The University Of Sheffield.

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The consequences of past climate change for state formation and security in southern Africa

PhD Thesis
Submitted in fulfilment for the degree of Doctor of Philosophy

March 2015

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Abstract

Considerable research has been undertaken into the nature and consequences of contemporary and future global climate change, yet detailed regional studies concerning these dynamics prior to the twentieth century have only recently begun to emerge. This thesis investigates this historical climate-society interface over a *c*. 400-year period of socio-political change in southeast Africa. This spans the development, expansion and impoverishment of African state structures, and the arrival of the Portuguese and its impacts, between *c*. 1450-1830 in the Zambezi-Limpopo region, and the origins and events of socio-political transformation between *c*. 1760-1828 in the KwaZulu-Natal area.

Previous hypotheses have proposed causal relationships between precipitation variability and this societal change, though these are predominantly built upon an apparent coincidence between the inferences of a narrow range of datasets. This cross-disciplinary study therefore reframes this research area by placing the interlinked concepts of vulnerability and resilience at the centre of its approach to tie past climate variability and societal development. First, past climate variability is evaluated using a wide range of proxy-documentary precipitation records over the last millennium, and then reconstructed using wind data from ships' logbooks in the early-nineteenth century. This analysis reveals good agreement between sources on the evolution of precipitation variability. Similarly, palaeoclimatic, written and oral sources display strong coherence between the increased variability of precipitation and recorded climate impacts, such as in the onset and amelioration of Little Ice Age cool-dry conditions in the 1570s-1590s and 1790s-1820s. While this suggests that direct climatic-induced stress increased in times of regional or global climatic change, extensive analysis of food security, livelihoods and socio-political vulnerability from written and oral sources indicates that longer-term, structural vulnerabilities of individuals and communities were crucial in conditioning the plurality of human responses to and the overall significance of past climate variability across southeast Africa.

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Abbreviations

CCP	Central Cattle Pattern
CLIWOC	Climatological Database of the World's Oceans
DPMCA	Documents on the Portuguese in Mozambique and Central Africa
EEIC	English East India Company
ENSO	El Niño Southern Oscillation
ICOADS	International Comprehensive Ocean-Atmosphere Data Set
IOD	Indian Ocean Dipole
IPCC	Intergovernmental Panel on Climate Change
ITCZ	Inter-Tropical Convergence Zone
JSA	James Stuart Archive
KCAL	Killie Campbell Africana Library
LIA	Little Ice Age
MCA	Medieval Climate Anomaly
QBO	Quasi-Biennial Oscillation
RSEA	Records of South-Eastern Africa
SAM	Southern Annular Mode
SOI	Southern Oscillation Index
SRZ	Summer Rainfall Zone
SST	Sea-Surface Temperature
WRZ	Winter Rainfall Zone

Acknowledgments

The list of people to whom I owe gratitude upon completion of this thesis is very long indeed. First and foremost I would like to thank my supervisors – Julie Jones, Martial Staub, Grant Bigg and Ian Phimister – for their guidance, support and feedback, and the University of Sheffield for funding the project, without which it would have not been possible. The experience of working with a group of esteemed scholars from very different fields, and indeed academic languages, has been immensely enriching to both the outcomes of the project as well as my development as a researcher. On the same note, I thank everyone in the Department of Geography at the University of Sheffield for their help and encouragement.

Special thanks go to Ian Phimister and Martial Staub for organising my visiting research fellowship at the Centre for Africa Studies at University of the Free State. My research was tremendously enhanced by the remarkable collection of southern Africanists at the Centre, not least in their helpful and generous feedback to my seminar at the Ramblers Club in Bloemfontein. The discussion generated from my seminars and meetings at the University of the Witwatersrand, the University of Cape Town and the Killie Campbell Africana Library was likewise highly beneficial to shaping aspects of my research, the latter of which I extend additional gratitude to for allowing me access to the archive on Easter weekend.

I am also extremely grateful to all those who provided me with the data so crucial to the formation of the thesis. Of the above I am especially indebted Tom Huffman and Wendy Voorvelt Work for giving me access to the once seemingly unobtainable volumes of *The Shona and the Portuguese*. Wendy very kindly scanned and sent the 600-page volumes, which to my delight I found in my inbox when on holiday after a day of arduous driving through the Namib Desert. Other acknowledgements for data and dialogue go to Dennis Wheeler, Stephan Woodborne, David Nash, Stefan Grab, Clare Kelso, Karin Holmgren, Hanna Sundqvist, Curt Stager, Raphael Neukom and the South African Weather Service.

The challenges of interdisciplinary research will become self-evident throughout the thesis, but it is my hope that this monograph will play its part in demonstrating the value of such research against a backdrop of increasing recognition of complex environmental and human issues. The productive and highly enjoyable dialogue with Heli Huhtamaa and other colleagues working at the interface of the natural sciences and humanities has in no small part aided this task.

Above all, I owe profound thanks to my parents, Maria, family and closest friends for their support and understanding, their untiring patience has always been truly appreciated. Maria has been effortlessly adept at reminding the third year PhD researcher of life beyond the thesis for which I cannot thank her enough.

Chapter 1. Introduction

The consequences of contemporary and future climate change are amongst the most complex challenges that face humankind over the next century. While uncertainties remain over the nature of climate change itself, it is the interface between climate and society where knowledge gaps are most considerable, and are particularly acute in Sub-Saharan Africa, where vulnerability is high, and adaptive capacity is low (Niang et al. 2014). It is perhaps surprising, then, that investigation into the implications of past climate variability has only recently begun to emerge, with very little of this centred on the seemingly data-deficient Southern Hemisphere prior to the twentieth century. The processes of socio-political transformation and disaggregation that marked the second millennium AD in southeast Africa (Figure 1.1) are, to some extent, an exception to this, and constitute a prime case for cross-disciplinary inquiry. The aim of this thesis is to investigate the significance of climate variability in these social, economic and political developments that played a large part in shaping southern Africa as it is known today.

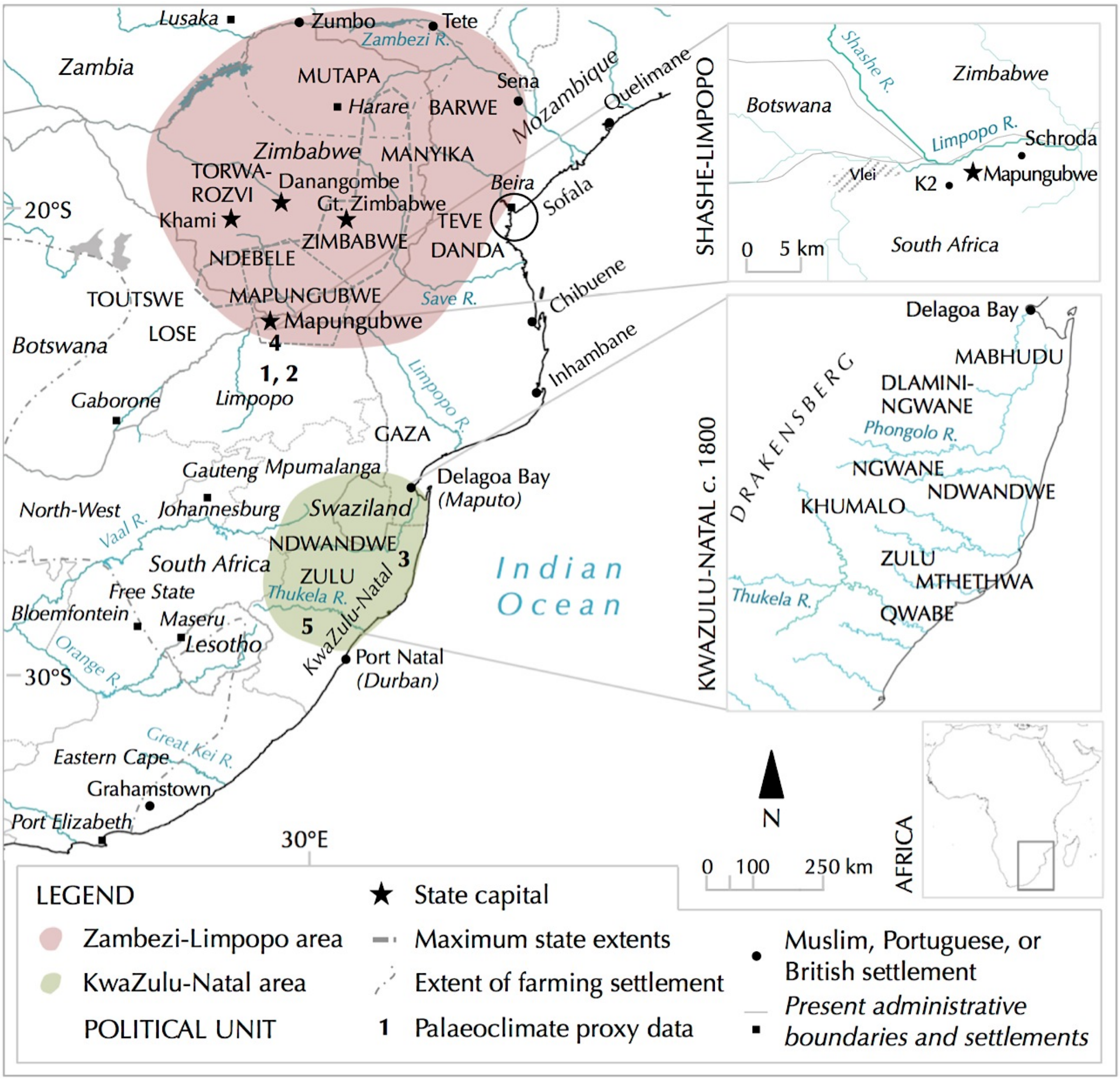

FIGURE 1.1 Map of southeast Africa with main sites and political units mentioned in the text. Approximated state extent from Huffman (2007). Numbers denote palaeoclimate time series shown in Figure 1.4: (1, 2) Makapansgat Valley Cold Air Cave speleothem isotopes (Holmgren et al. 1999; Holmgren et al. 2003), (3) Lake Sibaya diatom assemblage (Stager et al. 2013), (4) Limpopo faunal remains (Smith 2005) and (5) Karkloof Yellowwood tree-ring width (Hall 1976).

1.1 The second millennium AD in southeast Africa: an overview of societal change

Processes of socio-political transformation spanned much of the second millennium AD in southeast Africa prior to the imposition of regional colonial rule in 1890. Bantu-speaking agropastoralists came to the region in the early first millennium AD (Phillipson 1993; Huffman 2009b; Badenhorst 2010), and the evolution of dispersed farming communities and parochial chiefdoms into a number of complex states and kingdoms has provoked much scholarly interest. The initial emergence of socio-political complexity and centralised political units is rooted in the Shashe-Limpopo basin (Figure 1.1) (Huffman 2000, 2009b; Pikirayi 2013b). By the late-first millennium AD, material culture (Wood 2012) and Arabic documents (Burke 1962) indicate that trade links had been established between the stockade village of Schroda and the Indian Ocean network at the Afro-Swahili settlement of Chibuene (Figure 1.1). Succeeding the Zhizo people at Schroda (*c*. 900-1000), the leaders of the Leopard's Kopje people (*c*. 1000-1220 at K2) developed a new socio-political order and are said to have established sacred leadership (Huffman 2008, 2009b). This process, along with a great increase in economic activity, materialised in the development of southern Africa's first territorial state, Mapungubwe (*c*. 1220-1300), and the emergence of the 'Zimbabwe culture', an archaeological term incorporating several second millennium political units defined by factors such as class distinction and monumental architecture (Pikirayi 2001, 2013b; Chirikure et al. 2013). Beginning with Mapungubwe, these Zimbabwe culture polities dominated African socio-political activity in the Zambezi-Limpopo region in the centuries prior to the coming of colonial rule (Figure 1.1).

Around the time of Mapungubwe's decline, regional power shifted north to the Zimbabwe plateau. One Zimbabwe culture site, Great Zimbabwe, grew to become an urban complex home to around 18,000 people, state capital of an estimated 60-90,000 km^2 territory (Figure 1.1), and dominated regional power relations for at least 150 years (Huffman 2007; Pikirayi 2013a). The rulers of the Zimbabwe state used their newly acquired wealth, as well as innovation, to finance the building of elaborate stone structures at the capital (Figure 1.2), which represented the largest of many other centres across its wider state territory (Beach 1994; Huffman 2014). The decline of Great Zimbabwe (*c*. 1450-1520) and its surrounding state structure came at a time when European expansion was creating the origins of the modern globalised world, with the Portuguese settling at Sofala in 1505 (Figure 1.1), while the focus of the Indian Ocean trade shifted north towards the Zambezi (Pikirayi 2013a). Prior to this, however, and overlapping with Great Zimbabwe's demise, two successor states emerged: the Mutapa (or 'