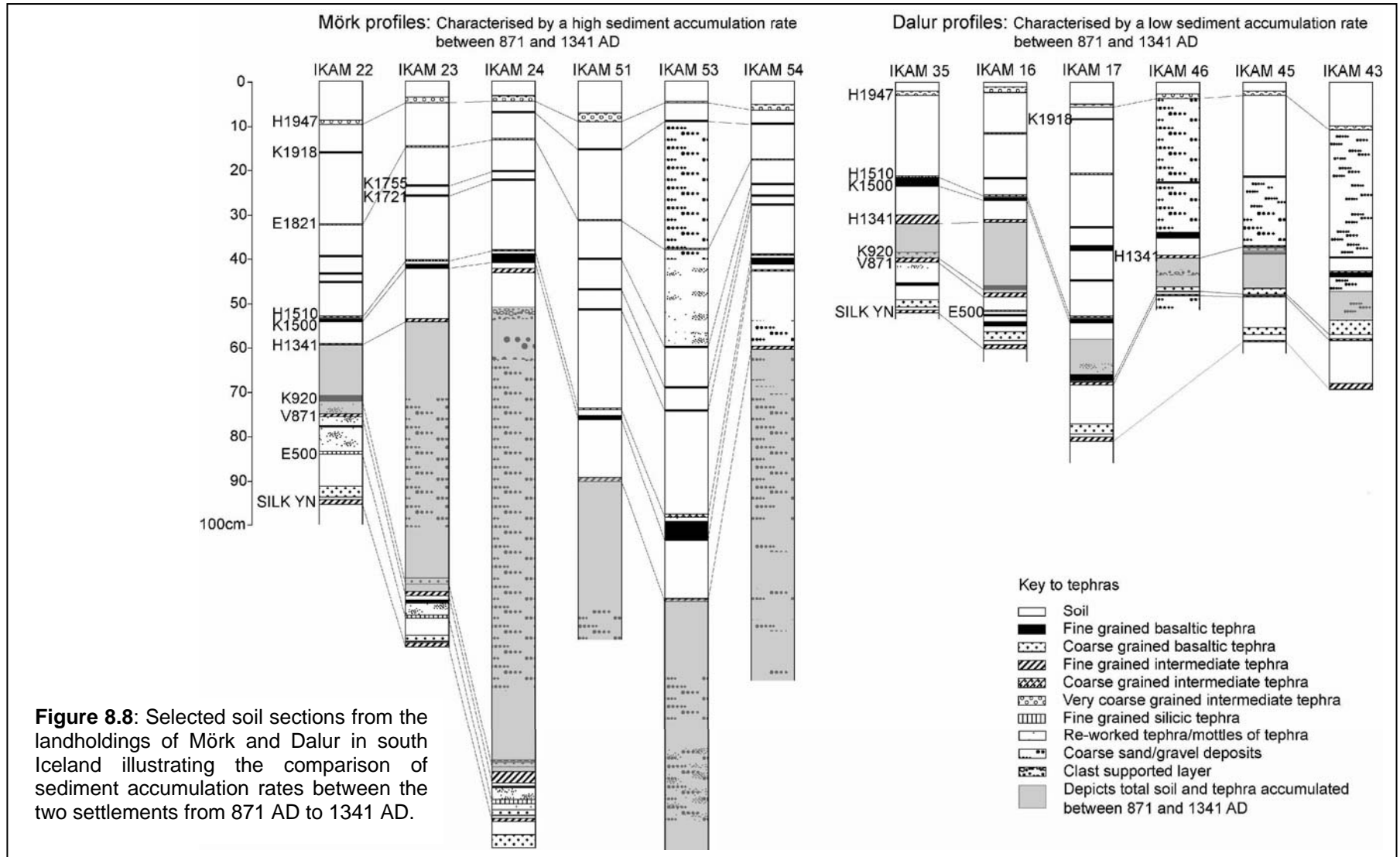
Although a generalised image of environmental change in Iceland has been presented above, by focussing on specific sites, historical landscape change in Iceland is revealed to be locally complex. A focus on two contrasting examples provides analogues, at a smaller and more measurable scale, of the generalised differences identified between Iceland and the Faroes. The first is from the south of Iceland, and illustrates the differences in landscape history between two adjoining farm settlements. The second is from the north of Iceland and links degradation, climatic sensitivity and the utilisation of natural resources. The examples also reiterate some of the arguments for limited environmental impact in the Faroes, specifically that the pre-colonisation environment already resembled a landscape affected by human impact and that the Faroese Norse utilised a wide and varied resource base over long-term settlement.

*An example from south Iceland: identifying the differences in environmental trajectories between the farms of Mörk and Dalur*

This example of two adjacent farms in the south of Iceland tests the extent to which inherent physical properties of the natural environment might result in increased human impact. The farm landholdings of Dalur and Mörk (Figure 8.6), a few kilometres apart, were assessed and compared in terms of their environmental histories (Mairs 2003, Mairs *et al* 2006). Both holdings were settled relatively early in the colonisation period, are still occupied today and have contemporary landscapes that look outwardly similar; predominantly open hayfields with open and partly eroded heathlands. However, the environmental record of the two holdings illustrates that the farms have had diverse historical environmental trajectories (Figures 8.7 and 8.8). Some of the divergence in environmental histories may be explained by their contrasting natural pre-settlement conditions. For example, the environs of the main farm site of Dalur were probably predominantly un-wooded at the time of settlement. The landholding comprised large expanses of marsh land below 50 m, and heath above 300 m, with a limited area at altitudes suitable for exploitation by birch. The environs of the Mörk farms, on the other hand, were more likely to have been forested at the time of settlement. The landholding is set back from the river on rolling terminal moraines with the slopes of Eyjafjallajökull behind, and much of the landholding is within the threshold altitude for trees. Birch wood pieces, including a trunk measuring c.240 mm in diameter, were discovered from a drainage ditch in the Mörk infields and substantial macrofossils preserved in peats below the 920 tephra layer confirmed that this area supported expansive woodland prior to settlement (and before 920 AD) (Mairs 2003, Mairs *et al* 2006). The more open nature of Dalur would have been preferred for initial settlement as the settlers would not have needed to expend labour and time on clearing woodland to grow fodder crops, the landscape already being suited to this purpose. This limited forest clearance at Dalur probably restricted the scale of rapid ecological change following settlement, ensuring the vegetation cover was not breached for some time, and minimising soil erosion until the 16<sup>th</sup> century. At Mörk, whose pre-settlement environment was more dominated by trees and scrub, widespread clearance would have been required in order to create the hayfields needed for growing fodder, which corresponds with the rapid and significant change in local sediment accumulation rates recorded after 920 AD.

In addition, the landholdings of Dalur and Mörk had differing access to a wide ranging resource base that included sheep grazing rights in locations at a distance from the main farms. This probably also limited the impacts of erosion within the Dalur landholding that would otherwise be expected to have taken place with early settlement. At Mörk, despite considerable erosion and landscape degradation in outfield areas, the major farms survived over a thousand years of settlement, indicating that access to greater resource opportunities acted as a buffer against landscape degradation, which was not available to smaller farms with limited access to additional resources.

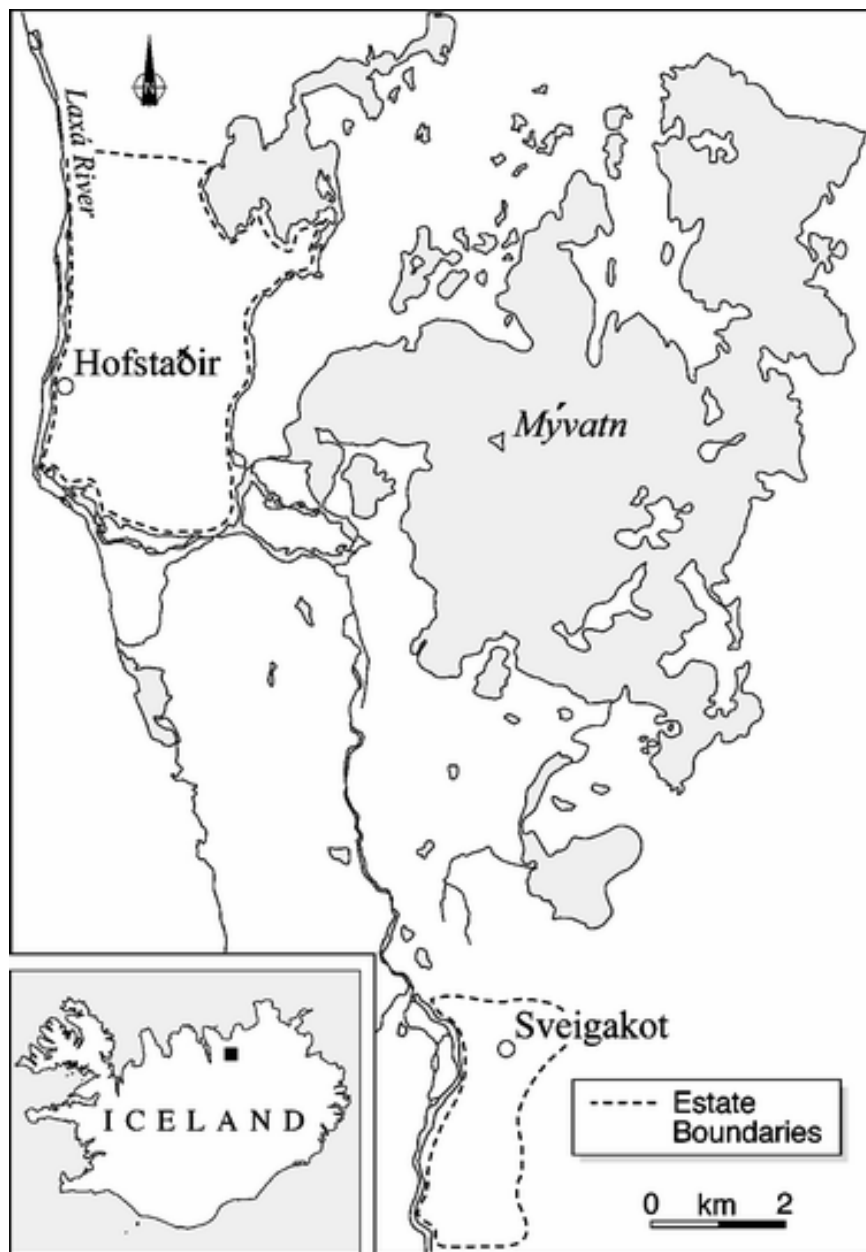




The difference in landscape histories between the outwardly similar environments of Mörk and Dalur enables the big themes of inter-island differences to be explored at a smaller scale. As with Dalur, the pre-colonisation environment of the Faroe Islands already resembled a landscape affected by anthropogenic impact, as it was predominantly open with few trees, and this must have contributed to the more limited soil erosion identified at both Dalur and in the southern Faroe Islands. Dalur and Mörk were situated only a few kilometres from each other, at the same altitude with the same volcanically derived soils and a similar climate. Yet the two farms still experienced quite divergent environmental trajectories. Applied to a larger, inter-island scale, this example implies that the inherent environmental differences between Iceland and Faroes, particularly the more sensitive soils and cooler climate in Iceland, do not, in isolation, account for the contrasting extent of human impact between the two sites. Although physical factors are likely to have had some influence, cultural factors and decision making are also likely to play a major role in determining trajectories of change.

