Chapter 2
Climate, Causation and Society: Interdisciplinary Perspectives from the Past to the Future

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Abstract Over the last two decades, the causal role of climate in African history has been the subject of renewed debate. In many cases, however, the limitations of extant methodological approaches have contributed to a tendency to view climate as a monocausal factor in past human events, leading to revived criticism of the concept of climatic causation. Similar claims have also surfaced regarding approaches to evaluating the potential impacts of future climate change, where it has been suggested that the predictive hegemony of modelling has left the future of humankind "reduced to climate", thereby overlooking the human factors that determine the magnitude of its impacts. In the context of urgent present and future African environmental challenges, questions over the concept of causation underline the need for further interdisciplinary research at the climate-society interface. One approach that can contribute to this discourse is assembling well-founded historical perspectives on climate–society interactions through the analytical framework of climate history. Indeed, studying the past is the only way we can examine the effects of and responses to shifts in physical systems. The aim of this paper is to provide an up-to-date starting point for such analyses in an African context. Using selected southern African case studies, previous approaches relating to climate and societal dynamics are first evaluated. Climate history is subsequently posited as a paradigm which is well-placed to deepen knowledge on long-term climate-society interactions, fitting alongside and incorporating key established paradigms such as vulnerability and resilience. Three key areas are highlighted for this challenge: climate reconstruction; understanding past human–climate interaction and vulnerability, and examination of societal resilience to climate change impacts. New research areas are then presented where studying the past can inform consideration of important future challenges, and the paper concludes by calling for the development of African climate histories on various spatial and temporal scales.

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Introduction

The causal role of climate in human history has been a source of long-term debate amongst historians, archaeologists and anthropologists. Over the last two decades, the increasing availability and resolution of palaeoclimate proxy data, offering unprecedented insight into past climates, coupled with concerns over contemporary global climate change, has contributed to resurgence in hypotheses proclaiming the significance of climate in human history (Middleton 2012). The African historiography is no exception to this trend, with some of the most important events in African history being linked to the variability of precipitation in particular (McCann 1999). The absence of coherent methodological approaches for such investigation, however, has promoted renewed criticism. This primarily conforms to suggestions of climate determinism, whereby climate is elevated to the position of a monocausal explanatory factor in past events and the performance of societies. This is conceptually illustrated in the basic input–output model in Fig. 2.1, which depicts climate directly determining societal impacts. Although changes in climate can certainly have significant biophysical consequences, these impacts affect complex socio-ecological systems shaped by the interaction of multiple stressors, as shown in model (c) (Fig. 2.1), meaning human response is strongly non-linear (Endfield 2012). Basing societal impacts primarily on the reconstructed physical aspects of past climate has thus led to misleading conclusions over its human significance (O'Sullivan 2008; Butzer 2012; Livingstone 2012).

Debate over the societal impacts of climate variability is, of course, not confined to the past. Africa is frequently referred to as one of the most vulnerable continents to climate change (Boko et al. 2007). Model outputs project that its warming in this century is very likely to be higher than the global average, with increases in extreme wet and dry seasons projected in most sub-regions (Christensen et al. 2007). While the recent increasing volume and sophistication of model-based climate impact studies has witnessed a significant move beyond the simplistic approach in model (a) in Fig. 2.1, critics argue that our understanding of the causal consequences of climate change for society remains limited (Hulme 2011). Reactions against the dominant methodological discourse have recently emerged, one of which argues that the predictive authority of climate modelling over geography and other environmental and social sciences has left the future of humankind "reduced to climate" (Hulme 2011). Similarly to climate determinism, then, this so-called climate reductionism is suggested to have resulted in an elevated position of climate as a universal predictor and causal variable, and an over-determined future where the biophysical impacts of climate "explain" the performance of future societies.

Owing to the urgency of contemporary environmental challenges and the stated vulnerability of the African continent, the notions of determinism and reductionism across different timescales raise pertinent questions for Africanists working at the climate-society interface. Are past and future views of Africa simply reduced to climate because it is a "known" variable? Are other factors that influence societies disregarded because they are less predictable? Perhaps most importantly, how can

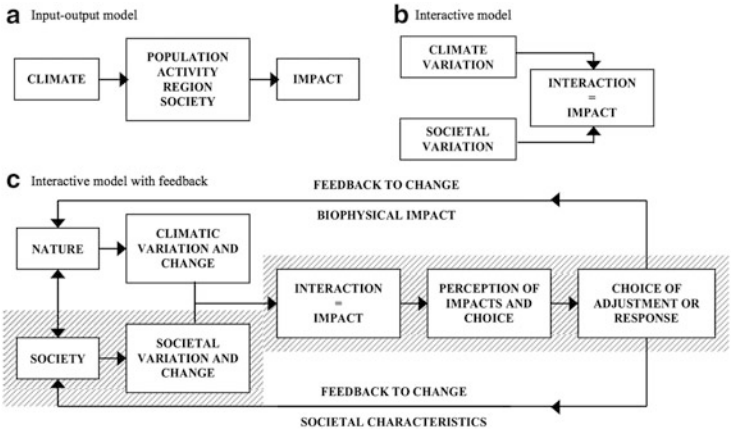

Fig. 2.1 Hierarchy of models of climate-society relationships. *Shading* indicates key research areas relating to societal impacts. Modified after Kates (1985)

geographers, social scientists, historians and others contribute to these discussions alongside model-based descriptions of the future? These are key questions that cut across disciplinary boundaries, and further research on the human aspects of climate change is required to deepen our understanding of these complex interactions (Boko et al. 2007; Hulme 2011). While there exists no universally accepted way of formulating the linkages between human and natural systems, one relatively recent approach that can contribute to this discussion is "climate history" (Ogilvie 2010; Carey 2012). This emergent field seeks to analyse both the past evolution of climate and its relationship with societal dynamics, and is often linked to the wider integrated modelling paradigm relating to historical ecology, vulnerability, and resilience (Holling and Gunderson 2002; Janssen and Ostrom 2006; Crumley 2007). Furthermore, although the combination of contemporary climate change and the rapid post-1950s growth of human societies mean that future impacts are likely to be of unprecedented complexity, examining the past can offer much-needed historical perspectives on linked social and ecological systems (Redman and Kinzig 2003). Indeed, with respect to Africa, the IPCC (Intergovernmental Panel on Climate Change) states that "there are still few detailed and rich compendia of studies on 'human dimensions', interactions, adaptation and climate change (of both a historical context, current, and future-scenarios nature)" (Boko et al. 2007).

This chapter therefore aims to examine approaches and research themes regarding the notion of climatic causation in African history, with the intention of providing a framework and starting point for Africanists researching related themes. Thus, the paper will necessarily be broad in scope. A case study approach is adopted, whereby historical examples from southern African history are first evaluated, with particular focus given to the inherent methodological challenges in linking nature and society. As a result of this critique, climate history is posited as

an interdisciplinary field and methodological framework which can both enrich the historiographical debate and open up long-term perspectives on socio-environmental dynamics of stated importance for the future. The paper culminates in a discussion of the range of sources and methods from various disciplines that are required in order to probe deeper into the human dimensions of climate change and enhance understanding of the continent's future challenges.

Climate Change and Societal Dynamics in the African Historiography

The Holocene, that is, the current geological epoch, holds many case studies where climate change has been posited as the chief causal factor in the rise and fall of settlements, societies and civilisations. Notable African examples include the decline of Rome in North Africa, the collapse of the Mapungubwe state and the rise of the Zulu Kingdom (Fig. 2.2) (see for example Shaw 1981; Holmgren and Öberg 2006; Huffman 2008). Alongside the increase in palaeoclimate data (for instance, tree-rings), McCann (1999) identifies increased environmental consciousness, and the human impacts of the 1968–1972 drought in the Sahel, Ethiopia's twin famines in 1972–1974 and 1984–1986, and the mid-1980s drought in southern Africa as stimulants for this renewed body of scholarship in Africa. Recent focus on past human-climate interaction has therefore shifted from comparatively narrow attention within the disciplines of archaeology, anthropology and environmental history into a matter of relevance for the present and future.

Two main approaches have dominated this African climate-society historiography: the first, and the most common, relates to the direct causal role of rainfall variability in short-term (annual to multi-decadal length) crises or events, often constituting "collapse", whereas the other explores the more fundamental relationships between the environment, climate, and human activity over much longer (centennial) periods (see for example Brooks 1993; Webb 1995; Ekblom 2012). Environmental historian James McCann argues that the former approach has in many cases led to misleading conclusions; while Butzer (2012) notes that the spectre of historical collapse is a red herring. This criticism is largely due to the lack of a coherent methodology for linking climate change to societal events, a persistent problem since Emmanuel Le Roy Ladurie's pioneering *Times of Feast*, *Times of Famine*, and Hubert Lamb's *Climate*, *History and the Modern World*. Moreover, the task of integrating the wide range yet limited quantity of climatic data sources has further contributed to this problem and has often resulted in dismissals of climate determinism. Despite these challenges, the focus on short-term events remains a prominent source of debate, replicated in the southern African region.

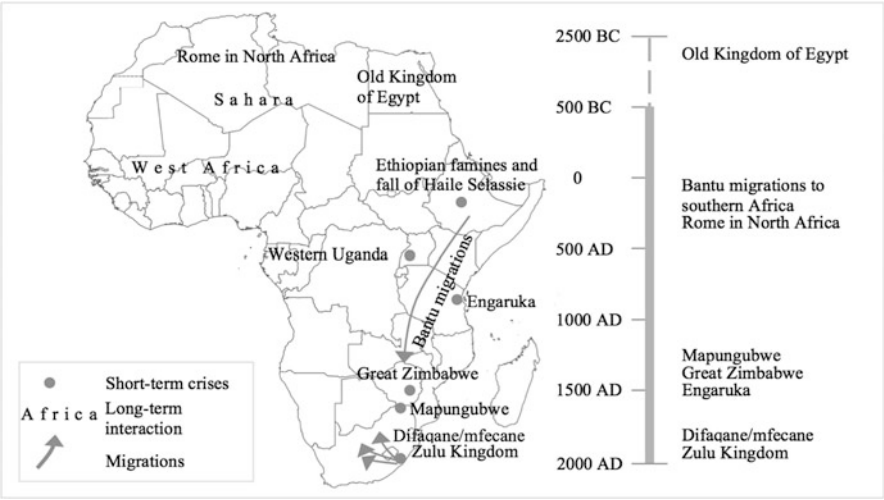

Fig. 2.2 Selected examples of climate-society case studies in the African historiography

