

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.

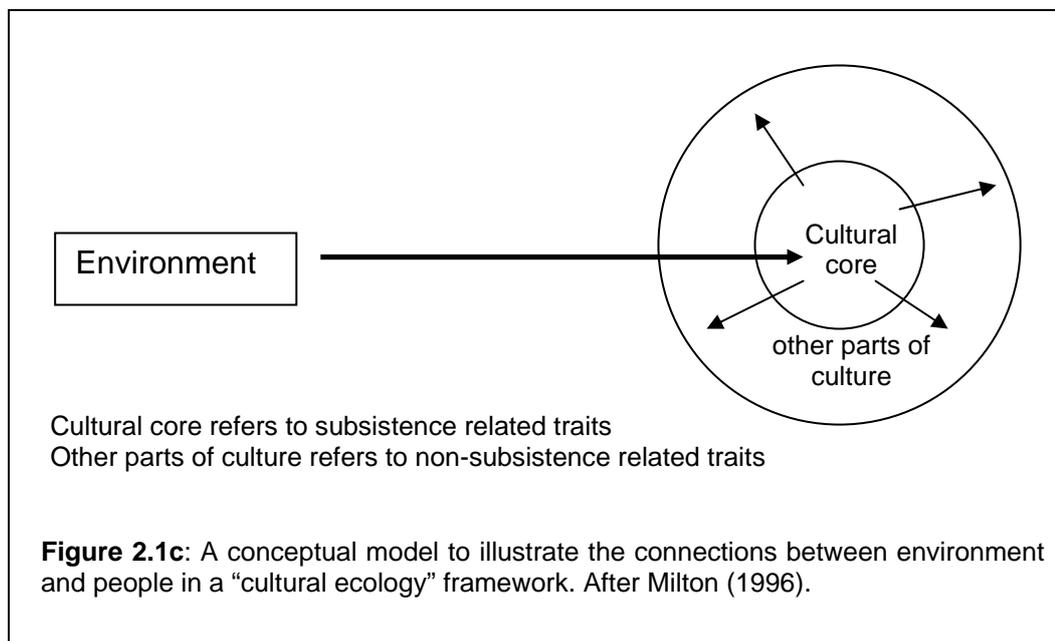
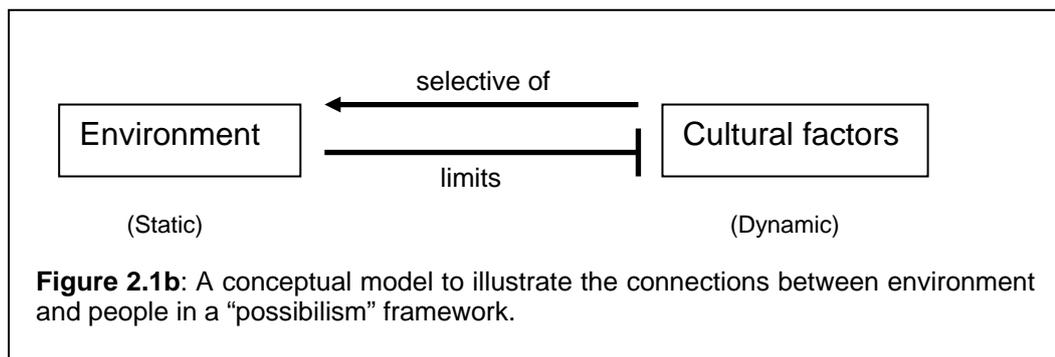
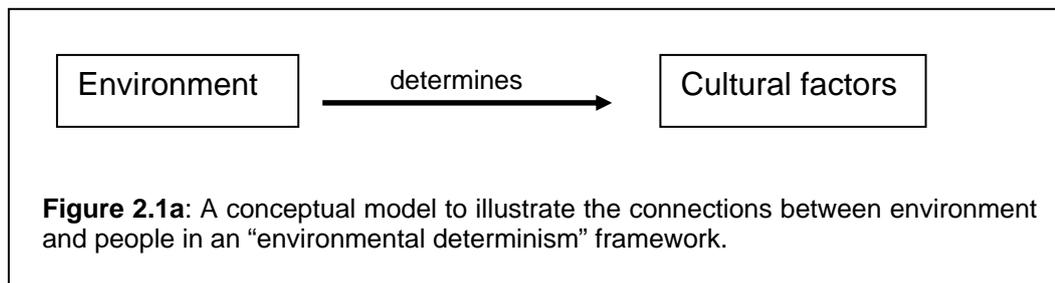
2.1 Approaches to human-environment research