*An example of contrasting environmental trajectories between adjacent farms in the Mývatnsveit region, north Iceland*

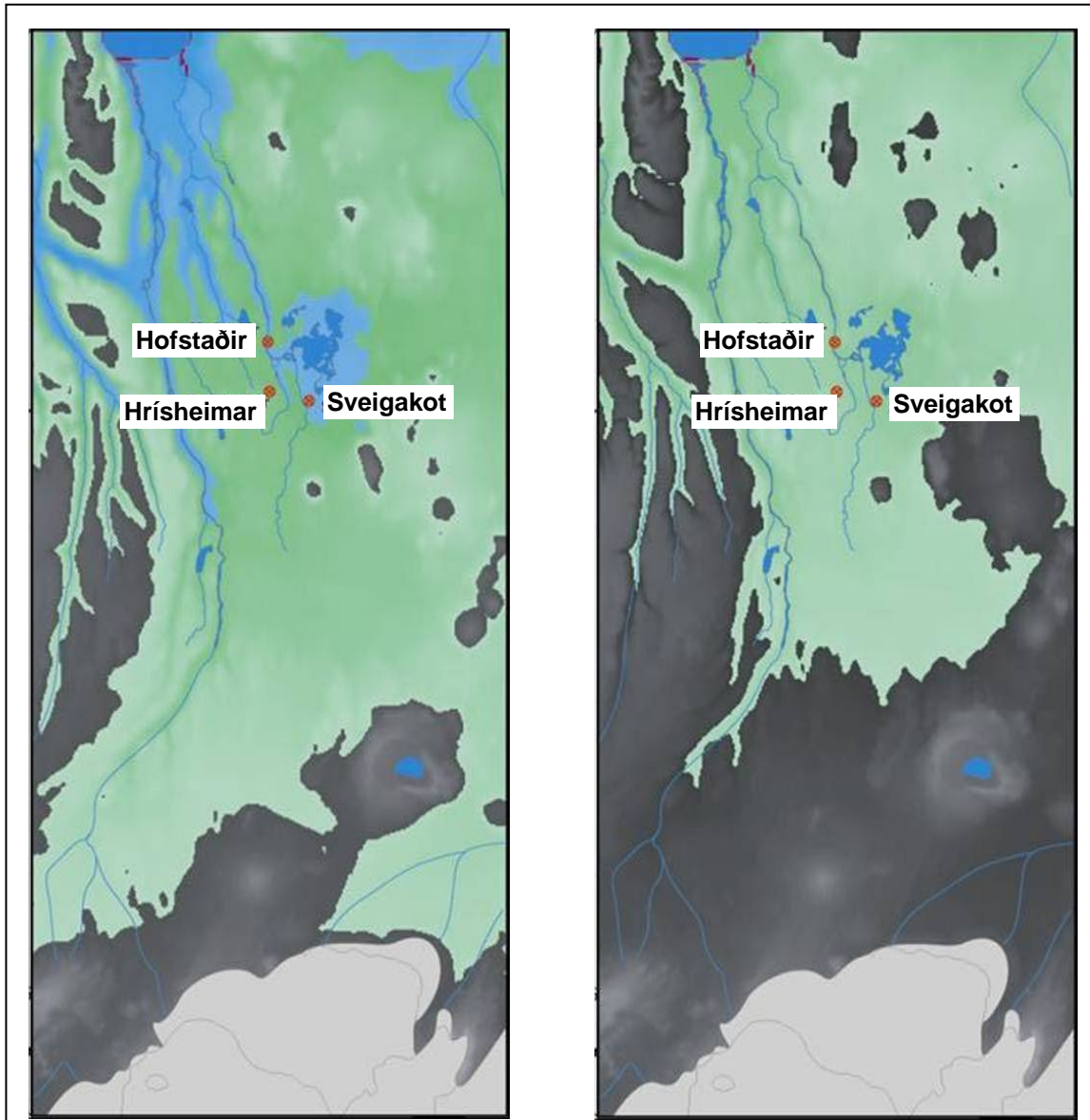
This example of two farms in the north of Iceland, just 12 kilometres apart, explores the extent to which inherent environmental sensitivity has an influence on the extent of anthropogenic landscape degradation. The Mývatn region in the north of Iceland, at an altitude of 250-300 m (Figure 8.9), represents the largest surviving inland farming community in Iceland but is surrounded to the north and south by heavily eroded desert. Prior to *landnám*, the environs surrounding the lake were covered with a mixed vegetation of birch woodland, heath, grasslands and wetlands. Since human settlement in the 9<sup>th</sup> century, the region has undergone environmental changes, such as soil erosion and deforestation, although pollen evidence suggests a more gradual deforestation after initial settlement than is evident in south Iceland (Lawson *et al* 2006). Two archaeological sites in this area provide a comparative example to illustrate the effect of subtle differences in environmental sensitivity. The first is Hofstaðir, east of Mývatn, which became a major chieftain's farm in the 10<sup>th</sup> century, and is still occupied today. The second is Sveigakot, situated 12 km inland from Hofstaðir, permanently abandoned in the 12<sup>th</sup> century and now located on a gravel plain at the edge of the inland desert (McGovern *et al* 2006). In this example, as in the example of Dalur and Mörk, the environmental and cultural trajectories of Hofstaðir and Sveigakot have been critically different despite their relatively close proximity. Although at both locations there is evidence of an acceleration of soil erosion with settlement through to c.1477 AD, at Hofstaðir there was a subsequent reduction in erosion rates to below the regional average, while at Sveigakot, the acceleration that began with initial settlement continued (Simpson *et al* 2004), indicating higher inherent landscape sensitivity. Despite their close proximity, the



**Figure 8.9:** Map illustrating the location of the farms and outfields of Hofstaðir and Sveigakot in the north of Iceland. After Thompson and Simpson (2007).

two farms may have been affected by climate differences that, although subtle, were enough to cause a threshold crossing event in one but not the other. The results of high resolution climate modelling and modelled vegetation limits in an area encompassing Sveigakot and Hofstaðir, illustrate that if the temperature is decreased by 1.5°C relative to the present temperature, there may be little change in vegetation limits in the outfields of Hofstaðir. Conversely, in the outfields of Sveigakot, the vegetation limits may be significantly decreased (Casely 2006) (Figure 8.10a). Modelling also illustrates that if the temperature is decreased by 1.5°C relative to the present temperature the end date of the growing season might be brought forward by at least a month at Sveigakot, but would remain the same at Hofstaðir (Casely 2006) (Figure 8.10b). Hofstaðir was therefore buffered by a degree of environmental resilience whereas the outfields of Sveigakot were more sensitive to climatic changes. Also, the location of Hofstaðir, whose landholding and environs were characterised by relatively good grazing land, differs somewhat from that of Sveigakot, which had landholdings bordering the eroded interior. With regards to human impact, these subtle differences are important; with a greater degree of buffering as experienced at Hofstaðir, the outcomes of unfavourable human decision making are not as detrimental to the environment. For example, a decision to keep sheep in the outfields for a fortnight longer than usual may not have any significant environmental consequences. At Sveigakot, however, the outcomes of environmentally unfavourable decisions are more significant. The decision to keep sheep in the outfields for a fortnight longer than usual could result in a threshold crossing environmental change.

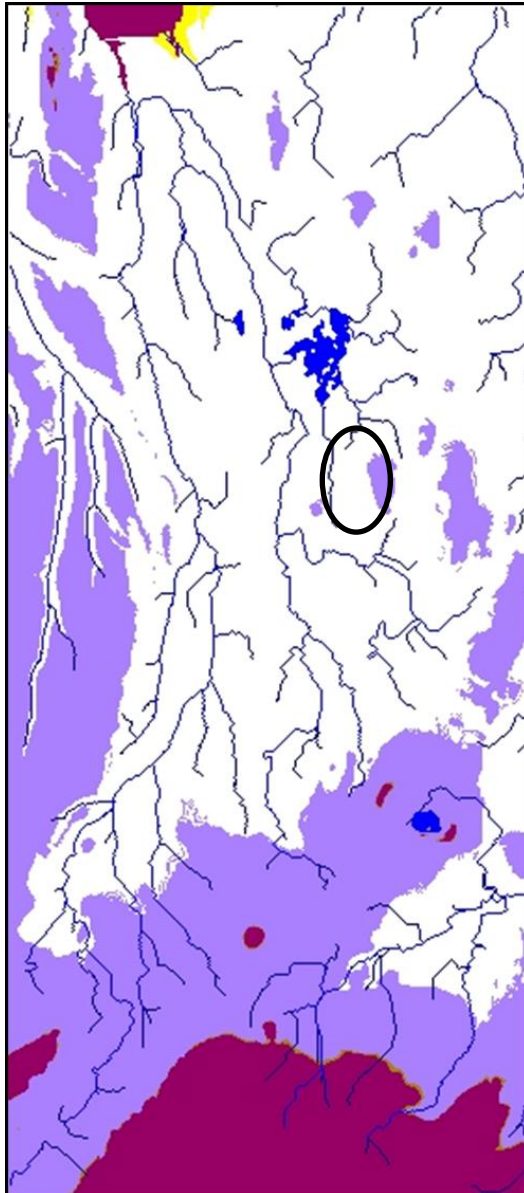
Differences in subsistence strategies between the two landholdings may also have been significant. The pattern of degradation suggests that the continuity of farm management strategies, such as the regulation of fuel resources, may have been an important factor in preserving the productivity of pasture communities around Hofstaðir (Simpson *et al* 2003). Although at Hofstaðir, the usual mix of domestic stock, cattle, pigs, goats and sheep, familiar from Norse settlements in the North Atlantic, was introduced, the importance of additional resources, particularly wild species, is highlighted in the archaeofaunal collections. These include a small (but surprising considering the inland location) number of seal and cetacean bone. In addition, some freshwater and marine fish bones are present and bird bones, mainly ptarmigan are also represented. One of the most interesting findings from recent research are fragments of bird eggshells found in archaeological contexts (McGovern *et al* 2006). This evidence indicates that the successful community management of waterfowl for sustainable egg collection extends as far back as the 9<sup>th</sup> century. Therefore, while at other Icelandic sites additional wild resources were only primarily utilised in the early centuries of settlement, Hofstaðir is an example where sustainable resources have been utilised for over a millennium, similar to resource utilisation in the Faroe Islands.



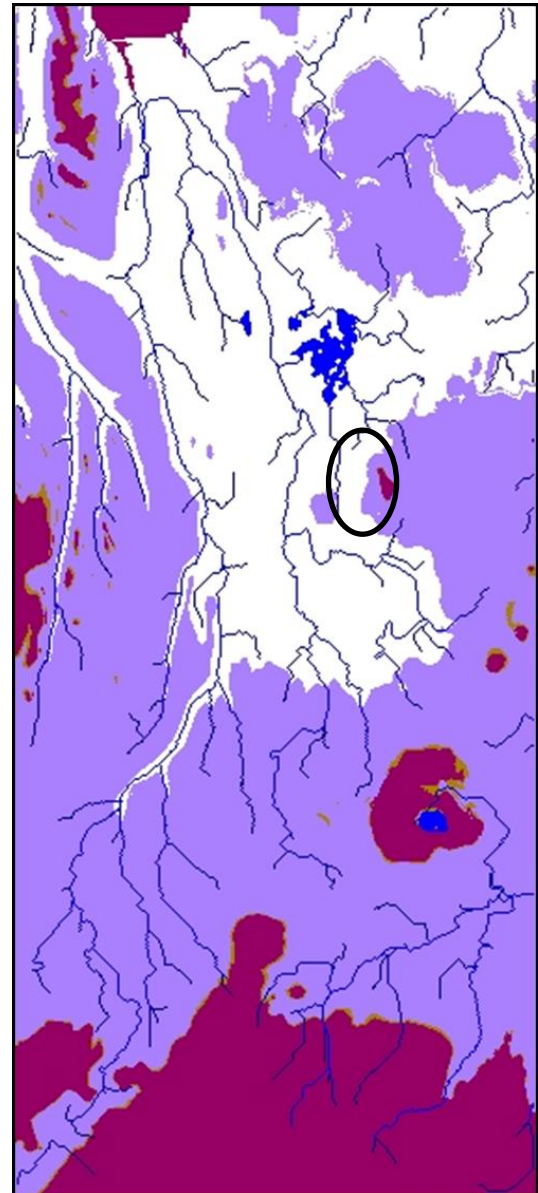
Modelled vegetation limits: present day

Modelled vegetation limits: 1.5° C below present day

**Figure 8.10a:** Results of modelling experiments (Casely 2006), illustrating the change in vegetation limits around the farms Hofstaðir and Sveigakot in north Iceland as the temperature is reduced by 1.5° C. Land area coloured in green represents the vegetation limit for grass at 4° C and light blue represents the vegetation limit for tree birch at 7.5° C.



Growing season end date with temperature as present



Growing season end date with temperature 1.5° C below present



**Figure 8.10b:** Results of modelling experiments (Casely 2006), illustrating the change in growing season end dates around the farms Hofstaðir and Sveigakot in north Iceland as the temperature is reduced by 1.5° C. In the outfields of Sveigakot (in black oval) the end of the growing season is brought forwards by a month while remaining the same at Hofstaðir.

This evidence supports the hypothesis proposed for the Faroe Islands, whereby an emphasis on continuity of alternative resource exploitation, e.g. waterfowl eggs and fish in the case of Hofstaðir; seabirds, eggs, fish and whales in the Faroes, may have been a factor limiting anthropogenic landscape impact. It is also concluded that inherent environmental sensitivity may influence the extent of anthropogenic landscape degradation in cases where there are few buffers to mitigate the effects of human impact. In addition, both of the Icelandic examples reinforce the importance of the spatial context. Comparison between sites at both smaller scales of a few kilometres (as in the case of adjacent farms) and larger scales of inter-island comparison (between the Faroe Islands and Iceland) expose patterns that are concealed beneath the variation in environmental trajectories.

#### **8.4. Comparisons between the Faroe Islands and Greenland**

##### **Are there comparisons between the environments and subsistence practices and impacts in the Faroe Islands and Norse Greenland?**

Iceland and Greenland have been compared in the North Atlantic research, for example, with regards to settlement patterns and land degradation impacts (e.g. Vésteinsson *et al* 2002). Yet, environmental and cultural factors in Iceland and Greenland are in many ways dissimilar. Conversely, little or no comparison has been made in the research between the Faroe Islands and Greenland, yet, some similarities can be made between the two, while their differences may illustrate a wider context in which to understand the continuity of Faroe Islands society on the one hand and the collapse of Norse Greenland on the other.

##### *Similarities between the scale of settlements and population in the Faroe Islands and Greenland*

A close comparison can be made between the size of settlements in the Faroes and Greenland. Despite the overall extent of Greenland in comparison to the Faroes, the Norse settlements were confined to two constrained regions in the south. The extent of land and sea area encompassed by the Eastern Settlement or Østerbygd, which was the largest Norse settlement in Greenland, was c.130 km from north to south and c.100 km from east to west. In comparison, the land and sea area encompassed by the Faroe Islands is c.120 km from north to south and c.80 km from east to west. In contrast, Iceland encompasses an area c.350 km from north to south and c.520 km from east to west. The size of Norse populations in Greenland and the Faroe Islands were likewise similar; estimates of the maximum Norse population in Greenland range from 3000-6000 (Gad 1984, Keller 1989, Berglund 1986, Meldgaard 1965, McGovern 1979), while in the Faroes the population remained in the region of c.4000 until the beginning of the 19<sup>th</sup> century (Schei and Moberg

2003). These figures contrast substantially with the estimates of the medieval population of Iceland at c.70,000-80,000 (Vasey 1996). Even accounting for errors in the estimations of the Greenland Norse population, the populations of the Faroes and Greenland are still almost an order of magnitude less than the population of Iceland.

The geography of the Faroe Islands and the Eastern Settlement in Greenland is also comparable, as the Eastern Settlement is characterised by its fjords and sounds, much like the Faroe Island archipelago.

#### *Similarities in the pre-settlement environments of the Faroe Islands and Greenland*

Although the vegetation of southern Greenland is affected by a cooler climate and a shorter number of growing days than either Iceland or the Faroe Islands, the absence of significant woodlands and the semi-open grassland and shrub cover that characterises south west Greenland, is similar to the open grass and heath environment that characterised the Faroes prior to settlement. The pre-Norse *landnám* vegetation of Greenland was dominated by its herbaceous component (Fredskild 1973; 1978), with copses of birch and willow woodland present. Recent research suggests that woodland and scrub clearance in the predominantly open Greenlandic landscape has produced subtle rather than major changes in pollen diagrams (Schofield *et al* 2006). This suggests that, as in the Faroe Islands, clearance or modification of woodland in order to create hayfields etc. was relatively limited. Consequently it might be expected that the overall environmental impact of clearance would be restricted.

Some research has suggested that landscape degradation may have played a role in the abandonment of the Norse Greenland settlement (Fredskild 1978, Jakobsen 1991, Sandgren and Fredskild 1991). This, however, is debated as there was a considerable time lag between the first signs of vegetation disturbance and the onset of detectable soil erosion (Sandgren and Fredskild 1991). More recent Greenland research suggests a pattern of vegetation change beginning with the initial clearance of shrubs, an expansion of grassland at the expense of the shrubs, and the appearance of a few weed species. It is concluded, therefore, that the Norse settlers did not have such a devastating impact on the vegetation and soils of Greenland as they did in Iceland (Dugmore *et al* 2005). Although erosion is detectable in south west Greenland today, severe erosion is confined to specific areas affected by glacial winds. Away from these areas the landscape is remarkably well vegetated, even at relatively high altitudes (Dugmore *pers.comm.*). A preliminary study of the marine cores and onshore soil profiles around the Igaliku fjord region in the Eastern Settlement also indicates that soil erosion was not a consequence of Norse farming in this area (Mikkelsen *et al* 2001). An alternative scenario is that the soil erosion is linked to a pronounced increase in the wind stress over south Greenland and the Igaliku fjord region at

the transition from the Medieval Warm Period to the Little Ice Age (Lassen *et al* 2000). Although more research is required to understand the timing, rates and extent of erosion, there is evidence that soil erosion in Greenland was more limited than has been previously asserted. It is concluded that anthropogenic landscape degradation in Norse Greenland may have been limited and is, therefore, more comparable with the Faroe Islands than with Iceland.

*A comparison of resource utilisation in the Faroe Islands and Greenland*

Certain subsistence practices in Greenland also have a greater similarity with those practiced in the Faroe Islands than those practiced in Iceland. In Greenland, hunting provided important sources of food. For subsistence the settlers hunted seals, especially migratory seals in spring from the outer fjords, caribou mainly in the autumn and some seabirds, mainly guillemots and murre, year round (Orlove 2005). In addition, there is evidence from the Western Settlement that some walrus killed on hunting trips to the *Norðrseter* (Northing Hunting Grounds) was used for meat (Arneborg 2000).

In Iceland, the exploitation of wild foods is generally intensive in the early period of settlement, reducing by the 12<sup>th</sup> century but increasing again after the 15<sup>th</sup> century with the exploitation of fish (for trade as well as subsistence). The Faroe Islands and Greenland, on the other hand, are characterised by a relatively continuous, or progressively increasing, exploitation of pseudo-infinite resources over the entire period of settlement. For example, in Greenland, isotopic evidence for human remains (Arneborg *et al* 1999) and the increase of relative percentages of seal bones through time (McGovern *et al* 1996), suggest that exploitation of seals and other marine resources played a progressively more vital role in subsistence (Arneborg *et al* 1999), while in the Faroes, bird bones at archaeological sites suggest their continued utilisation after settlement (Church *et al* 2005). Therefore, although ultimately complex, in general terms, the long-term sustainable utilisation of pseudo-infinite resources for subsistence in the Faroes is more comparable with that of Greenland than Iceland.

Comparisons can also be made between the systems of pseudo-infinite resource acquisition in the Faroe Islands and Greenland. In the Faroes, the whale hunt or *grind*, has not only provided a significant part of the staple diet, but also provided a convenient opportunity for socialising, illustrated by the culmination of the whale hunt by the *grindadansur*, or “pilot whale dance”, a fixed part of the institution of the pilot whale hunt (Joensen 1976). In Greenland, the summer voyages to the *Norðrseter* to hunt walrus, and communal migratory seal hunting may have performed similar functions to that of the *grind*, in terms of both the acquisition of significant food resources that were distributed around entire communities (of

seals, rather than walrus in Greenland), and as a communal gathering with a distinctly social dimension (seals and walrus).

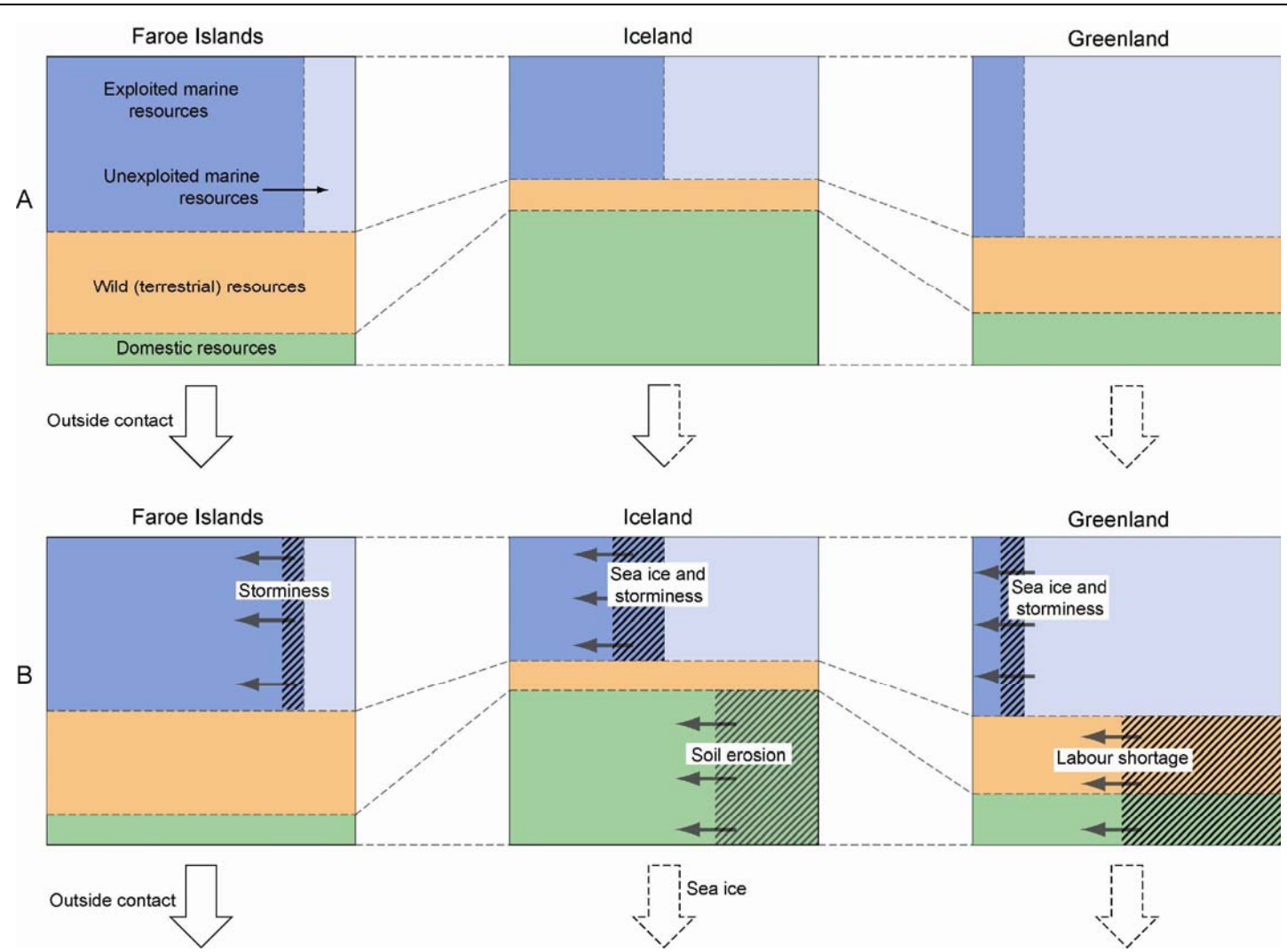
Figure 8.11 explores some of the comparisons and contrasts between exploited and unexploited resources in the Faroes, Iceland and Greenland, and how utilisation of these resources might vary over time.

### **Why might trajectories in the Faroes and Greenland be different?**

#### *Differing patterns of conflict, goals and aspirations between the Greenland and Faroese Norse*

Several similarities have been explored between the Faroes and Greenland, both in terms of their natural pre-*landnám* environments and similarities in their extensive subsistence practices. By identifying and comparing environmental and cultural *differences* between the Faroes and Iceland and Greenland, some assumptions can be proposed regarding why people put unsustainable demands on island environments. There are several differences that might have led to diverging trajectories in the Faroes and Greenland. Conflict and goals/aspirations are discussed only briefly here while the implications of climatic differences are considered in more detail below.

Isolation is a factor that may have made a difference to the trajectories experienced by Greenland and the Faroes, both in terms of the spreading of disease as discussed previously, but also in terms of geographical and cultural isolation. Although Greenland was situated furthest away from the European mainland and was the most affected by sea ice in cold years, Iceland and the Faroes also required a comparatively risky sea journey to be reached. Patterns of conflict were also distinct in the Faroes and Greenland. Between the 12<sup>th</sup> and 15<sup>th</sup> centuries, there was growing contact between the Norse Greenlanders and the Thule people, ancestors of the modern Inuit Greenlanders. Anthropological and historical evidence indicates some conflict as the Inuit expanded into Norse territory in southwest Greenland. Although the Faroe Islanders suffered abduction and hence fluctuation in population levels at the hands of French, British, Irish and Algerian pirates (Schei and Moberg 2003), these were sporadic visits as opposed to the gradual but consistent encroachment accompanied by low intensity conflict in Greenland. With the additional factor of having to contend with occasional conflict and an encroaching and potentially hostile Inuit population, the seasonal round on which the Greenland Norse depended on for subsistence, and the northern hunting expeditions, were likely to have been disrupted. Disturbance and distraction by conflict with the Inuit could have pressured the Norse Greenlanders into making less than ideal decisions regarding farming and subsistence strategies. With fewer



**Figure 8.11:** Conceptual figures illustrating the proportions of exploitable domestic, wild (terrestrial) and marine resources available to the Faroese, Icelandic and Greenlandic Norse. Figure A represents the resources available/ exploitable at the time of settlement and Figure B illustrates how these might change in the case of climatic deterioration.

buffers to mitigate the effects of any bad decision making, increasing demands may have been made on the Norse settlement.

A crucial factor, but one difficult to evaluate, is the extent to which the goals and anticipations of the settlers directly influenced the direction of trajectories in the Faroes and Greenland. This is important to address because if the goals and aspirations of a society are misunderstood there are implications for how researchers perceive or understand the importance of threshold crossing events and why people might make unsustainable demands on their environment. In Iceland, for example, it is suggested that the Norse initiated a threshold crossing event by inducing severe environmental degradation as a result of deforestation and overgrazing. However, if the goal of the Norse was to create a suitable landscape on which to carry out a sheep-rearing economy, to what extent did the settlers create a landscape that is "fit for purpose" as opposed to instigating a threshold crossing event that compromised long-term settlement? Ironically without the changes that caused erosion, a pastoral base for subsistence would not have been possible. Similarly, whether the aspiration of the Greenland Norse was to create a successful long-term subsistence society, or to exploit what natural resources were available and take advantage of trading in luxury commodities that were in demand in Europe, has different implications for how their society is perceived. The disappearance of the Norse was a threshold crossing "cultural collapse", but it could be argued that it was caused by a failure to create a sustainable cash crop economy as much as by a failure to create a sustainable subsistence economy. This would furthermore account for some of the differences in trajectories between the North Atlantic islands.

*To what extent does climate matter with regards to differences in cultural and environmental trajectories in the North Atlantic?*

Climate is consistently identified as a factor influencing settlement in the North Atlantic islands, particularly in Greenland where the climate is more Arctic in character and where the Norse were at the limits of their west Norwegian-based agricultural system. Variability in weather and climate systems rather than absolute temperature changes may have had more significant impact on human settlement. Even so, northern societies are broadly competent to deal with considerable environmental variability, and most have well articulated multi-layered coping strategies that can be successfully invoked to buffer extreme events (Berkes *et al* 1998). Therefore, it is not simply that a changing climate or an increasingly variable climate affects people detrimentally, or in a way that puts pressure on the landscape. Difficulties for human populations arise when the climate switches from one trajectory to another so that generations of past experience of, for example, the timing of bringing sheep down from, and returning them to highland pasture, becomes misleading. The ability of

human systems to accommodate or adapt to bad seasons may, therefore, be primarily constrained by their predictability on the decadal scale (Dugmore *et al* 2007a).

