1

Introduction

Between circa AD 250 and 800 (the Classic period), the Maya civilisation witnessed a period of increasing social complexity, accompanied by large-scale architectural construction and urbanism, widespread use of hieroglyphic inscriptions on monuments, and technological and artistic development. The political structure of this period was characterised by densely populated city-states, which normally operated independently but also sometimes formed alliances or claimed dominance over each other. During this era, most of the politically- and culturally-dominant Maya centres were located in the central lowlands. The focus of dominant Maya centres shifted over time, from the southern highlands during the Preclassic period, to the central lowlands in the Classical period, and eventually to the more northern parts of the Yucatan peninsula during the Postclassic (Folan et al. 1983a; Demarest 2004a). In the middle of this longer history, the decline and apparent abandonment of many of the prominent central lowland Classic Maya centres during the 8th and 9th centuries AD (a period referred to as the Terminal Classic period) was accompanied by a cessation of monumental architectural construction and diminished use of inscriptions.This seems to reflect a decrease in social stratification, a decentralisation of power, ideological change and, ultimately, a breakdown of the traditional framework of 'divine kingship' (Freidel 1992: 99; Santley et al. 1986: 123; Willey 1986: 31).

Often, the perceived successes and failures of the Maya are linked to their relationship with the local 'neotropical' (Schultz 2005) environment and, in some cases, to their response(s) to different episodes of suggested episodes of climate change over a period of nearly two thousand years. The early Maya archaeologist, J. Eric S. Thompson, once commented: '… to me, one of the greatest mysteries is why Maya culture should have reached its greatest peak in this region so singularly lacking in natural wealth, where man, armed only with stone tools and fire, had everlastingly to struggle with the unrelenting forest for land to sow his crops' (Thompson 1954: 26). Thompson's view illustrates well the portrayal of the Maya during the first half of the 20th century: living in the 'least desirable environment' (Lowe 1971: 237), unsuitable for monumental architecture, and depending on non-intensive slash-and-burn (swidden) agriculture as their main means of subsistence (Bullard 1964). Early investigations into the archaeology of the Maya mainly focused on the excavation of the monumental cores of sites, which did little to dispel perceptions of Maya sites as vacant ceremonial centres inhabited only by rulers and priests who were primarily concerned with astronomical observations, recording the passage of time, and performing religious ceremonies. The land outside the monumental centre was seen as occupied by peasants in dispersed hamlets, relying on swidden agriculture to produce enough food for themselves and for the priestly rulers living in the ceremonial centres.

In the late 1960s, the 'vacant ceremonial centre' view started to be revised with a growing focus on the settlement beyond monumental cores. Settlement surveys conducted at sites, such as Tikal, Guatemala and Copan in Honduras, facilitated estimates of overall population, recast our sense of what constituted a Maya 'city,' and proposed more labour-intensive models of Maya agriculture, besides swidden, as a main means of subsistence (Harrison and Turner 1978; Sanders 1979; Adams 1980; Siemens 1982; Lohse 2004). In addition, studies focused on the details of environmental variability and available resources further challenged the view of Maya lowlands as a hostile and resource-scarce environment (e.g., Graham 1987).

An increasing interest in climate change within the last few decades has led to a vast amount of palaeoclimatic data being collected from the Maya area, data which indicate considerable changes in rainfall patterns during the mid- to late Holocene (Brenner et al. 2002; Leyden 2002; Rosenmeier et al. 2002a, 2016; Wanner et al. 2008; Webster 2007; Kennett et al. 2012). These data gave rise to studies, such as those by Gunn and Adams (1981) and Folan and colleagues (1983a), that associated the rapid growth of Maya culture with cooler and wetter periods and its decline with drier and warmer periods. Others have argued that the variation in climate patterns explains the shift in power among major Maya centres (Folan 1977, 1980; Folan et al. 1983b; Kurjack and Garza 1981) and the movement in population concentrations from inland to coastal areas and back again (Folan 1978). There have also been many other environmental studies conducted in the Maya area, with emphases ranging from the development of agricultural economies, the implications of intensive food production, the development of social stratification and state-level society, and ultimately the possible relationships between climate and the perceived Classic Maya 'collapse'.

Many studies, especially those focusing on climate, have been criticised, however, for oversimplifying cause and effect or for being environmentally deterministic in ignoring the importance of cultural and social factors, such as religion, ideology, political strategies and economic organisation. '… [I]n the pursuit of a universal causal factor – climate – history and process have been left out. But it is in the history of a society, seen in the context of general processes, that we will understand why a society responds to climate stress in one period by growing in complexity and in another by collapsing' (Tainter 2000:

337; see also Flannery 1972). In Maya archaeology, we are fortunate that some glimpses of Maya-event scale history at least can be gleaned from hieroglyphic texts although, as with other past societies with surviving written records, the process of extracting the information from these records is less straightforward than we would wish or might at first expect. After the breakthrough in the decipherment of Maya hieroglyphs in early 1950s (Knorozov 1952) and later, the overturning of the idea that Maya hieroglyphic writing did not contain historical accounts (Proskouriakoff 1960), we now have an exceptional opportunity to look more closely at some of the missing socio-cultural issues. We know a great deal more now than we did ten years ago about Maya political organisation, dynastic histories, worldview and religion (e.g., Houston and Stuart 2001; Houston, Stuart and Taube 2006; Martin and Grube 1995, 2000, 2008; Stuart 2005).