Climatic Pathways to State Formation and Decline in Southern African History

The defining moments of the thirteenth century rise and decline of the southern Africa's first state, Mapungubwe, followed by the rise of Great Zimbabwe, and the early-nineteenth century famines, warfare, raiding and migrations of the *difaqane/mfecane* period and the subsequent rise of the Zulu Kingdom have each been causally linked to climate variability (Fig. 2.3). These events constitute regional "turning points" in the pre-colonial period, for which the importance of climate remains disputed. Climate-driven hypotheses mainly stem from the observation that in certain instances of societal change there is a general correlation between human events and the shift from wetter to drier conditions or vice versa (Fig. 2.3) (Pikirayi 2001; Tyson et al. 2002; Holmgren and Öberg 2006). The impacts of such shifts are usually depicted as causal chains, whereby a decline in rainfall, for example, is mediated through its biophysical impacts on vegetation and water resources, with consequent effects on human livelihoods and wellbeing. Climate variability has thus been seen as a factor that would inevitably have impacted the economies of the time due to its role as a limiting factor in food production. Nevertheless, it must be borne in mind that climate was just one of several prominent factors important to pre-colonial societies in the region. These factors are discussed to great extent elsewhere (Eldredge 1992; Beach 1994; Pikirayi 2001; Huffman 2007; Kim and Kusimba 2008), but include economic ties to the Indian Ocean trade at Sofala, wealth in cattle and minerals, the ideology of sacred leadership, coercion, conflict, and colonial interference.