Recent research that has investigated measures of cumulative deviation to identify the most important timings of climate change with regards to human impact, identifies a turnover or sharp change of climatic trajectory at 1425 AD, using a cumulative CuDe measure as an indicator of storminess. Correspondingly, a turnover is identified in the cumulative sea ice record around 1450 AD (refer to Figure 4.4). These abrupt changes mark reversals of two long-term climate trends that would have accumulated in the memories of the North Atlantic settlers and had formed the basis of generations of experience. The chronology of these turnover changes coincides with the disappearance of the Norse Greenland settlements, the end of the Eastern settlement dated to no later than around 1450 AD (McGovern 2000). This does not imply that a deteriorating climate caused the abandonment of the Norse Greenland settlement, however. Sudden turnovers and unpredictable climate changes could have potentially affected populations on all North Atlantic islands, regardless of the absolute temperature difference between Greenland and the Faroe Islands. Mitigation of climate impacts would be dependent on to what extent the islanders had created a system of buffering strategies to defend against unpredictable events, as well as buffers existing (or not) in the natural environment. The Faroe Islands may, therefore, have been less impacted by climate changes in historical time than Greenland because they had more buffers to cope with unpredictability, for example, pastoral farming was less marginal and they could rely on their closer and more dependable and pack ice-free connections with mainland Europe and more labour was channelled to communal subsistence than trading expeditions.

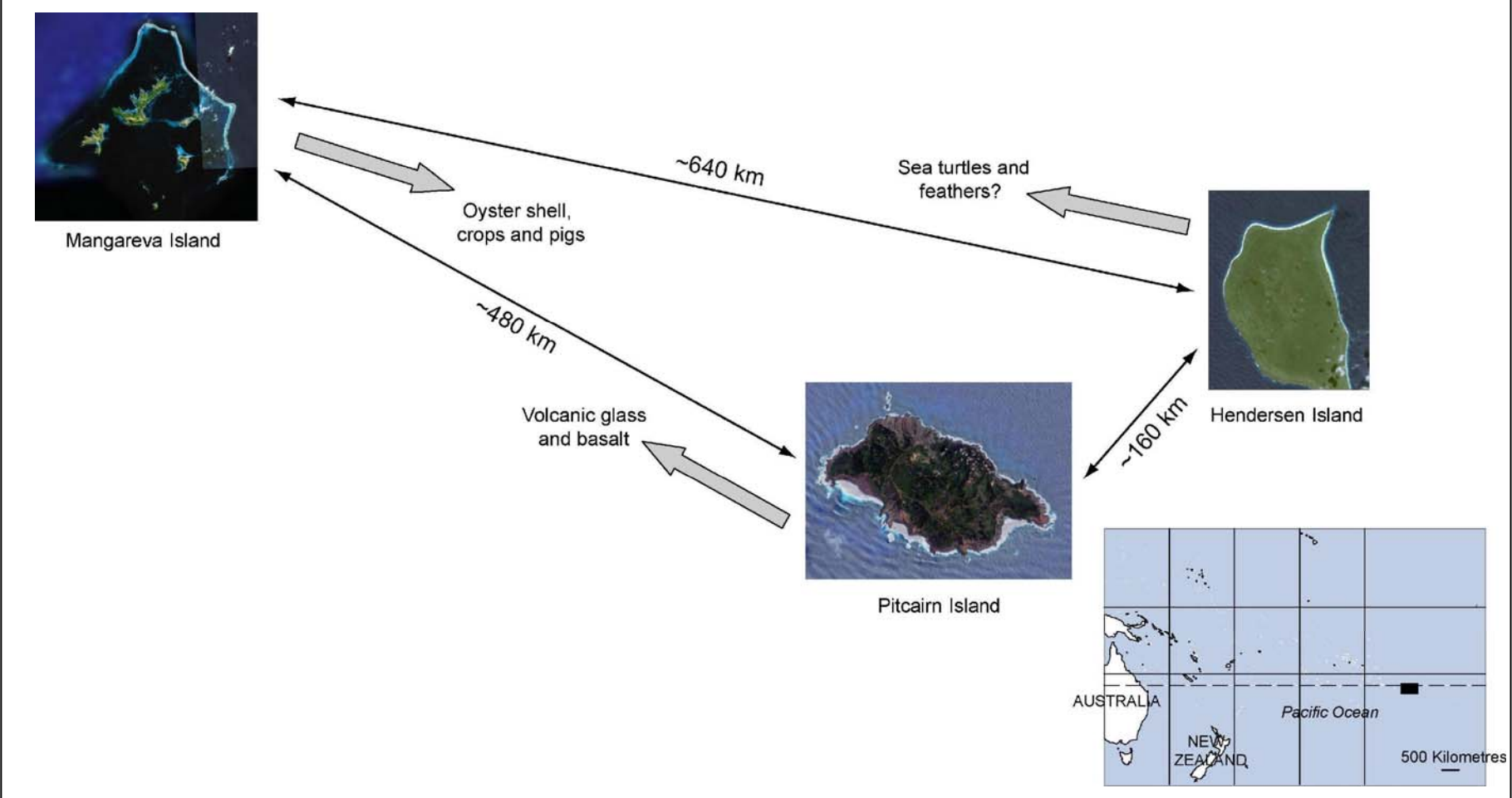
With regards to the question of whether climate increases the demands people made on North Atlantic environments, absolute climate changes, for example a decrease in temperature does not appear to have a direct or significant impact. Greenland, although more environmentally marginal in terms of climate, does not appear to have suffered from adverse anthropogenic soil erosion as recent research suggests that human-induced erosion around the Eastern Settlement was not significant (Mikkelsen *et al* 2001). Therefore, it is concluded that climate is not the key factor in influencing the demands people make on their island environments, at least with regards to the degree of environmental degradation. Climate does of course matter, but in an indirect way; Greenland was disadvantaged because of the particular subsistence methods employed by the Norse and because there were fewer buffers against unpredictable climate changes.

*When climate doesn't matter: a comparative example of environmental and cultural stress from south east Polynesia*

Although climate is one of many factors that might influence settlement in the North Atlantic, there are examples where environmental and cultural stress has occurred in the absence of climatic change, e.g. the Pitcairn Island grouping in south east Polynesia. The populations of Pitcairn and nearby Henderson Island suffered a population collapse, although on the nearest adjacent island of Mangareva, the population endured. As with the North Atlantic islands, factors such as environmental degradation, the over-exploitation of resources and conflict may have caused cultural stress, but unlike in the North Atlantic, on Pitcairn and Henderson climatic factors are more or less irrelevant.

The Pitcairn Islands encompass both Pitcairn and Henderson Island, 160 km apart, while the nearest neighbouring island, Mangareva, lies 640 km to the east of Henderson (Figure 8.12). Henderson and Pitcairn are two of twelve generally small islands in Polynesia, where there are archaeological traces of Polynesian habitation but which had become unoccupied by the time of European exploration in the 16<sup>th</sup> century. Extensive archaeological survey and excavation has been carried out on Henderson Island (Weisler 1994; 1995), which is considered the most environmentally marginal of the island group, and tenuous for human settlement because of a lack of specific resources required for Polynesian subsistence. Despite the barriers to human settlement, well-stratified deposits in rock shelters and a beach site testify to a continuous Polynesian presence on the island from around 900 AD to 1500 AD, which is comparable to the length of the Norse occupation of Greenland. As questions regarding the disappearance of the Norse in Greenland are posed by North Atlantic scholars, similar questions regarding population collapse on Henderson and Pitcairn have been addressed by archaeological research in southeast Polynesia.

Despite the large distances between the Pitcairn Island group and Mangareva, archaeological evidence highlights a substantial and complex trading network that existed between Pitcairn, Henderson and Mangareva, in food, natural resources and luxury/prestige items. Mangareva was largely self-sufficient in food, and exported surplus foodstuffs to the Pitcairn Islands. Basalt and obsidian available on Pitcairn were traded in return. Henderson, although deficient in crop producing soils and basalt harvested a surplus of what would have been prestige items, particularly sea turtles and bird feathers (refer to figure 8.12). In the archaeological record exotic imports are recorded on Henderson up until 1450, but after this disappear, and are replaced by distinctive artefacts utilising locally available materials. Soon after this the sites are abandoned. With climatic factors being insignificant it could be suggested that the abandonment of Henderson is an example of over-exploitation of natural resources leading to a cultural collapse. However, archaeologists have now turned to Mangareva, and the perspective of a wider context has highlighted some interesting results. Although archaeological work is ongoing, there is evidence that the break down in trade between Mangareva and the Pitcairn Islands may have been a result of social upheavals in



**Figure 8.12:** Location and trading activities of the Pitcairn Island group, in relation to the islands of Henderson and Mangareva.

Mangareva. With increased conflict between communities and tribes it became more imperative to stay at home and protect subsistence resources than to embark on long-distance trading and socially orientated voyages to the Pitcairns.

Climatic change is a more or less irrelevant factor with regards to the cultural collapses on Henderson and Pitcairn, as most Oceanic islands lie within the tropical to subtropical zone and receive sufficient rainfall for feasible agriculture. Therefore, even where climatic factors are largely irrelevant, threshold crossing events can still occur. This example highlights not only the significance of inter-island trade networks but also the importance of evaluating outcomes on “marginal” islands in the context of those larger social and environmental networks. Although archaeological research on Henderson Island has been invaluable in understanding aspects of its cultural and environmental history, the cause of its abandonment has only become clearer with regards to research in Mangareva. This example once again demonstrates the importance of understanding individual island trajectories from a multi-scaled approach.