However, despite all of these advances and new strands of evidence, we still know very little about either the short- or the long-term dynamics of human-environment relationships in the Maya region. For example, we still do not fully understand how societies respond to unexpected variability in rainfall patterns in different environmental conditions and at different timescales. Does society become increasingly complex? Is collapse inevitable? Do people simply move, and if so, why? Do their ideological and religious beliefs change or do they remain the same?

This book engages with these debates and the new analytical opportunities in Maya archaeology, and attempts to address a continuing void in our knowledge of how the Maya responded to environmental variability by examining information from: (a) the growing field of settlement archaeology, (b) increasing number of palaeoclimatic datasets, and (c) advances in Maya epigraphy and decipherment. The characterisation of Maya settlement through time, the understanding of cultural and political trajectories through epigraphy, and the study of Maya responses to the environment have not been embraced by a single and coherent study. I will, therefore, explore the relationship between Maya society and the local environment over the long term, while taking into account socio-cultural agency via information from the written record. A complementary strand of evidence – an exploration of very recent Maya responses to environmental stress, based on ethnographic fieldwork conducted in Belize (Downey and Jobbová 2011) – is also presented as a sort of bridge, connecting the past with the present.

More specifically, I will be addressing the following questions:

- How did Maya communities and their inhabitants deal with environmental stress, drought in particular? Where we have records of adverse rainfall conditions, is response to stress evident in settlement patterns, agricultural and water strategies, or in the written records?
- What can we learn about the relationship between Maya society and the environment through the examinination of a range of evidence over the long term and in different regions?

The questions will be examined in several stages, and through answering following sub-questions:

- How can environmental stress be defined and recognised?
- What can we learn from the historical period and ethnographic present about modern Maya responses or adjustments to spatial and temporal variation in weather patterns? How does knowledge of the range and kind of responses help us to recognise patterns related to climate change in the past?
- What can we learn from long-term climate records about variation and change in the weather patterns within the study regions?
- Are there changes in micro-regional Maya settlement patterns through time?
- Do Maya agricultural and water management strategies change through time?
- What can we learn from the written records (texts from the Early and Late Classic, versus Terminal Classic and Postclassic period)?

Combining such different datasets in a single study is still rare in Maya studies, therefore, after providing the environmental and archaeological context in Chapter 2, the theoretical and methodological framework behind combining approaches drawn from anthropology, archeology and epigraphy are discussed in Chapter 3.

Chapter 4, based on ethnographic fieldwork among contemporary Maya communities, explores how climate events, such as droughts, floods, and hurricanes, affect people's lives, how people react to these events, and what mitigation strategies they develop. The aim of this chapter is to gain a better understanding of the human-environment relationship at the level of human decision-making on shorter timescales, thereby adding a much-needed behavioural context. The chapter then serves as an exploratory groundwork when looking for similar patterns in archaeological and textual evidence in following chapters. Chapter 5 presents the palaeoclimatic data for the case study regions, which is then used for comparative purposes in the next three chapters. Evidence for the spatial and temporal variability in the climate record over long time periods is derived from long-term proxy data derived from lake sediments, speleothems and cave sediments.

Chapter 6 focuses on ancient Maya and explores settlement histories in the case study regions by considering chronology and rates of occupation through time. Variation in the extent and layout of the settlements, degree of nucleation, and indications of change or stasis were also important criteria. Chronology of occupation and settlement patterns were examined on both regional, as well

as local inter- and intra-site scales, using settlement and excavation data from projects carried out in the case study regions. In Chapter 7, settlement histories in individual regions are viewed through an exploration of the variation in environmental conditions such as soils, water sources and rainfall patterns, particularly how these factors, singly or in combination, potentially influence agricultural and water management strategies and settlement patterns.

Chapter 8 provides another context, this time socio-cultural, by exploring cultural and political histories in the case study regions, including the analysis of changes seen in the epigraphic record between the Classic and the Postclassic, the period known as the Terminal Classic. This transitional period witnessed considerable changes in the Maya area and covers the period of the Maya 'collapse', therefore, these records were of especial interest. Political alliances, the effects of warfare on settlements, the relationship between settlements and their hinterlands, and changes in iconography and in what was recorded are all explored.

Chapter 9 synthesises the results of the analyses and observations from the previous five chapters, discusses the explored questions in a more comprehensive way, including wider global and modern implications of the findings from this project.