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# Introduction

Are the moors and downs of the British Isles natural landscapes or were they created by human agency? To what extent has soil loss through erosion increased on cultivated land compared with areas of natural woodland? And is the recorded rise in global temperatures since 1980 a result of the current increase in greenhouse gases in the atmosphere, or is it just part of climate's natural tendency to vary through time? Answers to problems such as these are often sought by monitoring contemporary environmental processes. For example, Gordon Wolman (1967) measured sediment yields from forested and cultivated land in the eastern United States and found that erosion was up to eight times higher for the latter. Alternatively, data from gauged field stations may be used, although the short time period of observation often proves to be a handicap. Most meteorological stations, for example, only have records going back to the first half of the twentieth century (Jones et al., 1999), and this makes it hard to identify any long-term trends of warming or cooling.

In fact, neither monitoring nor gauged records are likely on their own to provide complete solutions to the problems posed. This is because a longer-term view is required. An average human lifespan is so much shorter than the millennia of natural history that we tend to be aware only of short-term variations in the environment – the wet summer, the late spring, the 'record' flood. What we are much less aware of are slower, subtler changes such as alterations in the floristic composition of woodland, the silting up of estuaries and the advance and retreat of glaciers. Yet only a long-term perspective could tell us that Britain's downs and moors were transformed from their original woodland before written history even began (Simmons, 2003).

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## Sources of information on past environments

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For historic times, documentary sources can sometimes provide reliable observations on the former state of the natural environment. Tax records have been used to indicate late seventeenth- and early eighteenth-century climatic deterioration in southern Norway (Grove, 2004), while maps and legal documents show the changing position of Spurn Point spit on the east coast of England during the last 300 years (De Boer, 1964). Among the best historical sources are the early United States federal land surveys which mapped the pre-existing forest and grassland vegetation, and even recorded their species composition, before laying out land boundaries. Documentary data of this sort form an important part of historical ecology which applied to past flora and fauna (Sheail, 1980), historical geology when related to changes in the physical landscape such as rivers (Hooke and Kain, 1982) and historical climatology when linked to former climates (Bradley and Jones, 1992; Brázdil et al., 2005). In practice, the distinction between these sub-disciplines is often an arbitrary one.