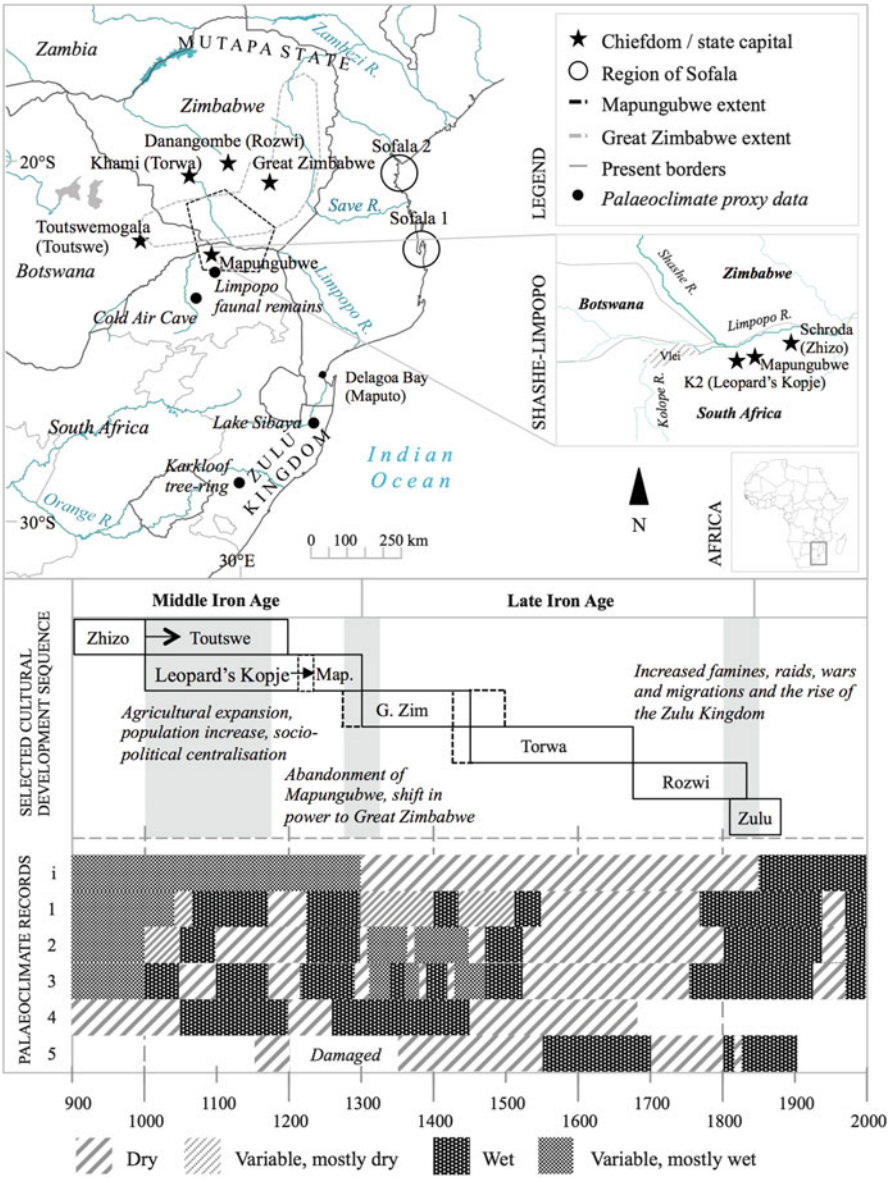

Fig. 2.3 Map of sites mentioned in the text, simplified overview of the Middle-Late Iron Age cultural development sequence, and precipitation variability over the past millennium. Information on approximated pre-colonial state extent from Huffman (2007). Cultural sequence abbreviations: *Map* Mapungubwe, *G. Zim* Great Zimbabwe. Palaeoclimate records: i: regional palaeoclimate review (Tyson and Lindesay 1992), 1: Cold Air Cave T7 stalagmite (Holmgren et al. 1999), 2: Cold Air Cave T7/T8 stalagmites (Holmgren et al. 2003), 3: Lake Sibaya (Stager et al. 2013), 4: Limpopo faunal remains (Smith 2005), 5: Karkloof tree-rings (Hall 1976; Vogel et al. 2001). Palaeoclimate timeline modified after Holmgren et al. (2012)

In the case of the Mapungubwe state, palaeoclimatologists and archaeologists posited that the warmer and wetter conditions associated with the regional manifestation of the Medieval Climate Anomaly, initially believed to be around AD 900–1300, aided agricultural expansion, population growth and the development of societal complexity, sacred leadership and institutionalised rain-control (Huffman 2008, 2009). Contemporaneity with inferred climatic conditions from certain palaeoclimate records, in this case the beginning of the "Little Ice Age" (Fig. 2.3) (Tyson et al. 2002), has also led the later abrupt abandonment of Mapungubwe at around AD 1300 to be linked with climatic factors. According to this hypothesis, the viability of the floodplain of agriculture which supported the growing population at Mapungubwe was the key factor in the causal chain that would have been adversely impacted, thus contributing to societal collapse (O'Connor and Kiker 2004).

The rise and decline of Great Zimbabwe followed between AD1300–1450. In its rise, the spatial variability of climate has been linked to the strengthened economic base of the state due to its location in the zone of higher rainfall along Zimbabwe's south-east escarpment, thus allowing agriculturalists to flourish (Huffman 2007, 2008). Some authors have further claimed that the impact of dry conditions observed in several palaeoclimate records in the mid-fifteenth century undermined the agricultural base of the state, on which its large population was dependent (Holmgren and Öberg 2006). Conversely, Connah (2001) prescribes local population pressures and environmental degradation as chief cause, stating that without fundamental changes in technology and the agricultural system, Great Zimbabwe was "fated to destroy itself". These claims have later been dismissed due to Great Zimbabwe's location in the 'high' rainfall district, on the basis that agriculture here was viable even with a drier climate most of the time (Huffman 2007). Ethnological research, although its applicability is disputed by some (Bonner et al. 2007), has further shown that in the Zimbabwe culture worldview, the sacred leader held accountability for environmental phenomena due to the relationship between leaders, God, ancestors and rainmaking. Drought or climatic drying could have therefore challenged the political status quo (Schoeman 2006; Murimbika 2006). This interrelated debate opens up questions over the role of leadership, elites and ideology, as well as the environment, for vulnerability and resilience to societal breakdown in the Great Zimbabwe region.

Later, at the beginning of the nineteenth century, profound increases in raiding, migrations, warfare and famine were observed on a near-regional scale. This period, albeit the subject of extensive debate (see Hamilton 1995), is referred to as the *difaqane/mfecane*. This had widespread socio-political and cultural consequences southern Africa, including the rise of the Zulu Kingdom, and has likewise been linked to climatic origins (Ballard 1986; Eldredge 1992; Huffman 1996; Vogel et al. 2001). Maize was introduced to KwaZulu-Natal in the early-middle eighteenth century (Maggs 1984), and its cultivation is suggested to have had twofold implications of rapid population growth and increased human vulnerability to drought due to the crop's water-demanding nature. Higher rainfall and warmer conditions following the end of the Little Ice Age (Fig. 2.3) could have played an important role in this

process. However, subsequent severe drought observed in a tree-ring record from KwaZulu-Natal (Hall 1976) at the beginning of the nineteenth century has been linked to a reduced carrying capacity of arable land and pastures, which could have contributed to a marked imbalance between population and resources and the famine, mass-migration and state transformation that followed (Holmgren and Öberg 2006).

