# INTRODUCTION

> The Nile, forever new and old,
> Among the living and the dead,
> Its mighty, mystic stream has rolled.
>
> Henry Wadsworth Longfellow (1807–82)

My enthusiasm for the Nile began as an eager postgraduate many years ago and has grown over countless excursions and excavations in Egypt. Observation of the geology of the landscape naturally led me to wonder what part humans have played in the river's life over millennia or, perhaps more accurately, the role of the Nile in defining the progress and development of the peoples who lived by and depended upon it. Has the Nile existed as it appears to us today or has it changed? What are the key influences on the Nile and how does this mighty river react? How have the inhabitants of the Nile Valley learnt to adapt to their environment? How are they able to harness the power of the Nile to their advantage and still live in harmony with it?

The ancient Egyptian kingdoms at their greatest extent stretched more than 2,000 kilometres up the Nile and included diverse habitats. In the north, they included the Mediterranean coast and the delta, while further south the thread of cultivation along the Nile Valley passed through the vast desert of the Sahara. As global climate and landscapes changed and evolved, the habitable parts of the kingdoms shifted. Modern studies suggest that episodes of desertification and greening swept across Egypt over periods of 1,000 years. In order to present a narrative of landscape and climate change in Egypt, I have explored the changes to the desert, the Nile Valley with its fringing wadis and the Northern Delta. Rather than isolated events, the changes in Egypt are characterised by a constant shift of events, so although broadly historic, this narrative follows a series of habitats as they change and evolve through time.

# 1

# HUMANS AND CLIMATE CHANGE: HOW PAST PEOPLES CAN INFORM OUR RESPONSES TO LANDSCAPE AND CLIMATE CHANGE

Egypt, part of the cradle of civilisation, is a product of the Nile, the world's longest river. Since the majority of the country is desert, its people live mainly along the Nile on the fertile floodplain and delta of the river. The population of Egypt, both now and in the past, has been subject to the river's behaviour and geography and the Nile Valley and Saharan region were important routes out of Africa for hominids in the early prehistoric period, who radiated from the Rift Valley.

To give a flavour of the persistence of habitation in this area, we need to consider the time before the last ice age, around 30,000 BC, when permanent populations were already present in Egypt. Evidence remains of extensive deposits of stone tools and workshops around the Faiyum and Kharga oases. We know from redeposited tools that they made use of habitats in the Nile Valley but subsequent river activity has destroyed traces of this period of human activity.

During the glaciations of the last ice age (c. 110,000 to 9640 BC), as global temperatures dropped, the Sahara became arid and inhospitable. At the same time, the Nile shrank and became more approachable as its water supply from the Ethiopian Monsoon dwindled. At the poles, cooler temperatures meant that water was locked away in the ice caps, lowering global sea level and consequently reducing the water level in the Mediterranean. The Nile, eroding down to the new sea level, formed narrow canyons, shrinking the habitable area of Egypt considerably.

These glacial processes were reversed during the interglacials, with the reinvigoration of the Ethiopian Monsoon and rising sea level. The delta was flooded as the sea rose and fresh water was held back in the Nile Valley, which became wet and marshy. These marshes, liable to flooding and inhabited by hippos and other large mammals, were a rich, if dangerous, habitat. Upstream, the rising Nile also extended its floodplain and, in places, overflowed into the Sahara, creating a patchwork of lakes that formed an almost perfect habitat for early humans and ushered in the Holocene, the time since around 11,000 years ago. In the lake-shore environments there was access to fresh water, fish, game and, as lakes receded during dryer times, calorie-rich grains.

Throughout history, climate oscillations caused the Nile to rise and fall as well as periodically drying and re-wetting the Nile margins and the Saharan lake beds. In the wetter times, the Nile, as all rivers do, responded to the rise by rebuilding its delta and floodplain and developing into a meandering river. As the meandering river matured, the inhabitants of Egypt became increasingly dependent upon the Nile as the deserts dried. They left the deserts and migrated into the oases and to the Nile Valley flanks. With time, the Nile coalesced into fewer channels and humans came even closer to the river.