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 19th 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

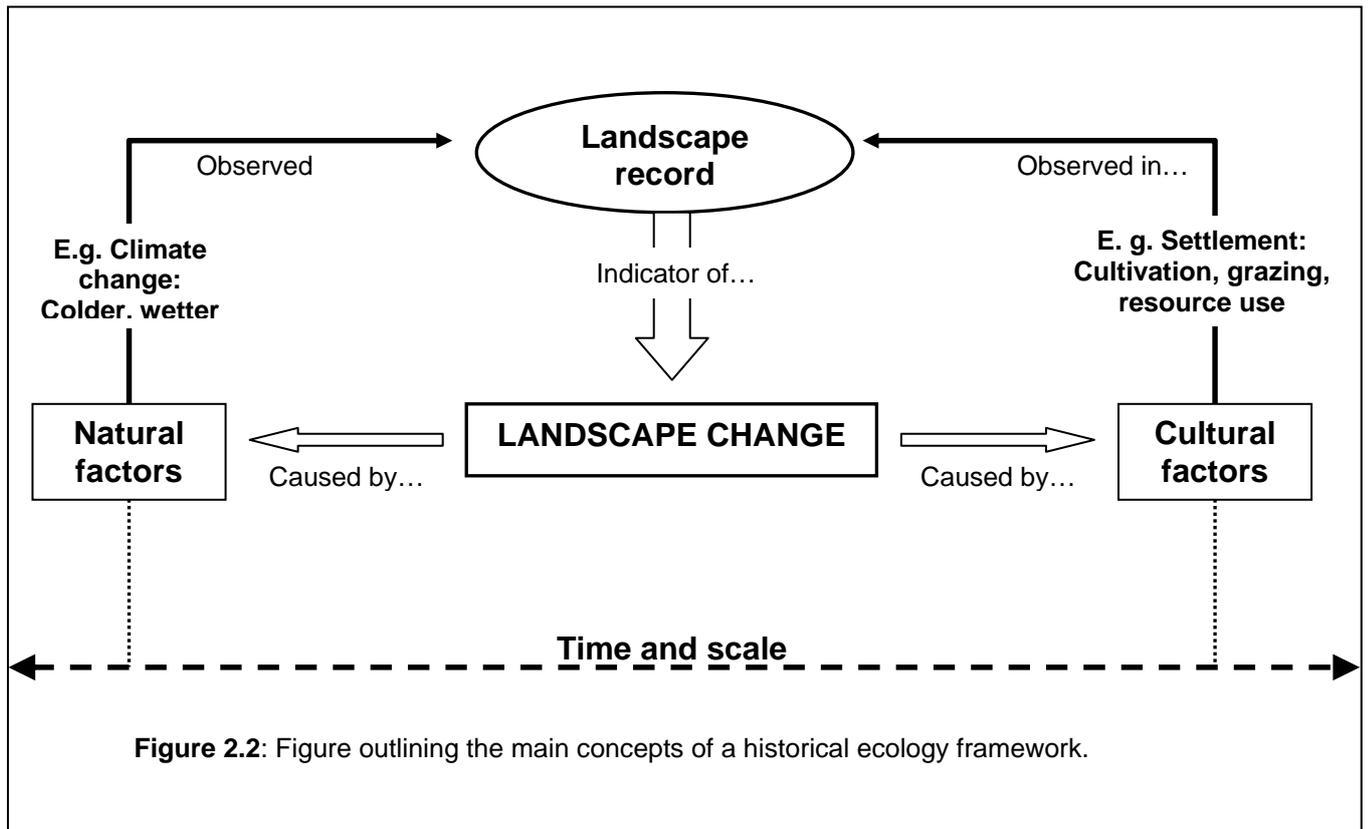


Figure 2.2: Figure outlining the main concepts of a historical ecology framework.

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 (Brunsdén 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

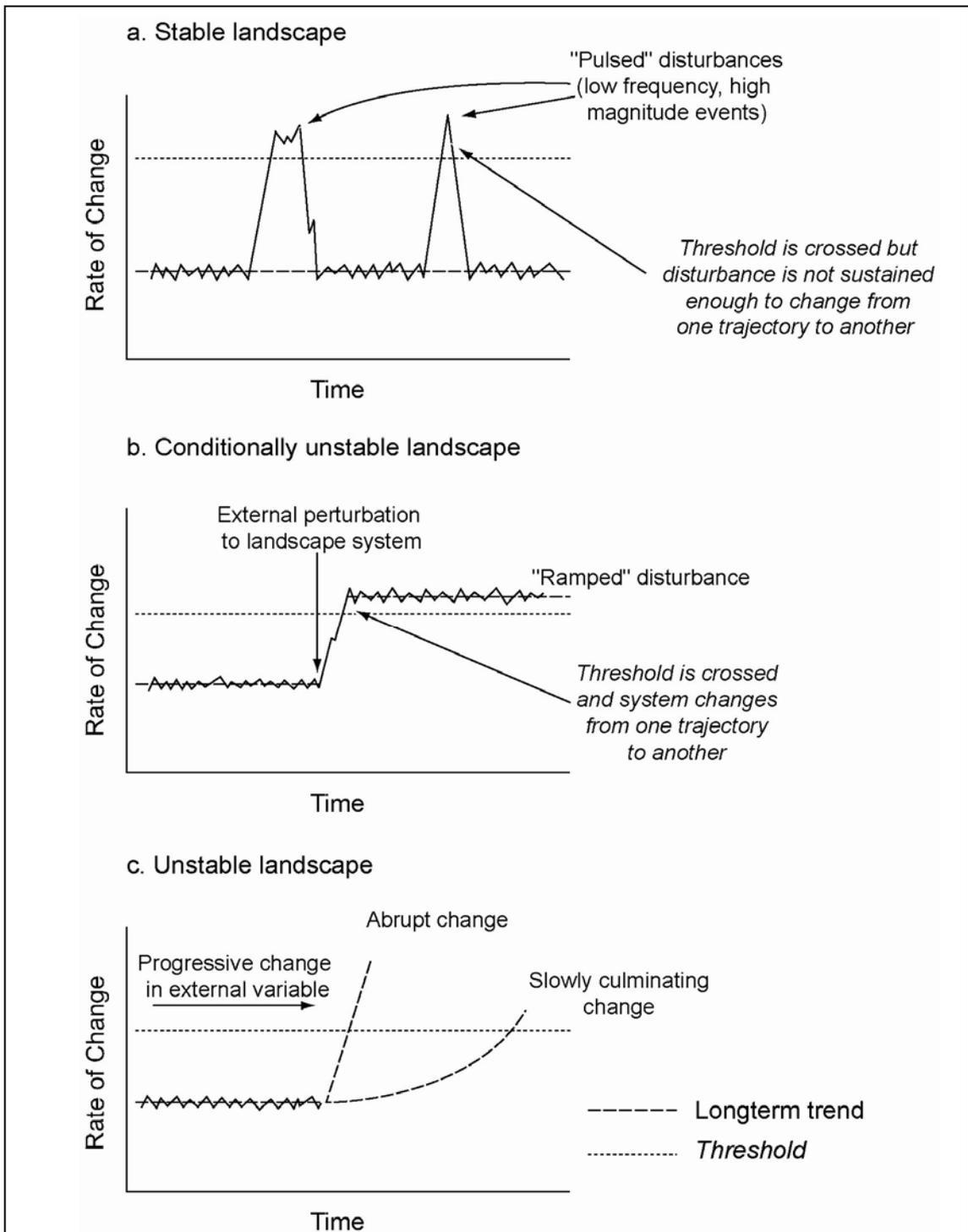


Figure 2.3: Examples of rates of change and threshold crossings. Figure 2.3a illustrates a "pulsed" model of change, where the imposed disturbance is short compared in relation to the temporal scale being considered and is followed by a return to, or near, the initial state of the system. Figure 2.3b 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