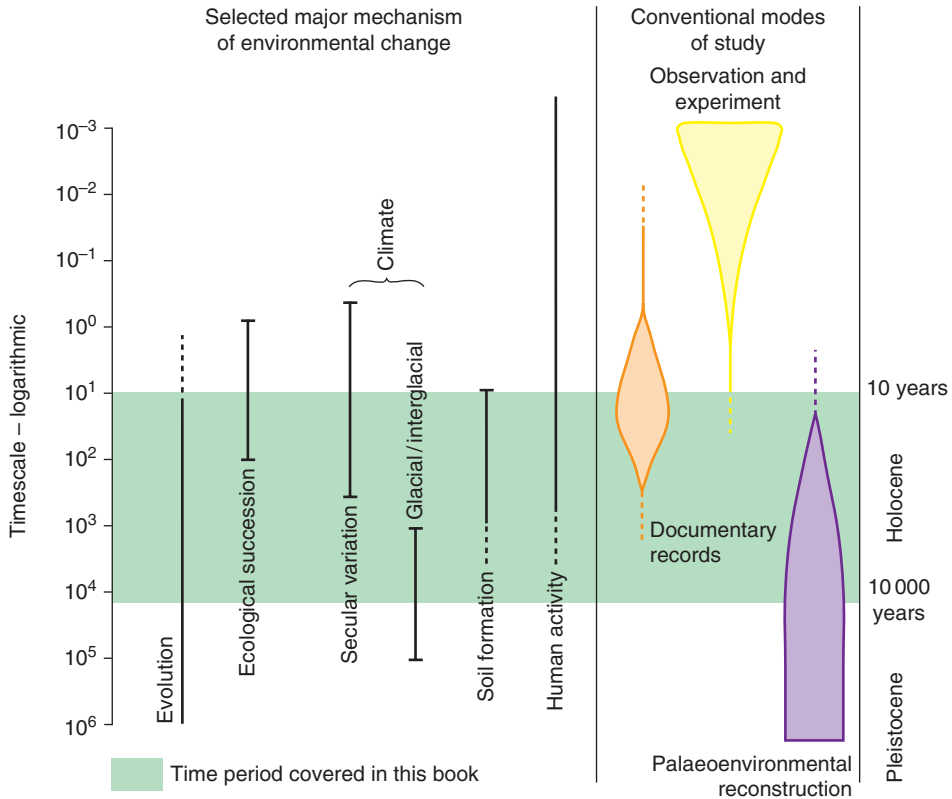
Written records are, however, restricted to literate cultures, and as late as AD 1500, they existed only in Europe, Asia and North Africa. There are consequently long periods of human history for which recorded observations are absent, termed prehistory by archaeologists. Moreover, written history covers very different time spans in different parts of the world. Whereas written history began around 5000 years ago in Mesopotamia with the Sumerians, and 2000 years ago in Britain with Julius Caesar, it only started in the 1930s in the highlands of Papua New Guinea when aircraft brought the first European contact. Prehistory has come to be associated in Western thought with all that is remote, both in time and in cultural affinity, to twenty-first-century life. On the other hand, to a New Guinea highlander (or a Maori or black Zimbabwean), prehistory represents a direct cultural heritage which ended only a few generations ago. All of this means that the attitudes towards the natural world of many past societies have either gone unrecorded, or have appeared in written form only through the eyes of others. Ethnobotanical and other studies, however, have revealed a remarkable indigenous knowledge of the natural environment and its uses by modern non-literate hunter-gatherers, peasant farmers and nomads (Cunningham, 2001).

It is not only from ancient times and distant places that historical data on the natural environment prove to be deficient. Old men may recall how, when in their youth, fine catches of salmon were taken from Scandinavian rivers now devoid of fish, but because no one recorded the pH of the water until acid rain became a problem during the 1970s, it is difficult to know whether the salmon were eliminated by **acidification** or

simply overfished. Availability of documentary sources therefore tends to inhibit consideration of non-literate regions such as Papua New Guinea and problems such as acidification, which do not appear in historical accounts. The example of megafaunal extinctions (see Chapter 3) serves to illustrate the point. When told that much African wildlife is threatened by extinction, our reaction is one of horror. Yet extinctions of even greater magnitude have occurred within the time span of human history considered in this book, notably in the Americas and Australia where up to 90% of all large mammals were lost. However, this ecological crisis remains known only to a narrow audience of specialists because no contemporary written accounts of it were handed down to posterity.

This book aims to recount and try to explain changes in the natural world through time, including those in human–environment relations. If a truly cross-cultural perspective is to be taken on this, then we need to escape from the restrictions imposed by information derived solely from contemporary or documented historical sources. This is not to deny the critical importance of such sources, but while they have been employed extensively in studies of environmental relations (e.g. Glacken, 1967; Worster, 1993; McNeill, 2000), other sources have not. Without a time machine in which to return to the past, we have instead to rely on proxy evidence, including that from palaeo-science, which provides environmental histories, and archaeology, which provides human histories. These two sources sometimes come together as **environmental archaeology**, in which plant remains, animal bones and sediments from archaeological sites are studied to reconstruct their past economy and environment (Branch et al., 2005). These subjects share in common many techniques such as **radiocarbon dating** and pollen analysis, and they are often investigated together to form interdisciplinary research projects.