Closer proximity meant that the Nile-dwellers began to understand how the Nile swelled and diminished through its annual cycle and also how the channels and islands behaved over the generations. This emerging knowledge was captured in myths, ceremonies and agricultural practices as well as in the more empirical calendars and Nilometer records. Record keeping particularly was developed to aid the collection of taxes since knowledge of the size of land packages and the depth of the flood allowed the state to calculate the likely agricultural yield. With growing expertise, an increasing number of practices designed to manage and control the Nile flood developed and accreted. In modern times, with the construction of the Aswan Dam, the Nile level can be held steady throughout the year, maximising the potential for transport and irrigation although simultaneously, as we will see, creating problems of salination and water supply.

## Geological Origins of the Egyptian Landscape

The geological canvas upon which this history of the Nile Valley is placed is one of extreme variation. Full details appear in Said (1981) and are excellently summarised by Sampsell (2014) but, in brief, the rocks of most of Egypt are a stack of more or less flat-lying, sedimentary deposits resting upon an ancient crystalline basement. At the base of the sediments lie the important aquifers of the Nubian sandstone and above this a stack of chalk and limestone rocks. These were laid down during the geological era of the Cretaceous, around 70 million years ago, in a warm shallow sea. During ice ages, when the water level was low in the Mediterranean basin, the Nile cut down through this sandwich of sediments to form a deep canyon with tributary canyons, similar in size to the Grand Canyon. This canyon stretched from Aswan in the south to the Mediterranean, or rather the salty and dried-up remains of what was left of it, in the north.

Although the Nile currently has no tributaries in Egypt, in the distant past, when the sea level was much lower than today and there was more rain locally, the tributary river valleys were deeply incised into the walls of the canyon through which the Nile flowed (Said et al. 1962, 1981). Later, when sea levels rose, these valleys became inactive and were choked with sand and gravel from the desert to become the wadis. In the Eastern Desert, these wadis continue to host drought-tolerant plants and fauna as well as the local tribes, creating additional habitable land beyond the Nile Valley (Hobbs 1990). Although rains are rare, perhaps once in ten years, they can cause flash floods, the wadi gravels become fluidised and collapse, carrying gravel, roads and other material with them.

While the wadis form mainly in the flanks of the Nile Valley, to the north in the delta, as sediment was eroded away, mounds of sand were left between the branches of the delta's distributary system. The relict mounds still emerge from the Nile floodplain in the north of Egypt today; they are known as the gezirehs. With rising sea levels, the old river valleys refilled and a thin veneer, around 10–20 m thick, of rich, black mud was deposited on top of the gravels and around the gezirehs. It is this thin layer of mud upon which the majority of the modern inhabitants of Egypt rely for agriculture and from which they derived the early name for Egypt, *kmt*, the black land. The sandy mounds of the gezirehs became some of the earliest inhabited parts of the delta.

## Landscape and Early Egyptology

Our understanding of the landscape processes was slow to develop. The earliest excavations in Egypt were preoccupied with the exploration and deciphering of the hieroglyphs that were visible on the monuments (Thompson 2015). These monuments, known throughout the world, have long been a subject of scholarship and many ancient visitors recorded their wonder at the achievements of the past in their inscriptions. Modern Egyptology began to gather momentum in the late eighteenth century. In 1798 Napoleon, as part of his campaign to add Egypt to his empire, landed a force of 160 scholars alongside the army to collate and propagate knowledge. The 'savants', as they were known, published newspapers and made maps, plans and drawings of monuments, landscapes, plants and animals. A comprehensive catalogue of Egypt emerged, including many images of monuments and their inscriptions so detailed and accurate that, although hieroglyphs had not been deciphered at the time, the images could later be used to translate texts that subsequently disappeared. The process of recording was interrupted when the British army arrived and the French army withdrew. The savants left with as many of their notes and artefacts as they could. They even had a copy of the Rosetta Stone that later proved to be the key to deciphering hieroglyphs, although the original had been taken into custody by the British army.