In each of these simplified case study overviews, a causal chain of events initiated by a change in rainfall has been posited as a determinant in societal change. Nevertheless, much of the debate surrounding climate and society in pre-colonial southern Africa has not considerably advanced beyond a series of hypotheses based largely on association with wet and dry conditions. Indeed, while some point to climate as an ultimate factor in societal events, others dismiss this as mere background noise. According to Judkins et al. (2008), these contrasting positions are based on the opposing fallacies of climate determinism and climate indeterminism, where the former position has commonly been adopted by geographers, and the latter by historians. Although it is true that societies condition the consequences of climate change through cultural choices, rather than vice versa, this does not mean that climate should be discounted as a potential causal factor (O'Sullivan 2008; Hulme 2011). Such divergent debate therefore marks a need to consider more fully the role of climate and the environment in societal development. Alongside a lack of interdisciplinary research, this stems from three broad restrictions in previous approaches:

- Lack of African palaeoclimate data and ambiguity in its interpretation;
- The isolation of climate impacts in the form of causal chains, resulting in;
- Limited contextualisation of climate variability with other contemporary events.

First, the differing signals of limited palaeoclimatic proxy data has directly contributed to divergent claims and hypotheses regarding the attribution of climatic impacts. For instance, the publication of records (i) and (1) in Fig. 2.3 gave rise to the hypothesis that Mapungubwe was abandoned due to coincidence with the onset of drier conditions in the Little Ice Age. This led some to claim that "the coincidence of the Mapungubwe collapse with the ending of the moist medieval warm period. . . strongly suggests that deteriorating climate was an important contributory factor in the decline of Mapungubwe" (Tyson et al. 2002). Later, however, record (2) gave markedly different indications regarding the onset of the Little Ice Age, leading to differing conclusions on the significance of climate in societal change. This provides a clear example of how the quantitative nature of past climate reconstructions has directly elevated the position of climate as a causal factor due to its status as a "known" variable, in other words, taking results from one context and extrapolating into another.

Although it is tempting to prescribe climatic variability as a chief cause in past events due to a loose correlation between the climatic and cultural records (Fig. 2.3), this can only show coincidence, not causation. Causal links are more complex, and sole consideration of the moisture availability inferences of palaeoclimate can lead to monocausal and misleading conclusions which overlook human capabilities of problem solving (Tainter 2006). While it must be stated that

several studies do consider a wider range of human and physical factors that were important to historical societies (for example Pikirayi 2001, Huffman 2007, 2008, 2009; Manyanga 2007), bold claims that generally reflect the simple cause-effect process depicted in Fig. 2.1 have surfaced without the required full consideration of the socio-economic, political and cultural context for a specific spatial area. This particularly relates to the concept of vulnerability, a key factor in determining the magnitude of climate impacts past, present and future (Pfister 2010; Endfield 2012). Moreover, if we are to avoid narrowed view where climate variability is isolated as a causal factor, the myriad of wider human events and societal forces, for instance, trade and colonial influence in southern Africa, must also be considered through rigorous historical investigation. The highlighted limitations in understanding of climate-society interactions in the past signify the need for an integrated and interdisciplinary framework for which the scope of climate history is well-placed to contribute (Pfister 2010; Carey 2012).

Interdisciplinary Climate History: A Methodological Framework

The integration of historical, archaeological and palaeoenvironmental records is a major task, and requires the incorporation other research areas and methods from disciplines such as environmental science and modelling, political and economic history, anthropology and ethnography. Climate history can form part of a new integrated analytical modelling paradigm required to link these disparate data sources and consequently link human and environmental change. Centred on past African climate change, this field contributes to the call for alternative frameworks by Butzer and Endfield (2012), as opposed to a metanarrative-driven understanding of historical human-environment relationships. Figure 2.4 illustrates how this manifests in the form of a basic interactive conceptual model, showing research areas and their interaction.

This framework is open to multicausality rather than monocausal environmental explanations, and shows that while the environment is certainly important for sustainability, interrelationships are filtered through a web of complex social responses. The following three areas in particular, summarised in Table 2.1, can contribute to historiographical debate, and as is later suggested, contemporary discussions regarding potential future climate change impacts:

1. Reconstruction of past environments and climate;
2. Assessment of the interaction between the environment, climate and society at the scale of peoples, settlements, societies and civilisations;
3. Examination of periods of more abrupt climate and environmental change and its impacts on humans, with appropriate contextualisation against other factors.