## **8.5. Chapter conclusions**

### **Comparison of approaches to adaptation on the North Atlantic Islands**

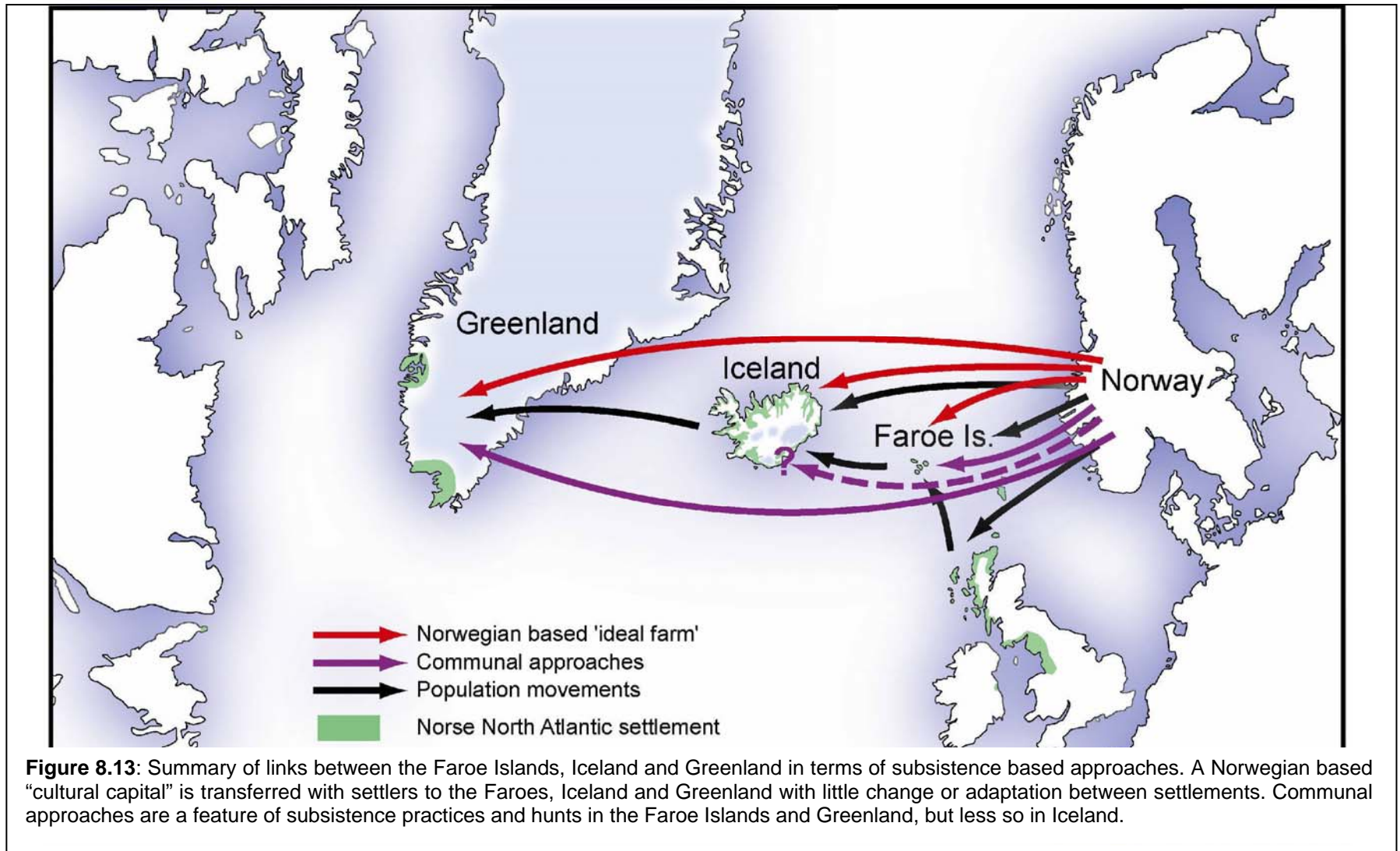
The Faroe Islands were the first of the North Atlantic islands to be colonised by the Norse and were the first “pristine”, previously uninhabited landscape to face the Norse settlers on their westwards colonisation. The challenge for the Norse was to adapt to these new environments, while implementing a traditional Norwegian based pastoral economy. Over the course of settlement the population of the Faroe Islands remained remarkably consistent (aside from the impact of plague c.1350), in Iceland it was more oscillatory, and in Greenland it declined, leading to a cultural collapse. It could therefore be alleged that adaptation to the environment was achieved more effectively in the Faroes than in Iceland or Greenland. However, adaptations from a Norwegian-based experience to a new environment are evident in archaeological sites in the Faroes, Iceland and Greenland. For example, archaeobotanical evidence illustrates the changing mix of domestic animals across the North Atlantic from a mixed Norwegian-based ideal to one dominated by sheep. When colonisers settled Iceland they referred back to this Norse ideal rather than utilising experiences learned from the Faroe Islands, and similarly evidence from the Greenland settlements indicates an initial mix of domesticates, including a significant number of pigs, based on the Norwegian model, as opposed to one based on the mix of domesticates from a 10<sup>th</sup> century Icelandic farm which had already begun to adapt to a new environment (McGovern 2000).

Although evidence does indicate that in many cases the Norse were able to adapt, there are also examples whereby the Norse could have adapted but didn't, such as by not engaging with the application of Inuit clothing and technology in Norse Greenland. In this case, however, the Norse *chose* not to utilise Inuit approaches to subsistence, opting instead to elaborate and emphasize their own European based traditions and ideology. In Norse Greenland, one such tradition, of importance primarily for trade (and probably also with a social function), was the annual communal hunting expedition to the *Norðrsetur* in the Disko Bay area. These organised hunts demonstrate an approach that may have been influenced by earlier communally based activities (e.g. 8<sup>th</sup>-9<sup>th</sup> century Viking raids). In both the Faroes and Greenland, the Norse adopted communally-based approaches to certain tasks, illustrated in the Faroes by the importance of the communal whale hunt and bird hunting expeditions, and in Greenland by caribou and seal hunts in addition to the trade-driven *Norðrsetur* expeditions. In Iceland, despite the complex exchange and kin networks between farms, and gatherings of people for fishing expeditions, there may have been less emphasis on communal hunts at scales involving entire communities (e.g. at the scale of whole villages in the Faroes) (Figure 8.13). Despite the ultimate collapse of Norse Greenland, which involves complex suite of causes, the emphasis on community driven subsistence and sustainable utilisation of pseudo-infinite resources, may at least be a factor in explaining the significant similarity between the limited extent of landscape degradation in the Faroes and Greenland, in addition to inherent environmental factors.

### **Were outcomes on the Faroe Islands, Iceland and Greenland inevitable?**

To understand the trajectories and causes of change in settlements in the Faroe Islands, Iceland and Greenland, it is important to question whether outcomes on the three islands were to some extent inevitable, based on the scale of the islands, the size of population, the available resources, the distance from mainland Europe and the differences in climate. A key question throughout this research has been whether differences in the outcomes on islands is a function of diverse inherent natural environments and climate, or something else. By examining the outcomes of settlement on the Faroe Islands in a wider North Atlantic context, and by utilising examples on scales ranging from adjacent farms to adjacent islands, the following reflections can be made.

It is concluded that to some degree natural factors influence the extent to which people in the North Atlantic put unsustainable demands on their environment, but that the relationship is complex. The extent of woodland in the pre-colonisation environment, for example, is a factor that increases the sensitivity of a landscape to human impact. However, this factor is only significant in relation to the actions, mindsets and experiences of the inhabitants. The degree of soil erosion is dependent on the nature of subsistence practices that people were



carrying out and also on the extent of buffers to cope with landscape erosion, such as having access to varied resources (as much a question of political or social access as the actual existence of such resources), as well as the type of soil. Similarly, environmentally deterministic arguments, e.g. that a cooling climate causes increased environmental pressure, are simplistic and misleading. Climate does matter in terms of anthropogenic impact on North Atlantic environments, but in a complex way where long-term trajectories of change, memories and the extent of cultural as well as environmental buffers need to be considered.

Outcomes on the Faroe Islands, Iceland and Greenland were therefore not inevitable or entirely determined by environmental factors although these play a significant role, especially regarding the pre-colonisation landscape and inherent environmental characteristics. Alternative options were available to the settlers that would have resulted in different outcomes, although in areas more environmentally sensitive, certain decisions will have more serious implications than in less environmentally sensitive areas. What might be considered “good” or “bad” decisions are also dependent on the goals, aspirations and mindsets of the settlement communities. Therefore, although outcomes are *influenced* by climate and natural factors, this is in an indirect and more complex way, that in many cases could be mitigated or adapted to by people *if they so wished*. A contemporary analogue is presented with regards to attitudes to global warming. People *are* able to act to reduce carbon emissions and therefore mitigate the impacts of global warming, but in some cases they *choose* not to in order to, for example, protect economic or ideological values.

### **Chapter summary**

Comparisons between the North Atlantic islands indicate that human impact in the Faroe Islands was less significant, and the outcomes of settlement less distinct in the environmental record, from either Iceland or Greenland. Yet the Norse colonisers brought a similar “cultural capital” to all three islands, which were settled in relatively quick succession over the course of less than a few hundred years. The specific outcomes on the Faroes are therefore of considerable interest when placed in a North Atlantic perspective. This chapter has integrated research from Iceland and Greenland with that of the Faroe Islands, and in doing so has both highlighted the importance of research conducted in the Faroe Islands to North Atlantic human-environment research, and emphasised some of the circumstances whereby people might make unsustainable demands on island environments. Human impact in Iceland appears to have been particularly significant, as a result of a combination of diverse environmental and cultural factors. Human impact on the Greenland environment appears to have been less significant for reasons that are closely identified with those of the Faroe Islands.

## Chapter 9

### **Conclusions: Under what circumstances do people put unsustainable demands on island environments?**

#### **Summary**

The aim of this thesis is to identify the extent to which, and the circumstances whereby people might make unsustainable demands on island environments. This aim has been achieved through the development of the key themes of multi-scale, multi-disciplinary, scale-matching enquiry and a focus on common problems. A table summarising the thesis objectives and how they were achieved is presented as Table 9.1. Firstly, detailed and focussed research in the Faroe Islands was carried out at an appropriate spatial scale, from which details of pre-colonisation landscape change, the initial impacts of colonisers on a “pristine” environment, and longer-term anthropogenic impacts and adaptations, could be understood. Secondly, bold ideas were explored by developing a comparative approach that enabled the thesis to build upon the site-specific research, to a spatial scale encompassing Iceland and Greenland. Assessment of the Faroe Islands in a wider North Atlantic context allowed the understanding of colonisation, adaptation and long-term settlement undertaken by a comparatively well-known population in contrasting environments, to be developed. From this, general principles and patterns regarding human impacts on island environments can be suggested at a potentially global scale.

A fundamental objective of the research was to develop and utilise an approach that allowed data from a combination of environmental and culturally led methodologies to be integrated, so scale-matching is key. For the focussed, Faroe Islands research, a landscape-scale was applicable to both environmental and anthropogenic data, allowing diverse data sets to be compared. Original data was collected from areas of putatively early Norse settlement, specifically the catchment of Hov on Suðuroy and northern Sandoy, using landscape mapping techniques, archaeological survey, interviews, stratigraphic analyses and radiocarbon dating. From the incorporation of these datasets, conclusions regarding the location, timing, extent and causes of human impact could be drawn. Assessment at other scales was incorporated by utilising tephrochronological and sediment accumulation rate data collected from Iceland, and by developing a comparative approach from which the varying impact between the Faroes, Iceland and Greenland could be understood.