Back in France, the savants' work was collated into spectacular display volumes with many plates, today known as *Le Déscription de L'Égypte*. Perhaps somewhat nettled after their departure from Egypt, French scholars, including Jean-François Champollion, continued to compete with other European scholars to be first to decipher the meaning of the hieroglyphs. Success was slow in coming but by the time of his death in 1832, Champollion and his competitors were making good progress and were anxious for new samples of text to extend their understanding. To obtain these texts, scholars travelled through Egypt copying inscriptions and, as the mania developed, excavating the ancient ruins to find more. Egyptology continued to be focussed on the recovery and preservation of texts until Flinders Petrie (1853–1942), a trained surveyor, started his work in 1880.

Few records of the archaeological context in which the texts appeared were kept until the late nineteenth century when Joseph Hekekyan Bey (1807–75) (Jeffreys 2010) and Petrie, among others, began to make detailed observations of the find spots. Modern archaeology now takes careful note of the 'context' or sediments in which inscriptions are found, yielding valuable information about the ancient landscape. Perhaps unsurprisingly, given the absence of context for many of the texts, translations of the texts and interpretations of the sites took it for granted that the landscape in which the sites were set had been much as it is now. When Baines and Malek (1980) compiled their atlas of ancient Egypt, they realised that, as there was so little information about how the Nile moved, they were obliged to portray it in its modern course, regardless of the period and the ancient geography.

Gertrude Caton-Thompson in the early twentieth century suggested that the environment had not always been what it is today. The geologist in her team, Elinor Gardner, observed from sediments associated with the ruins that they had been built in wetter times. Soon afterwards, during the 1960s, there was a major campaign of rescue archaeology preceding the inundation of a large part of Nubia with the waters of the reservoir, Lake Nasser. From these surveys, further prehistoric discoveries were made, including those by Fred Wendorf and Romuald Schild at Nabta Playa (1998). Observations of the sediments associated with these sites made it clear that the environment was a crucial consideration in the occupation patterns of prehistoric humans. From their excavations, Wendorf and Schild could see how strategic lakeshore sites were reoccupied, even though the traces of earlier occupation were shallowly buried and no longer visible. Furthermore, ancient sand dunes buried in the lake mud had contained reservoirs of fresh water.

Manfred Bietak, who also participated in the Aswan Dam rescue excavations, later went on to explore the large sites of Tell El-Dab'a and Piramesse in the delta, taking due account of the waterways that had surrounded and connected the sites. Around the same time Karl Butzer, working in the Nile Valley at the Pyramids of Giza, started to apply the evidence from sediments around historic sites to understanding their environment. His seminal work on the Nile Valley, 'Early Hydraulic Civilization in Egypt: A Study in Cultural Ecology' (1976), set the scene for modern archaeological investigations where sediment logs and boreholes are considered a routine part of the work.

To sample the sediment, a narrow column of around 10 cm in diameter is extracted using an auger. This is a barrel at the end of a long rod that cuts and lifts around 5–10 cm depth of sediment from a known depth for subsequent analysis, including description of the type of sediment and the archaeological and other remains encapsulated in it. More detail of this process is given in the Appendix. Broadly, the results of auger analysis yield a detailed history of that point in space which may go back thousands of years. Fragments of pottery, bone, textile and building and decorative stones can be compared with the neighbouring sites from which they are derived to determine the type of activity and sometimes the date that the sediment was deposited. At the same time the sediment description reveals the source of the material, whether from the Nile or the desert, and the speed of the current that delivered it. For example, a harbour will accumulate anoxic, smelly mud while the main riverbank will accumulate coarse sand and pebbles. A set of auger cores, when combined with other geographical data, reveals the history of the whole landscape.