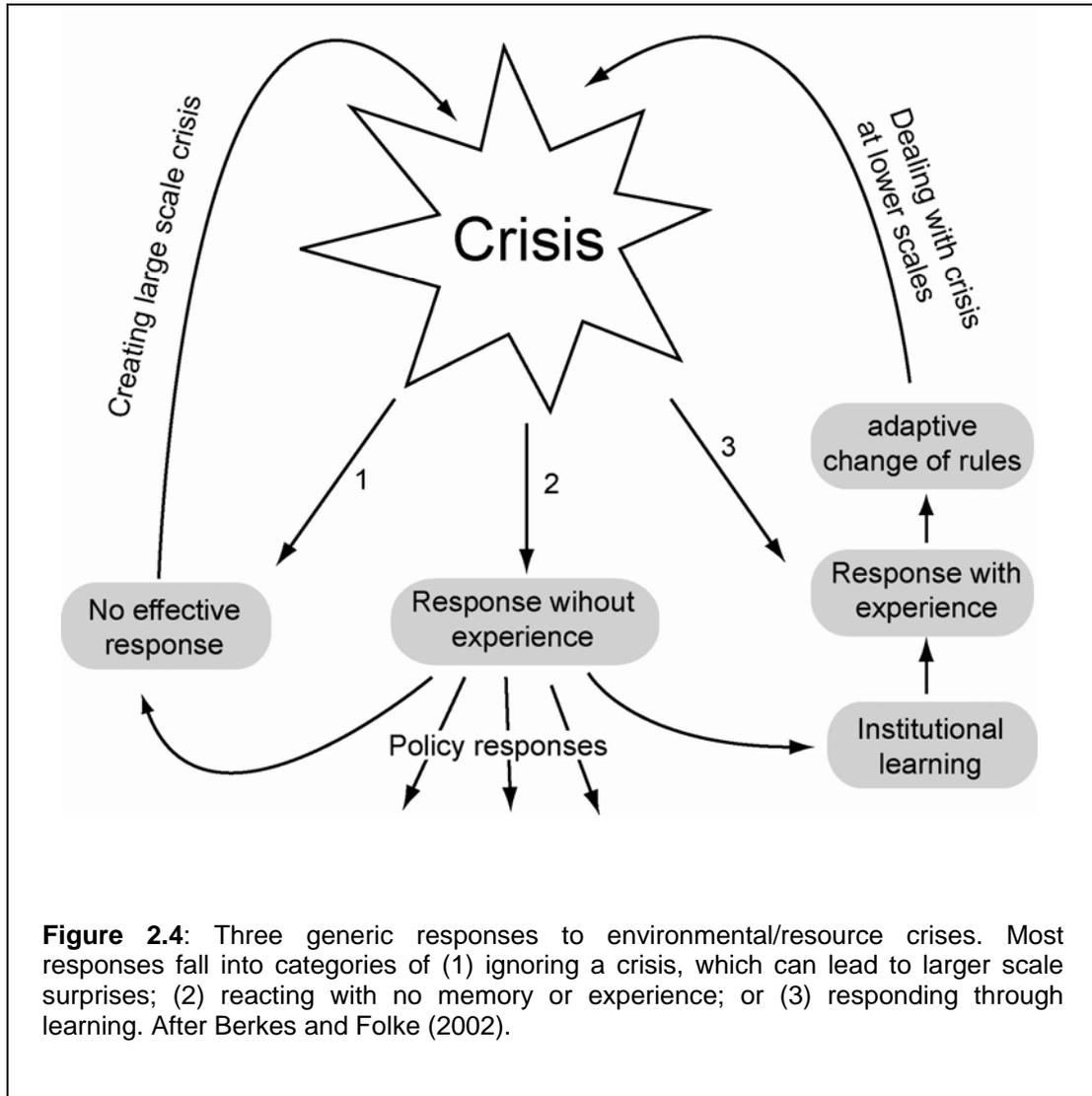
The degree of resilience, or how well the environment recovers from change, is also determined by how people respond to environmental stress, which is dependent upon the technological, social and economic tools they have available with which to respond. As environments with differing degrees of marginality 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).



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

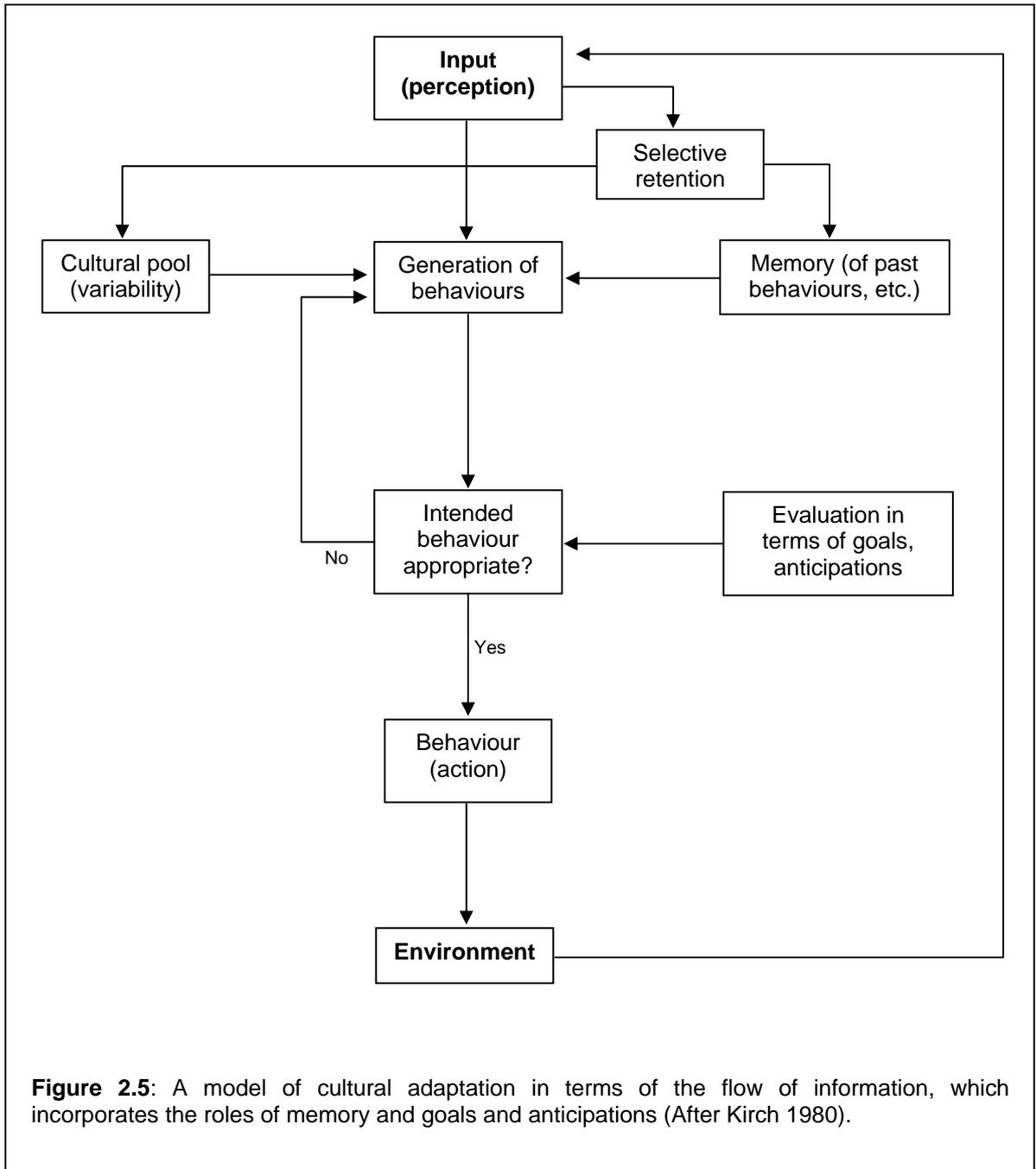


Figure 2.5: A model of cultural adaptation in terms of the flow of information, which incorporates the roles of memory and goals and anticipations (After Kirch 1980).

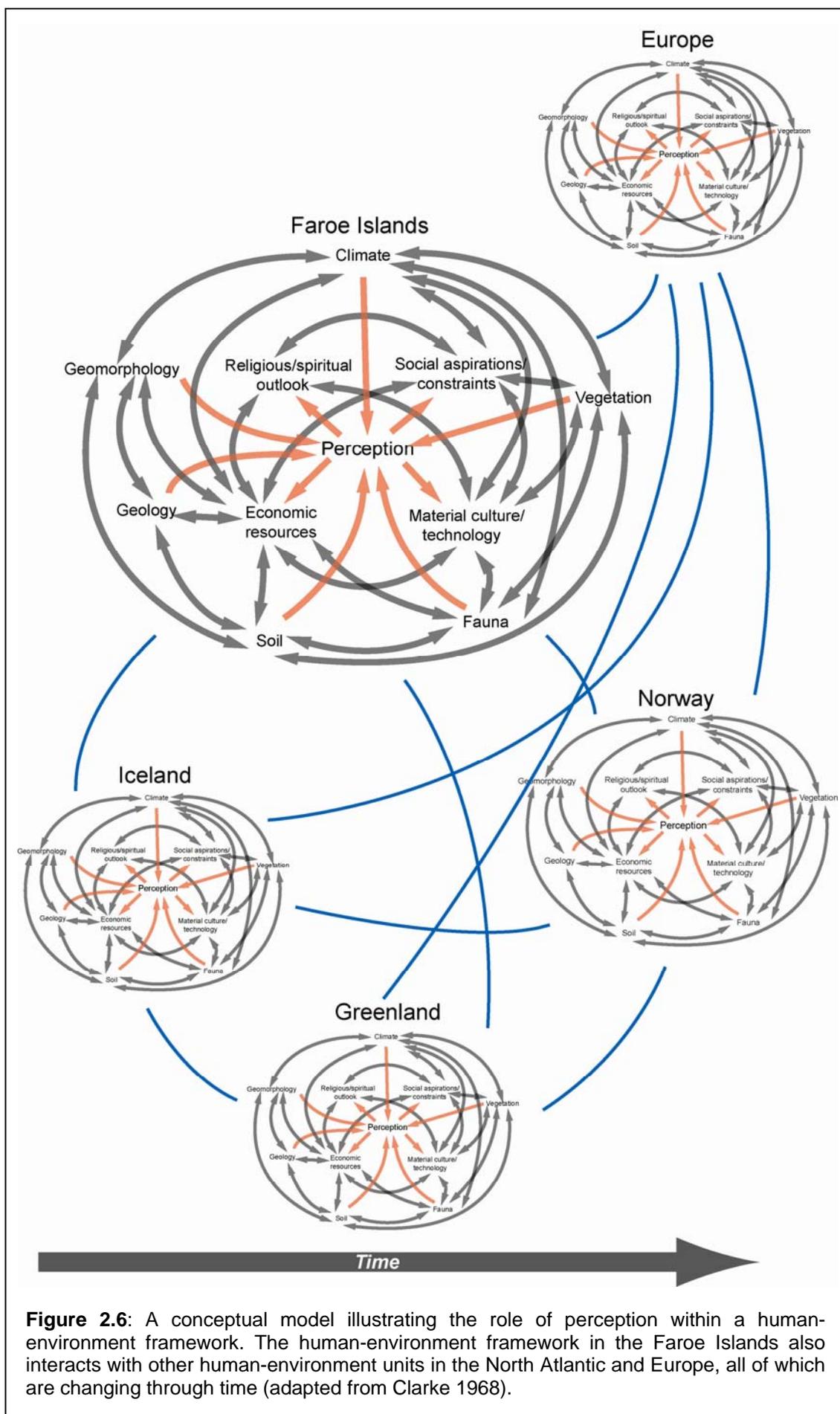


Figure 2.6: A conceptual model illustrating the role of perception within a human-environment framework. The human-environment framework in the Faroe Islands also interacts with other human-environment units in the North Atlantic and Europe, all of which are changing through time (adapted from Clarke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