The thesis conclusions are outlined below and are structured around the questions raised in the introduction based upon the three principle scales of site specific research, inter-island comparison and of fundamental issues concerning islands and human impact.

Objectives	How objectives were achieved
<p>To develop scale-matching and a focus on common problems as ways of enhancing methodologies for integrated studies of human-environment interactions on islands.</p>	<ul style="list-style-type: none"> <li>- Data from different methodologies (e.g. geomorphic mapping, archaeological survey, stratigraphic recording) evaluated at comparative scales in Hov and north Sandoy.</li> <li>- Integration of data from interviews with present day farmers to enhance historical landscape data.</li> <li>- Development of interviews (and cognitive mapping) as a step towards understanding the ‘perception’ element of human-environment research.</li> </ul>
<p>To develop the interdisciplinary scale-matched, focussed approaches though detailed human-environment research in the Faroe Islands.</p>	<ul style="list-style-type: none"> <li>- The recording over 80 soil profiles to build up a picture of late Holocene development in the southern Faroese landscape.</li> <li>- Undertook comprehensive archaeological walk-over surveys at a catchment scale where none previously existed.</li> <li>- In-depth interviews provided data at a localised scale and at a personal level to complement catchment to regional-scaled data.</li> <li>- Demonstrated importance of research in regions like the Faroes where landscape change has been limited, to compare against areas where landscape change has been significant.</li> </ul>
<p>To develop the scale-matched, focussed approaches though an assessment of site-specific research in the Faroe Islands in the wider context of North Atlantic settlement.</p>	<ul style="list-style-type: none"> <li>- Identified a methodology and approach (a landscape-scale based approach utilising different methods) to enable comparison.</li> <li>- Outcomes of landscape change and settlement on the Faroes were compared for the first time with those on Iceland and Greenland</li> <li>- Exploration of similar and contrasting patterns in the Faroes, Iceland and Greenland.</li> <li>- Used specific examples as small-scale analogues of larger scale comparisons between the Faroes and Iceland.</li> </ul>

**Table 9.1:** The thesis objectives and how they were achieved.

### Implications of site-specific research in the Faroe Islands

1. *Have natural or human impacts been the major driver of landscape development over the last 5 ka in the southern Faroe Islands?*

Natural processes set in motion prior to colonisation, have been the main factors shaping the contemporary Faroese landscape, out with the infields. The most significant threshold crossing event to affect the Faroe Islands landscape in the Holocene occurred prior to human colonisation at c.2900-2300 cal yr BP. It is proposed that deteriorating climatic conditions at this time, as supported by evidence from many North Atlantic records (Dahl-Jensen *et al* 1998, Møller *et al* 2006, Fredskild 1983, Funder and Fredskild 1989, Kaplan *et al* 2002, Kerwin *et al* 2004, Bond *et al* 1997, Andersen *et al* 2004, de Jong *et al* 2006, O'Brien *et al* 1995, Denton and Karlén 1973, Karlén *et al* 1995, Dahl and Nesje 1994), initiated a variety of geomorphological changes resulting in the creation of a more varied landscape surface than existed previously. Several key elements of the present landscape were, therefore, already well established by the time of the arrival of people in the islands and the significant geomorphic changes acted to desensitise the impact of subsequent human impact 500-1000 years later.

2. *To what extent did people have an impact on the environment of the southern Faroe Islands and how did those impacts change through time and space?*

Although more limited in comparison to pre-colonisation geomorphic changes, human impact is evident at specific spatial scales. A second significant period of late Holocene landscape change, indicated by an influx of silts, gravels and clays in sediment profiles in the Faroe Islands occurred at c.60-660 AD. However, unlike earlier geomorphic changes recorded c.2900-2300 cal yr BP, where evidence of change is seen extensively across the landscapes of both Hov and Sandoy, the later changes vary in their timing and extent. An early phase of landscape change is evident in sediments from Sandoy, c.60-400 AD, but similar changes at Hov are not evident until c.400-660 AD. In the absence of a climatic driver for these changes, and because of their differential spatial and temporal occurrence, the simplest explanation is that the changes resulted from human impact by small-scale and probably episodic occupation of the islands. The spatial scale of these changes, which occur in profiles across both Hov and north Sandoy, implies some limited impact from grazing of introduced domesticates. However, as yet there is no firm evidence of human occupation in the Faroes prior to the 6<sup>th</sup> century.

Longer-term human impact on the Faroe Islands landscape is characterised by significant localised degradation of the vegetation cover and erosion of the underlying sediments. Grazing impact, and impacts relating to peat cutting have been the most significant causes of

anthropogenic influence in the outfields, post-colonisation. Grazing has undoubtedly affected the landscape to some extent, and has probably contributed to the formation of top silt present in the sediment profiles; however, in comparison to other islands, grazing impacts have been limited. At specific, spatially limited locations, human impact has caused significant landscape degradation (removal of vegetation cover and underlying soft sediments) as a result of peat cutting.

3. *Were unsustainable demands made on the Faroe Islands environment?*

In comparison to other islands, relatively few unsustainable demands have been made on the Faroe Island environment within the timescale of enquiry (pre-16<sup>th</sup> century). Human impact has been limited by a combination of inherent environmental factors, e.g. relatively robust soils, a predominantly open pre-colonisation landscape, and by the particular long-term subsistence strategy of the settlers, e.g. the regulated utilisation of pseudo-infinite resources and communal approaches to subsistence based activities. By analysing the circumstances whereby catastrophic impact was avoided in the Faroe Islands, assumptions can be made regarding what caused unsustainable demands to be made on island environments elsewhere.

**Implications of inter-island comparisons in the North Atlantic**

1. *To what extent are outcomes in terms of environmental degradation and resource exploitation between the Faroe Islands and Iceland similar and why?*

Iceland and the Faroe Islands differ in terms of their geography, environmental sensitivity and trajectory of landscape change. The focus towards the sea in the Faroe Islands, and to the land in Iceland may also have influenced how the two islands approached their subsistence strategies. For example, in the early Icelandic settlement period, archaeobotanical collections indicate that locally available pseudo-infinite resources, such as seabirds, were initially substantially utilised. However, after the 11<sup>th</sup>-12<sup>th</sup> centuries many collections were dominated by domestic mammals (McGovern *et al* 2006) until the 15<sup>th</sup> century when fishing increased. In the Faroe Islands, marine resources have provided a more significant and varied proportion of the islands' subsistence, from fish as well as pilot whales and seabirds, not just over the initial colonisation period, but over longer-term settlement.

2. *To what extent are outcomes in terms of environmental degradation and resource exploitation between the Faroe Islands and Greenland similar and why?*

Cultural and environmental factors of settlement in the Faroe Islands have not previously been compared with Greenland, but some aspects e.g. local geography, population density,

anthropogenic landscape impacts and subsistence strategies are strikingly similar (although climate factors, extent of conflict and settlement trajectories differ). In the Faroe Islands, the communal *grind* contributed a significant proportion of the subsistence base in the Faroe Islands, and had an important social function. In Greenland, the exploitation of migratory seals, caribou and seabirds provided a significant proportion of subsistence over the period of settlement. Hunting was carried out communally and, as with hunting in the Faroe Islands, probably had a social as well as subsistence/trade function. The long-term utilisation of pseudo-infinite resources in Greenland is therefore more comparable to that of the Faroes than Iceland.

### 3. *Why does impact between the North Atlantic islands vary?*

Based upon analyses of the data collected from the Faroe Islands, combined with an exploration of comparisons with Iceland and Greenland, the following factors are concluded to explain some of the variance in outcomes of human impact in the North Atlantic islands;

- *The inherent natural environment.* The inherent natural environment influences the extent to which people might have an impact on their environment, but rather than a deterministic force, matters specifically in combination with other factors. At a regional scale, this is demonstrated by comparisons between the farms and landholdings of Hofstaðir and Sveigakot in northern Iceland. There is greater degree of buffering at Hofstaðir, whose landholding and environs are characterised by relatively good grazing land. Therefore, human impact, as a result of climate changes or unfavourable human decision making, may be offset to some degree. At an inter-island scale, the significance of the inherent natural environment is demonstrated by comparisons between the vegetation and soils of the Faroe Islands and Iceland. The predominantly open nature of the pre-colonisation Faroese environment, combined with the relatively robust vegetation and soils, lessened human impact caused by deforestation and soil erosion. Some aspects of this argument are, however, only significant with regards to the particular way in which people decide to utilise that environment. For example, if the Norse Icelanders had not pursued a strategy of extensive deforestation, the issue of vulnerable soil would have been less significant (but a pastoral base to subsistence farming would have been impossible).
- *The pre-settlement development of the natural environment.* Whether or not people make unsustainable demands on their environment is influenced by the direction of the pre-colonisation environmental trajectory. At a regional scale, this is demonstrated by differences in the post-settlement trajectories of the farms and landholdings of Mörk and Dalur in southern Iceland. Dalur and Mörk are (and were) situated only a few kilometres from each other, at similar altitudes with identical soils and and climate. Yet the two farms

experienced divergent environmental trajectories; soil erosion has been of much greater significance at Mörk than Dalur. The pre-colonisation environment of Dalur already resembled a landscape affected by anthropogenic impact (predominantly open, with few trees), and limited scales of landscape transformation probably contributed to the more limited soil erosion. At an inter-island scale, the significance of the pre-settlement environmental trajectory is illustrated by sediment profiles in the Faroe Islands. c.2900-2300 cal yr BP, the Faroese landscape underwent a significant change from a peat dominated to a more variegated landscape, which may have acted to desensitise the island landscapes from the impact of people following settlement c.500-1000 years later. Therefore as the Faroe Island landscape underwent significant environmental changes prior to occupation, the impact of settlement is not as significant in the environmental record as, for example, in Iceland.