For the moment, it is sufficient to note some of the strengths and weaknesses of the palaeoenvironmental approach (Rymer, 1980; Oldfield, 2005). One of its weaknesses is that it cannot reconstruct attitudes to the natural world by former human societies in the way that historical sources can. Medieval cosmologies which placed ‘man’ in a holistic relationship with the natural world, for example, would be scarcely comprehensible without texts to explain them (Cosgrove, 2008). Environmental archaeology, with its concern for site economies and food remains, inclines the investigator towards an economic view of past human life (e.g. Higgs, 1972). This bias towards economic and away from social and cultural explanations is most easily countered where the archaeological past meets the anthropological present, for instance, with the Hopi Indians of the American southwest (Butzer, 1982). In the case of prehistoric Europe, it is not so easy. Even so, we occasionally get glimpses of past symbolic and ritual activities linked to the natural world; for example, pollen of meadowsweet (*Filipendula ulmaria*) from



**Figure 1.1** Mechanisms and modes of studying environmental change over different timescales (modified from Oldfield, 1983). Reproduced with permission of the Geographical Association.

Bronze Age burials in Scotland demonstrates how floral tributes were placed next to their dead (Tipping, 1994; Clarke, 1999).

On the other hand, one of the great advantages of archaeology and palaeo-science is their ability to identify long-term patterns of cultural or environmental development (Caseldine and Turney, 2010; Caseldine, 2012). This is especially important because the timescales of adjustment in many environmental systems span centuries or millennia rather than individual years, via processes such as soil maturation and ecological succession (see Figure 1.1). In the case of palaeo-science, environmental reconstruction can be applied to more recent as well as to long-term changes. Most lake sediments, for instance, have continued to accumulate up to the present day, and they can therefore be used to give a historical dimension to such contemporary environmental problems as pollution of freshwaters. The continuous nature of most palaeoecological records provides what Frank Oldfield (1977) aptly described as ‘a true continuum of insight’. This enables us to establish whether environmental changes have been episodic or gradual and to

identify baseline conditions if they existed. These techniques, unlike written records, have the further advantage of being as applicable in New Guinea as they are in New England.

## Nature and society

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All of the world's landscapes and ecosystems are products of the natural and cultural processes that have shaped them over time to bring them to their present state. But what are those processes? Over the last one million years, a major factor has been climatic change, with the climate oscillating between Pleistocene glacials and interglacials. Only after the end of the last glaciation, around 12 000 years ago, did the world's climates and environments take on a recognisably modern form. Secular climatic variations of smaller magnitude and shorter duration have continued up to the present day. But whereas most environmental changes brought about by natural agencies have diminished in amplitude as one moves forward in time, there is one set of processes which has done precisely the reverse; human impact on the environment has increased progressively through time as *Homo sapiens* has been transformed from hunter-gatherer to city-dweller.

The oldest and simplest human mode of production is hunting, fishing and gathering (h-f-g), described by Mandel (1969, p. 34) as a 'primitive economy...in which the results are so meager that they must be shared to avoid death by starvation'. In fact, a wide range of anthropological studies suggest that far from eking out a meagre existence in a hostile environment, h-f-g groups probably represent the original affluent society (Sahlins, 1974; Simmons, 2008). Old World h-f-g populations are represented archaeologically by **Palaeolithic** and **Mesolithic** cultures.

Hunting and gathering was followed in the process of cultural evolution by peasant farming, the two being distinguished by the latter's exploitation of domestic plants and animals. The adoption of agriculture by h-f-g groups, termed the **Neolithic** revolution by Vere Gordon Childe, was a decisive moment in human history. Undeniably, it changed the basis of human relations with nature. The basic form of production in h-f-g and subsistence agricultural economies is simple and communal, with no systematic expropriation of surplus labour. This is not true, however, of more complex agricultural economies which supported feudal, classical and 'hydraulic' societies. The resulting states and civilizations typically – although not always – brought with them literacy and consequently the start of written history. Finally, the last two centuries of human history have witnessed the rise of industrial, and arguably post-industrial, economies and the global expansion of Western European culture. Human impact

on the Earth system in recent centuries has become so large that it has been proposed that it should be designated as a new geological era – the Anthropocene (see Technical Box IX). Each stage in this social evolution of humankind has seen an increase in control over our relationship with nature (Simmons, 1996, 2008). As we have evolved from hunting to agriculture to industry and beyond, so human impact upon the environment has apparently come to counterbalance or even replace environmental influence over human affairs.

A great strength of an evolutionary approach to human–environment relations is that it is historically mediated. However, consideration of the historical dynamic is usually focused on the human half of the partnership (e.g. Diamond, 1997). The forces of nature are all too often viewed as an essentially passive backcloth against which human history is acted out. Although this environmental backcloth may change from one scene to another, it plays little or no active part in its own right. Perhaps the sky will be permitted to vary to show storm, snow or sun as a token gesture to the fact that nature is not static, but the forests and streams will be ever present, the natural landscape constant. It is above all this *ahistorical* view of nature that this book seeks to challenge. Climate, forests and rivers have their histories too.

By employing a long-term perspective, it becomes possible for us to ask interesting and important research questions, such as the following:

- When, where and how has our planet moved from a being nature- to human-dominated?
- Can the past provide us with meaningful targets for restoring damaged environments?
- What lessons can the Holocene offer us about societal responses to climatic adversity and other environmental crises?
- Has the Earth system crossed any ‘tipping points’ since the time of the Last Ice Age, and if so, what determined these non-linear responses?
- Can the Holocene tell us anything about the possible future course of climate, and what might happen to ice, ocean and biota on planet Earth?

This book not only asks but also attempts to answer these and other questions in the chapters that follow, and particularly in the concluding chapter.

## The significance of the Holocene

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The period over which most of these cultural and environmental changes have taken place is the **Holocene**. The Holocene – or post-glacial – epoch provides the time frame for this book, which is organised in chronological fashion, starting with the last glacial-to-interglacial transition and then working towards the present day.

During the late Pleistocene, 25 000–12 000 years ago, the glacial climate made the Earth cold and unfamiliar. Canada lay buried beneath several kilometres of ice, Europe was largely devoid of forests, and the southeast Asian islands were joined to form a single land mass – these are some of the changes described in Chapter 3. This chapter also discusses human evolution and the enigmatic – and not unrelated – mass extinction of megafauna in Australia and the Americas. The huge shift in climate which occurred at the end of the last glaciation was important not only in its own right but also because it indirectly controlled many other parts of the Earth system. Post-glacial adjustments of plant and animal distributions, sea levels, geologic and soil-forming processes are discussed in Chapter 4, along with the changes in climate that took place during the first half of the Holocene. This time period, between 11 700 and 6000 years ago, is when we might look to if we were to search for nature's primeval, virginal baseline state – one free from 'significant' human disturbance. However, if it ever existed, this condition was to end with the **domestication** of plants and animals. The emergence of farming and its initial impact upon forest ecosystems are considered in Chapter 5. Chapter 6 focuses on later Holocene environments, notably those produced by complex agroecosystems such as those which developed around the Mediterranean basin and Mesoamerica. It also includes an account of the landscape history of Britain and Ireland. Chapter 7 moves forward to the last millennium; it discusses the impact of human populations upon land use and ecology as we expanded our occupation of the planet's lands and oceans during historical times and the role of industrial capitalism upon pollution of the atmosphere and freshwaters. Included too is the historical background to recent human-induced changes in atmospheric greenhouse gas concentrations, with its potential for altering the global climate. Finally, Chapter 8 brings these threads together to offer an overview of our changing relationship with nature, with implications for how we might put into practice our responsibility as environmental stewards.

But before embarking on a natural history of the Holocene, we need to establish how this remarkable story can be told. For this reason, Chapter 2 of this book is devoted to describing the main techniques that are available for us to reconstruct and date past environmental changes.

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