This type of investigation was taken up by others, who were augmented by the parallel explorations of Attia (1954) and his teams on behalf of the Geological Survey of Egypt. Similarly, Stanley and Warne (1994) used carbon dates and more than a hundred boreholes to explore the architecture of the delta. Around the same time David Jeffreys added a programme of auger coring to the work of the Survey of Memphis. Over the ensuing thirty years his team cored and logged at hundreds of locations, totalling more than 2 km of sediment. As they went, they trained a battalion of students in the art of

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logging and landscape interpretation. In this book, we draw upon the work of these students and others who have investigated numerous sites across Egypt: in the Nile floodplain, in the delta and in the deserts. To hundreds of boreholes from tens of sites they have added emerging techniques to their interpretation, drawing upon satellite imagery and geophysics to enhance their understanding of the changing landscape through Egyptian prehistory and history and fathom the patterns of human habitation through antiquity.

The Nile as a large river system, forced by climate change, responds according to the laws of physics, as any large river does. The borehole investigations reveal that although early humans tracked habitats as the landscape changed, with time they started to understand the river and its behaviour, and intervene, adapting it to their own needs for transport, drinking water, food and irrigation.

## Notes on Dating

In this exploration of the history of landscape change, I have used the traditional nomenclature for the periods of Egyptian history. Although dates for the Egyptian periods are quite well understood, there is naturally some variation in the years assigned to the reigns of the kings, particularly for those who reigned three or four thousand years ago. Egyptian artefacts are generally dated either from inscriptions or from pottery series dates. Pottery chronology dating, pioneered by Petrie during his excavations in the late nineteenth and early twentieth century, relied upon the ancient Egyptian taste for fashion and novelty in pottery. Initially, Petrie identified a series of developments in pottery from a Pre-Dynastic cemetery that he was excavating at Naqada in the Luxor area. Since then, pottery specialists, whose work has been essential to the development of the narrative presented in this book, have extended our understanding of pottery types to include all archaeological time since the earliest known sherds from Egypt discovered by Wendorf at Wadi Bakht through the Islamic period to the present day. In the same way that Emma Bridgewater's ceramics will endure as the look for the 2000s, ancient pottery can sometimes be dated to a specific king's reign or, in some cases, even to a subdivision of the reign.

The pottery dates are also tied to the ancient Egyptian king lists. Initially created as a historical record of the origins and hence legitimacy of the kings, these lists were later compiled by Manetho, a priest and scholar of the early third century BC, to create a calendar for ancient Egypt. Manetho tended to arrange the kings in a chronological series, assuming that none overlapped with any other. However, modern scholars increasingly consider that some kings continued to reign (or claim to reign) while others were also reigning. Understandably, the degree of overlap was not generally made explicit, since they potentially had rival claims to the throne or may have been de facto rulers of separate geographical areas.

However, within the king lists, individual kings and their subjects or correspondents were often punctilious in recording the precise year of the reign in which they were founding a temple, recording a battle, making a gift or writing a letter. For example, at the Palace of Malkata, near Luxor, many labels recording details of gifts to Amenhotep III on the occasion of the thirty-fourth jubilee of his reign were recovered from the desert around the ruined buildings. Some sources even include, as do our modern dates, the month, the day and the season as well as the year of the reign and the identity of the king. Synchronisation of these king lists and regnal year dates with celestial phenomena described in the texts provides even greater precision to the timescale that in this work is then expressed as a year BC or AD.

Where pottery or regnal year dates are not available, the somewhat blunter instrument of carbon dating may be employed to assign an approximate date to a deposit. Initially, carbon dating was thought to be extremely accurate. However, comparison with wood of known age collected from Egypt among other places showed that the dates could only be determined to an accuracy of +/− 100 years and that there were small-scale variations recorded in tree rings that were part of the discrepancy. Comparison with analyses of tree rings from long-lived species to correct the carbon dates improved the accuracy to around +/− 50 years. Modern laboratory processes continue to be refined and improved.