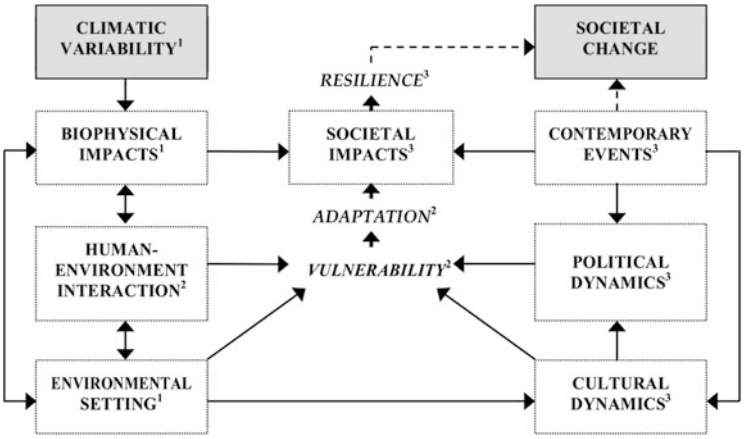

Fig. 2.4 Analytical model of research areas in climate history. 1: Climatic and environmental conditions and change; 2: Climate-society interaction; 3: Climate impact analysis and contextualisation

Discussion: Application and Scope of African Climate History

In examining the impact of climate change on society, it is important to first consider the nature of the climate change or weather event itself (Endfield 2012). With respect to climate reconstruction, multi-layered sources are required to establish the environmental setting of past societies (Pfister et al. 2008). Prior to the period of instrumental weather observations, it is necessary to consult palaeoclimate proxy data, along with other, man-made records of climate. Proxy data include tree-rings, corals, lake levels and speleothems, most of which are compiled under the National Oceanic and Atmospheric Administration (NOAA) Palaeoclimate Database. Although Africa suffers from a relative lack of proxy records compared to other continents, it is their interpretation that has been the subject of debate in the southern African historiography. One task, using extant methods within palaeo- and historical-climatology, is therefore to establish clearer sub-regional pictures of the past climate, particularly the timing and length of major wet and dry periods. This involves statistical analysis and comparison of records [see Jones and Mann (2004) for discussion of methods and Neukom et al. 2013 for southern African example], and investigation of their spatial extent and relevance. For the more recent past, there now exists a range of sources for historical climatologists to assess climate variability on an inter-annual scale in nineteenth century Africa. Sharon Nicholson has led the development of an Africa-wide precipitation data set from 1801–1900 based on proxy and rain gauge records and split over 90 geographical regions (Nicholson et al. 2012). This represents one of the first continent-wide resources providing scholars working on related issues with

Table 2.1 Climate history: an interdisciplinary framework

Area	1. Climate reconstruction	2. Climate-society interaction	3. Climate change impacts
Aims	To further understanding of late-Holocene climate variability	To deepen knowledge on long-term socio-environmental interaction and vulnerability	To assess climate impacts and their contextual importance in African societal development
Sources	Documentary data; missionary reports, administrative records, oral traditions, ships' logbooks Palaeoclimate data; tree rings, coral, speleothems, lake levels Global Climate Models Other; rain gauge records, archaeological site remains	Archaeological records, archival sources, oral traditions. Environmental geospatial data; soils, minerals, vegetation, water resources Palaeoenvironmental data; pollen records, animal and plant remains	Knowledge of past climates, environments and interaction with society (previous steps), archival sources, environmental models, resilience and systems theory
	Past interaction		
Key research areas	• Reconstructions of spatial and temporal climate variability • Importance of various mechanisms of climate variability to humans (for instance, impacts of El Niño Southern Oscillation on drought in southern Africa)	• Economic, social, political and cultural role of climate and the environment • Physical and socio-cultural factors that influenced the vulnerability of past societies • Adaptation measures to buffer potential climate impacts	• Socio-environmental resilience to climate change • Significance of climate change impacts different groups • Contextual interaction of impacts with other factors important to these groups
	Past-future connections		
	• Past spatial and temporal variation in climate and relation to future projections • Important modes of variability in the past, particularly those linked to drought, and their projected changes in the future	• Long-term economic, social, political and cultural importance of climate and the environment to various groups • Changing causes, mechanisms and timescales of vulnerability • Successful and problematic adaptations to climate change	• Human significance of climate over the long-term and its changes • Causes of changing socio-environmental resilience • Projected climate change impacts on historical land and resource divisions

a basis for assessing past precipitation variability. Various other reconstructions using man-made documentary archives such as missionary reports have also been undertaken. In southern Africa, for instance, reconstructions of nineteenth century precipitation variability have been conducted for Lesotho and the Kalahari (Endfield and Nash 2002; Nash and Grab 2010). This has recently culminated in

the development of a regional reconstruction of precipitation variability over the last two centuries (Neukom et al. 2013), and further such work is ongoing in this area (see ENSO Africa Project 2013). It is also possible to examine precipitation variability in the context of reconstructions of global atmosphere–ocean phenomenon such as the El Niño Southern Oscillation, an important mechanism of variability for precipitation in southern and East Africa (Tyson and Preston-Whyte 2000).