- *Emphasis on a diversity of subsistence, especially utilisation and access to pseudo-infinite resources.* Although the robustness or sensitivity of the inherent natural environment is crucial, the inappropriate or ineffectual use of available resources or technology also influences the impact of people on the environment. At a regional scale this is demonstrated by the example of Mörk in southern Iceland. Although the vegetation had changed, causing considerable erosion and landscape degradation, alternative resources and landholdings outside the contiguous farm provided Mörk with greater opportunities and buffers, which ensured that the degradation could be managed and that the farm site survived. At an inter-island scale, the importance of pseudo-infinite resources is illustrated by subsistence strategies in the Faroe Islands, which were based on a diverse range of practices including both domestic pastoralism and the continuity of the substantial utilisation of pilot whales, seabird colonies and fish. Effective utilisation of these resources, however, depends on factors other than simply their availability. For example, to exploit marine resources, suitable boats and harbours were needed. In addition, a pool of labour that could be quickly mobilised was required for hunts or expeditions. For example, the success of the *grind* depended on the fast mobilisation of villagers and boats in addition to a well-developed system of alerting other villages through use of the *grindaboð* (a message that a grind had been located) and *grindaglaða* (a beacon lighted to transmit the *grindaboð*).
- *Emphasis on communal decision making and activities.* The effective utilisation and regulation of resources appears to have been accomplished in the Faroe Islands by an emphasis on communal activity and decision making. Decisions regarding both pastoral subsistence activities and resource exploitation were implemented at the scale of a collection of farms or the village. For example, while each farmer owns certain sheep and feeds them through the winter, in the summer sheep graze in jointly owned and demarcated sections of the outfields. The success of a *grind* was also dependent on

collaboration amongst the local population, and the importance of community relations is demonstrated by the sharing of the catch of the *grind*, which was distributed amongst all inhabitants of the village, regardless of their extent of landownership. Regulating the exploitation of pseudo-infinite resources also appears to have been successful in the Faroe Islands. Regulations to prevent overexploitation were in many cases implemented at a community/village scale by the *grannastevna*. In Greenland, communal activities also featured highly in the seasonal round, including seal drives, guillemot harvesting and autumn caribou hunts. Communal led activities assume a different importance in Iceland, on the other hand, where key subsistence activities were carried out on a more independent basis. This probably reflects differing access to the sea (and distances from it), the availability of boats, the lack of major whale/seal migrations and more limited bird colonies.

4. *Are the consequences of human actions taken on the Faroes applicable to understanding human-environment interactions in Iceland, Greenland or even more distant islands?*

This thesis highlights the limited significance of human impact on the Faroe Islands environment in comparison to that on islands elsewhere, in both the North Atlantic and Pacific. In much research on human impacts on islands, investigations are biased towards those farms, landholdings or islands where impacts have been most significant, even catastrophic. However, by understanding why the Faroe Islands *have not* undergone significant human impact, assumptions can be made, and new hypotheses tested regarding why human impact has been more significant on some islands, e.g. Iceland, or why the outcomes of settlement were different, e.g. Greenland.

Therefore, the subject of under what circumstances people put unsustainable demands on island environments may be alternatively approached through evaluation of farms, landholdings, regions or islands whereby human impacts on the environment were *less* significant.

**Implications of the thesis for the fundamental issues of islands and human impact**

1. *What causes “threshold crossing events” to occur in island environments?*

The focussed Faroe Islands research has demonstrated that people do not always cause threshold crossing impacts on islands that are analogous to that of Easter Island or Iceland, and that the degree of human impact can be different, even on islands that look superficially similar today. Comparisons of the Faroes with other North Atlantic islands has shown that threshold crossing events in the Faroes were limited by many factors including landscape transformation prior to colonisation, relatively robust vegetation and soils, the regulated

utilisation of pseudo-infinite resources in combination with pastoral farming and an emphasis on communal resource acquisition and decision making. These factors would also seem to apply at much larger scales, to islands out with the North Atlantic. The wider implication is that human impact would be more significant on islands where there has been a limited breadth of landscape transformation, environmental sensitivity in terms of biota or soils, limited access to pseudo-infinite resources, an emphasis on bounded resources and emphasis on independent decision making and activities.

Despite the differences in island locations, environments, climates and the cultural backgrounds of the settlers, there are recurring themes that are applicable to most island colonisations and, which ultimately influence the circumstances whereby people put unsustainable demands on island environments. These are;

- the breadth of landscape transformation prior to human settlement,
- the fundamental sensitivity or resilience of the environment, biota or soils,
- the balance between cash/trade and subsistence activities,
- the balance between reliance on bounded and pseudo-infinite resources,
- the importance of communal organisation in terms of labour.

2. *Is it the degree and extent of human impact or the inherent sensitivity of an island environment that matters more in terms of environmental change and cultural collapse?*

The extent of human impact is influenced by varying degrees by both the inherent sensitivity of an island environment and by how populations utilise their resources. However, human impact is likely to be more significant if the environment is highly sensitive and if there is access only to a narrow range of resources. Environments of islands with a more diverse range and greater depth of resources and a more robust environment are buffered to some degree from experimentations, mistakes or environmentally unfavourable decisions made by colonising populations. Therefore, even if people make mistakes, the landscape can cope (although an impact will still be seen in environmental records). Where outcomes are buffered, an additional problem lies in the timing and unpredictability of perturbations or change, which determines how long people have to respond/adapt. Even with buffers in place, cultural collapse may occur in societies that don't respond quickly or effectively to change.

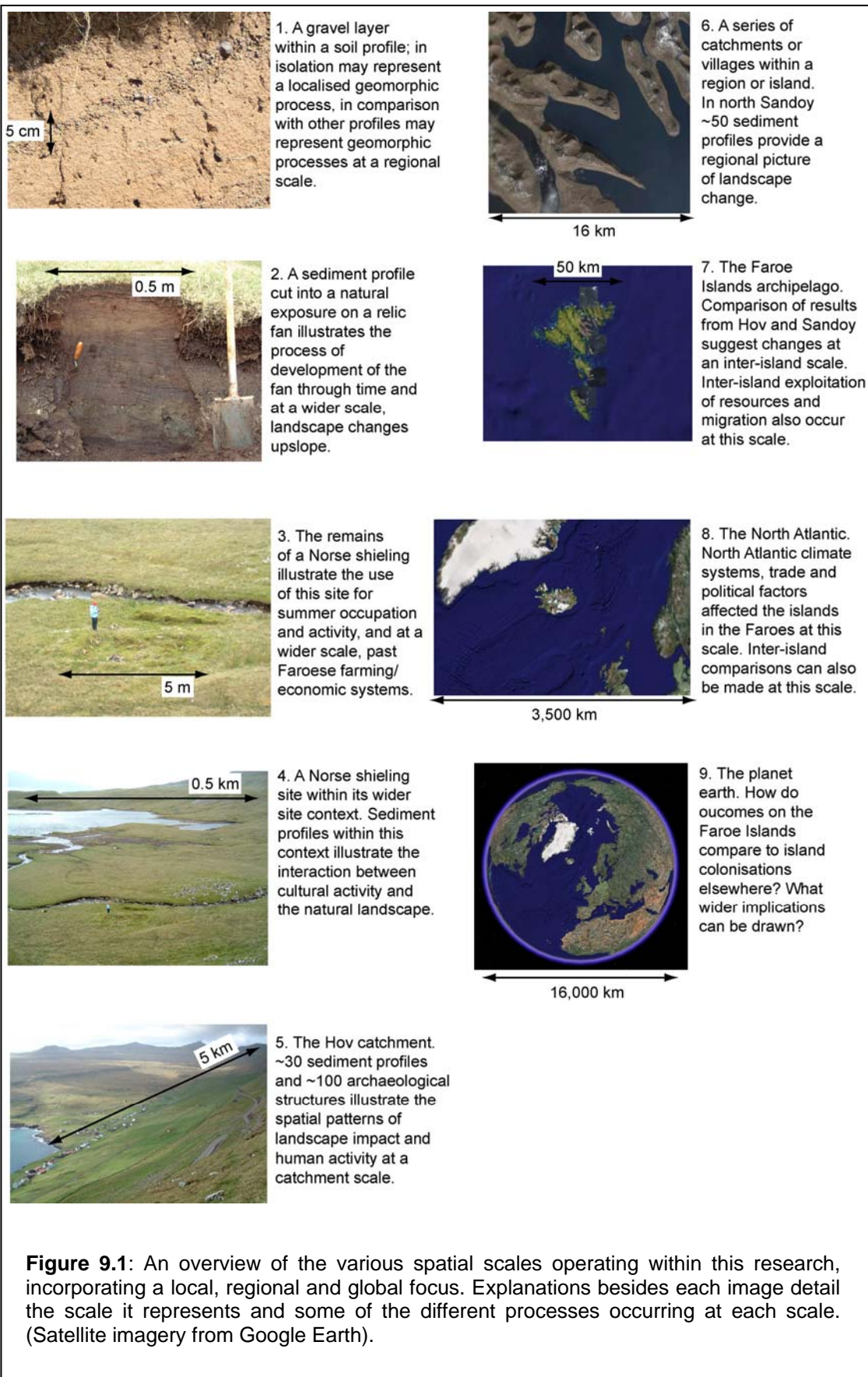
3. *At what scales can we understand human-environment interactions on islands?*

Human-environment interactions need to be understood at many different spatial scales (Figure 9.1), in order to both integrate cultural and environmental data, and to explore the many facets of a common problem. A focussed, hypotheses-led approach based on the

collection of datasets from different disciplines and utilising different methods, needs to be balanced with comparative research at a range of spatial scales, e.g. comparison between individual sediment stratigraphies within a catchment, comparison between catchments on neighbouring islands, and comparison between the outcomes of settlement on diverse islands. As Kirch (2000: 323) states with reference to Pacific island archaeology and historical anthropology;

...for through comparison we move beyond the particular, the local, and the time-bound, to what is generalising and sometimes global. Comparison reveals similarity as well as difference, exposing patterns that lurk beneath variation. Ultimately, comparison yields general principles (not "laws"), and it is these which allow us to make of our historical narratives not merely "just so stories" but robust explanations of historical phenomena (Kirch 2000).

This thesis has incorporated focussed research, based upon the collection of empirical data and has applied to the North Atlantic islands, a comparative approach supported by Kirch. Several bold ideas have been introduced, and it remains for these to be further explored and tested with more site-specific focussed research at appropriate scales.



**Figure 9.1:** An overview of the various spatial scales operating within this research, incorporating a local, regional and global focus. Explanations besides each image detail the scale it represents and some of the different processes occurring at each scale. (Satellite imagery from Google Earth).

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