Additionally, in 1950 the first nuclear tests changed the carbon isotope composition of the atmosphere and biosphere forever, so carbon dates are quoted as a date BP (before present) where the present is set at 1950 AD. Dates that are refined by calibration to the tree-ring sequences are described as dates cal. BP. Where possible, we have used AD and BC in this work for comparability except where we are dependent upon the carbon dates. These calibrated radio-carbon dates are identified in the text as cal. BP.

A number of traditional designations of periods of Egyptian history have emerged. For consistency, we have used the ancient chronology used by Shaw in his *Oxford History of Ancient Egypt*, which is summarised as a timeline in Table 1.1 and Figure 1.1.

TABLE 1.1 The main periods of Egyptian history referred to in this text (with commonly used abbreviations) taken from the timeline of Shaw (2000).

| | |
|---|---|
| Palaeolithic Period | c. 700,000–5000 BC |
| Saharan Neolithic Period | c. 8800–4700 BC |
| Pre-Dynastic Period | c. 5300–3000 BC |
| Early Dynastic Period (ED) | c. 3000–2686 BC |
| Old Kingdom (OK) | 2686–2160 BC |
| First Intermediate Period (FIP) | 2160–2055 BC |
| Middle Kingdom (MK) | 2055–1650 BC |
| Second Intermediate Period (SIP) | 1650–1550 BC |
| New Kingdom (NK) | 1550–1069 BC |
| Ramesside Period (subdivision of NK) | 1295–1069 BC |
| Third Intermediate Period (TIP) | 1069–664 BC |
| Late Period | 664–332 BC |
| Ptolemaic Period | 332–30 BC |
| Roman Period | 30 BC–395 AD |
| Byzantine Period | 395–619 AD |
| Persian Empire | 619–639 AD |
| Muslim Dynastic Period | 639–1517 AD |
| Arab and Ottoman Period | 1517–1882 AD |
| Khedivate | 1882–1953 AD |
| Republican Period | 1953 AD– |

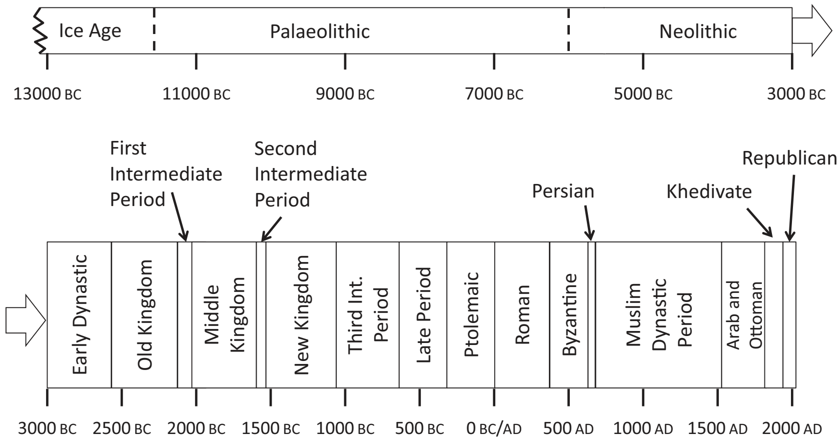


FIGURE 1.1 Ancient Egyptian timeline (after Shaw 2000)