It is not enough, however, to simply state that an abrupt change in climate would have inevitably had an adverse impact on society. We must therefore consider the mediating context in which climate acts to understand societal vulnerability and resilience at multiple spatial scales. Vulnerability, often defined as the potential for loss (Tainter 2006), has important implications for understanding the susceptibility to harm in the context of climate change, and can lead to an improved understanding of long-term risk, though is often overlooked when considering the past (Carey 2012). This concept concerns both the physical characteristics of the local and regional environment, and the specific socio-economic and cultural relationships with the landscape. Physically, the impacts of anomalously wet or dry conditions are not the same for all crops, nor for the same crop in different soils. It is therefore necessary to examine the spatial differences in the environment as a whole rather than just climate, and the example of understanding the implications of spatial differences in soil character on food-producing societies offers just one way of doing this. A promising case study is found in the analysis of the role of the environment in the pre-colonial society of Engaruka in East-central Africa, which pays particular attention to soil character and local conservation practices (Westerberg et al. 2010). As well as physical factors, we must also consider socio-economic and cultural factors that affect vulnerability. In the case of southern Africa, ethnographic research on the Zimbabwe culture has suggested that the ideology of sacred leadership played an important role in the stability of state structures, particularly by way of the ‘control’ of natural phenomenon and rainmaking (Murimbika 2006; Schoeman 2006). This connection at Zimbabwe culture sites such as Mapungubwe and Great Zimbabwe could have meant that extended dry spells undermined the authority of the leadership and contributed to state decline (Huffman 2007).

A more formalised approach to assessing past vulnerability is “landscape vulnerability assessment” (Fraser 2007). Here, vulnerability is identified and evaluated using three key scales: agro-ecosystem, human action, and society [see Fraser (2007) for methodology]. Examining variables on these scales therefore creates three-dimensional space, indicating the vulnerability of the particular context under examination. In a similar approach, Ekblom (2012) examines the changing vulnerability and socio-environmental dynamics of Chibuene, Mozambique over several hundred years, while Manyanga (2007) comprehensively assesses landscape vulnerability in the Shashe-Limpopo basin in southern Africa. These areas constitute physical and cultural spatially specific features which can mediate the impacts of climate variability, each of which, alongside other factors including past adaptation and local knowledge systems, are key areas requiring further research across Africa.

Consideration of changing socio-environmental vulnerability thus provides a more fruitful approach than examining abrupt events of environmental and societal change or collapse. Such research generally follows the observations of McCann (1999), who suggested that in Africa, the "real value of linking the environment to historical process may lay in a more subtle, nuanced view of how environmental conditions set a context for social and historical interaction". Certainly, understanding the fundamental human role of and relationship with the environment and climate is essential when considering the possible effect of climate change.

A third key area in this climate history framework is evaluating the impacts of climate variability. This essentially depends on ability of a society to respond to this change, and the time- and place-specific context in which such changes take place (Endfield 2012). To a large extent this is based on the informed consideration provided from the previous two areas, though also involves contextualising climate, drawing it into debates concerning the range of other factors important to historical societies (as shown in Fig. 2.4) to avoid narrow and misleading conclusions. One concept that is important to this discussion is resilience, usually defined as the ability of a system to adjust its configuration under disturbance (see Holling and Gunderson 2002; Redman and Kinzig 2003; Tainter 2006; Endfield 2012). Investigation into societal resilience relates to numerous factors under the interactive areas in Fig. 2.4, notably the rigidity of social, economic and political networks, human resourcefulness, effectiveness of problem-solving, and the diversity of biophysical resources (Constanza et al. 2007). Taken together with analysis of vulnerability, then, these concepts can help to clarify the complexities of past environment-society synergies, giving far greater depth than the simplistic explanations put forward in some cases. In addition to resilience, contextualisation with other events and causal hypotheses is needed. One example in southern African history is the hypothesised link between "favourable" climates and political centralisation. Research has nevertheless suggested that only those societies connected to the East Coast trade network have evidence for large territories and the highest levels of political centralisation, and that it was only when the trade arrived in the greater Maputo that the southern polities of the Tsonga and Northern Nguni became centralised (Huffman 2004). Although this explanation is as disputed as the climate hypothesis, it may be a salient point, and it is therefore plausible that trade links may have been a factor of greater significance in the origins of class distinction. One could argue, therefore, that the role of the wetter conditions in the Middle Iron Age may be better viewed as contributory, allowing population increase in a concentrated area, encouraged by other mechanisms, contributing to the initial growth of the Zimbabwe culture. While parts of the literature, as evidenced, currently consider some of these factors, climate history provides a framework to evaluate and eventually weight each of the processes involved. This marks a move beyond a reductionist approach which isolates climate as a limiting factor in food production, towards the more nuanced view of the role of the environment and climate in societal dynamics over the long-term originally called for by McCann (1999), as well as the implications of climate change.

Climate History and the Future

Understanding of present and future challenges can greatly benefit from knowledge of the past co-evolving human-environment system (Constanza et al. 2007), and a state-of-the-art research theme is the potential of climate history to offer insights into future climate-society challenges. Nevertheless, such research remains in its infancy, with poorly focussed, alarmist and simplistic analogues of projected future conditions often presiding over appreciation of the experience of and adaptive responses to environmental challenges (Butzer 2012). While integrated assessment modelling, which incorporates factors such as population dynamics into the analysis of human impacts, offers tangible and relevant outputs, the translation of future climate change into societal impacts has been criticised (Hulme 2011). The societal impacts of climate change in Africa, according to the IPCC, will range from increased food insecurity, migration and conflict, to the exacerbation of gender inequality (Boko et al. 2007), while claims in the academic literature and media alike are often marked by fearful tones and overly precise numbers:

- "When combined with climate model projections... historical response to temperature suggests a roughly 54 % increase in armed conflict incidence [in Africa] by 2030, or an additional 393,000 battle deaths..."—Burke et al. (2009)
- "Millions of people could become destitute in Africa as staple foods more than double in price by 2050 as a result of extreme temperatures, floods and droughts..."—Vidal (2013).