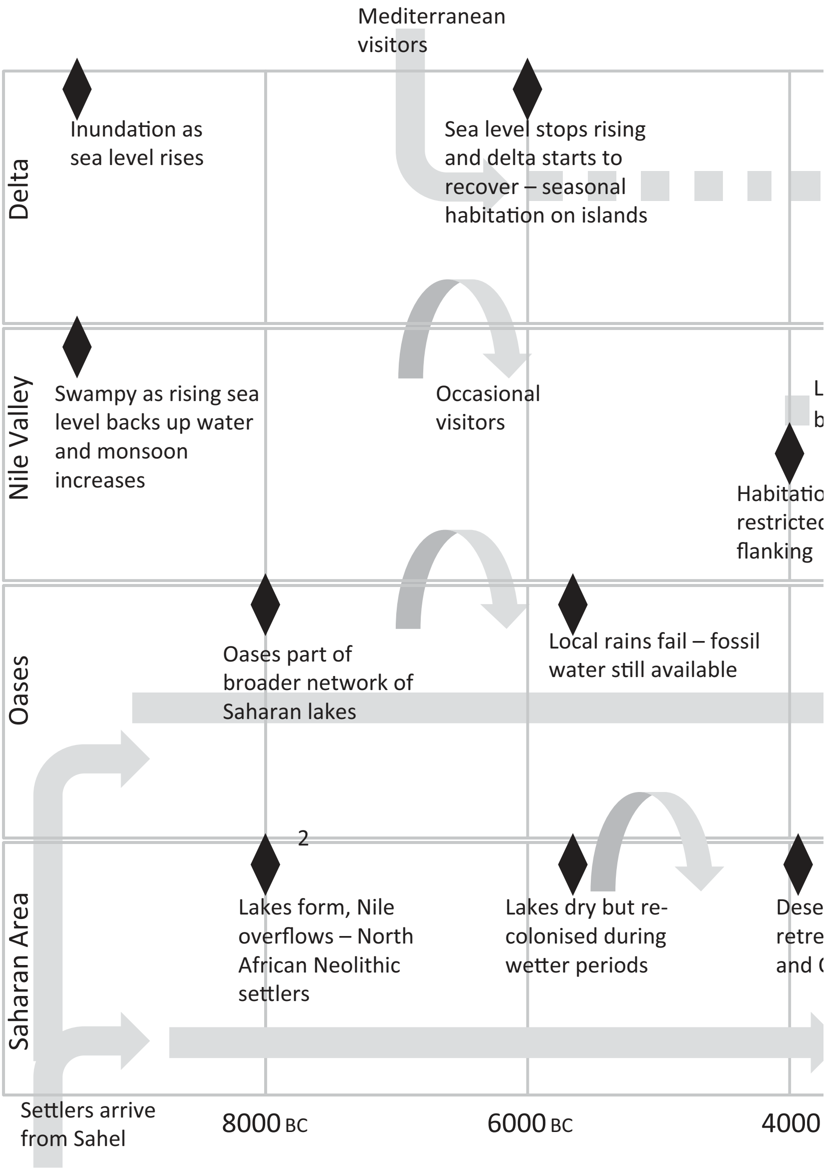


FIGURE 1.2 Diagram to show how landscapes changed with time in the main habitats of Egypt

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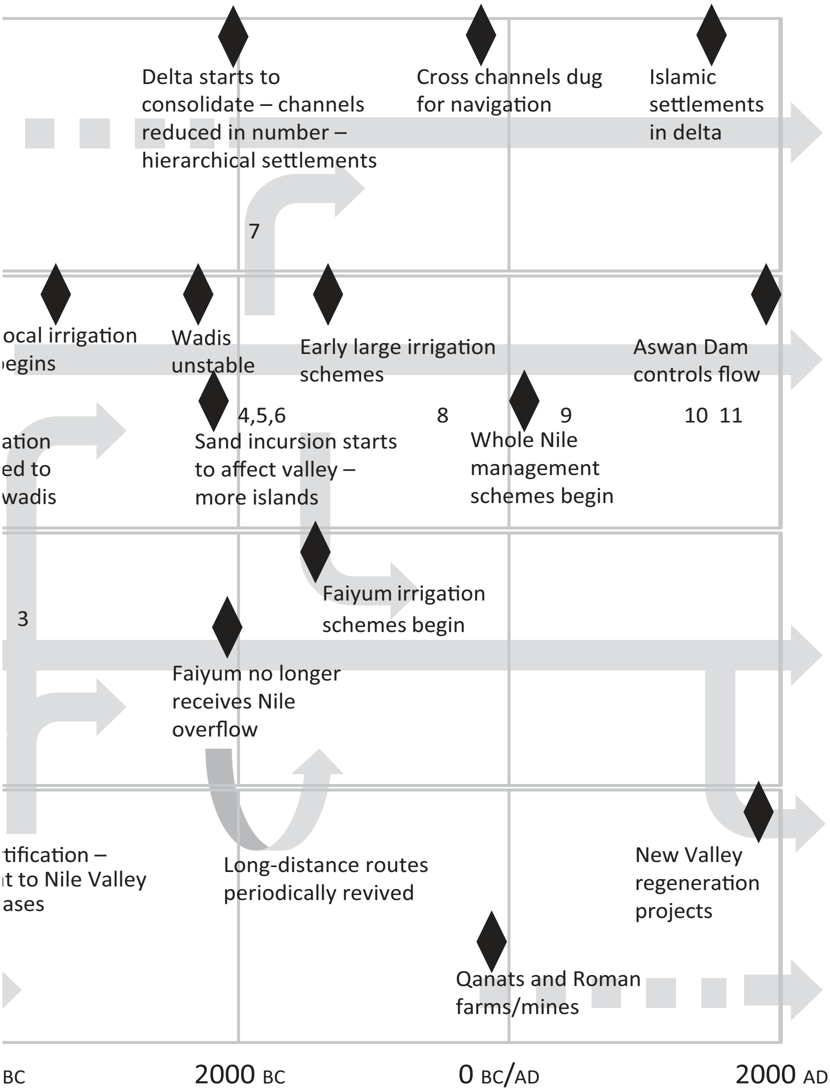

## Landscape in Egypt

Broadly, Egypt can be divided into three main types of environment: the delta to the north; the Nile Valley running through the centre; and the deserts and oases that flank it. Within these environments, landscape change is relatively slow, for example the Nile migration that is perceptible over a few generations or the desertification of the Sahara that lasted around a millennium. On an even longer timescale the delta, swamped by rising sea levels, reached its marshiest around 6000 BC and spent the following 3,000–4,000 years re-consolidating its channels to form the topography we see today. Figure 1.2 shows the changes to the main habitats – the delta, the Nile Valley, the oases and the deserts. Black diamonds identify points at which changes are recorded in the archaeological record and grey arrows show how human patterns of habitation and migration have responded to the changing environment. I have also added the numbers of the chapters of this book to show how we will navigate the changes in both space and time.

Even though much of landscape change is slow, gradual change to a habitat may mean that it reaches a tipping point. For example, when the Saharan playas (seasonally drying lakes) dried up in the late Pre-Dynastic (around 4000–3600 BC), the deterioration of the food source forced many of the people living there into the Nile Valley. This influx of population also had a dramatic impact on those already resident there, as we will see. Further north in the delta, in another example, a change from very rich and diverse habitats towards a more monotonous set of channels was a driver for a more hierarchical society managed from Memphis, the node at which they met. Likewise, a period of unpredictable weather in the Nile Valley in the New Kingdom led to a series of high Nile flood levels and flash floods in the nearby desert which may have inspired the development of a landscape-wide system of channels and reservoirs in Luxor.

While it would be simplistic to present the landscape history of Egypt across these diverse environments as a linear narrative, we have tried here to highlight the main changes that occurred and their impact on the communities that lived in and migrated between them. The processes that we describe also occurred at other times at different sites in Egypt. For example, laminated windblown sand (thinly layered sand typical of that blowing into a damp environment), often associated with the First Intermediate Period, predates it in the north of Egypt at the pyramids and postdates the Middle Kingdom at Gebel al-Asr in the south. To assist the archaeologist in navigating this work, we have created a broadly chronological narrative and woven together the evidence from each of the three environments discussed. For those living in Egypt, these habitats are intimately connected.

Added to the sweeping nature of the changes is a cyclical pattern where climate warms and then cools, so the changes recorded for the Late Pleistocene, the time before the last ice age, are mimicked in a number of similar cycles occurring through the Holocene, the time since the last ice age, which we will also highlight.