These grand narratives of the future, stemming from the predictive authority of the dominant methodological discourse, neglect socio-cultural aspects that determine the impacts of and responses to climate change (Hulme 2011). Novel ways are thus being sought to contribute to this discussion, particularly by introducing a greater human dimension into studies. The reconstruction-interaction-impacts framework presented in Table 2.1 is consequently also relevant to this area. Firstly, investigation into past climates is a long-established tradition in climatology (Jones 2008), and there remains a continual need for this research as future model projections are subject to uncertainty. This particularly concerns how modes of variability for different spatial domains, for example sea-surface temperatures and the El Niño Southern Oscillation, have changed over the past millennium and recent centuries, as well as their impacts on regional and local precipitation. Methods of reconstruction in climate history, as well as palaeoclimatology are thus centrally located in this challenge (Ogilvie 2010).

Aside from further understanding past changes in the climate system, the scope of simply offering historical perspectives on climate change can go further. Carey (2012) argues that there is a relative shortage of research and policy discussion about people's lived experiences with climate. This relates back to the introductory claims of methodological reductionism, and future climate history research can therefore go beyond this by putting people back into the equation. Through examining concepts such as socio-environmental vulnerability, adaptation and resilience

in the past, climate history can provide insights into the societal forces, rather than just the environmental forces, that affect the human impacts of climate change. This includes social divisions, economic inequality and power imbalances, as different socio-cultural and political groups are affected in various ways. Such a focus can illuminate why climate has been a determinant factor at some times and places but not at others, and how this may be relevant to future impacts on different groups of people. Difficulty in assessing possible future climate impacts arises, for instance, when considering pre-colonial land and resource divisions, where predictability is reduced and uncertainty is heightened. A key historical development relating to this was the formation of state borders during the colonisation scramble of the late nineteenth and early twentieth centuries. These borders were geo-political constructs which paid little attention to previous boundaries between people or states, of which land and resource divisions were a part of. This divergence between nation states and ethnic entities has fuelled tensions and security issues in several sub-Saharan African nations, and it is thus possible that climate change will fuel this inherent source of conflict by exacerbating existing land and resource divisions in these zones of cultural friction (Boko et al. 2007; Scheffran and Battaglini 2011). An important question, therefore, is how past climate change has affected these areas, and how contemporary and future climate change will feed into historical conflict and security issues across the region. One recent suggestion in this area is for the production of "climate ethnographies" (Crate 2011). Crate argues that in the context of global climate change, the disciplines of anthropology and ethnography should focus further attention on developing locally contextualised information, especially in zones of cultural friction, on human perceptions and understandings of and responses to local change in both the recent past and present day.

Here, climate history is uniquely placed to locate potential renewed environmental conflict and security issues across the continent by its focus on the long-term societal forces that affect human-climate dynamics. It is well-established that the poor and marginalised will suffer disproportionately from climate change, but research must probe deeper into this matter. Why and how are they the most vulnerable? How has historical societal development affected this? Has societal change been inevitably linked to environmental change in the past? Does it offer precedents to develop solutions for the future? By offering deep-time interdisciplinary perspectives, a theoretical basis for climate-society interactions, and giving greater focus to human dimensions, the global development of climate history is beginning to contribute to these matters, but can, as Carey (2012) asserts, go much further in contributing to present-day discussion.

Concluding Remarks

Assessing the precise role and significance of climate variability on past societies is, as Endfield (2012) observes, fraught with difficulty, and in the pursuit of this, the insight of many disciplines is essential. Previous criticism regarding determinism

reflects a general need to further appreciate complex interrelationships (Butzer 2012), and related research would greatly benefit from the application of the concepts such as vulnerability and resilience. Climate history, through the above outlined reconstruction-interaction-impacts approach, offers one analytical framework to incorporate these concepts and clarify the complexities of past climate-society relationships. The development of climate histories on various spatial and temporal scales across Africa can thus enrich the historiography, and this chapter provides a starting point for Africanists working on related themes. Moreover, in the context of contemporary global climate change, one could argue that this debate has taken on a new significance. Through improved understanding of the temporal evolution of climate-society interactions, climate history is also well-placed to contribute to current discussion on this theme, particularly by placing human dimensions at the centre of research efforts. Far from advocating simplistic ideas about the past repeating itself, this concept of past-future linkages has the potential to provide the necessary well-founded, long-term perspectives on both the physical and human dimensions of climate change.

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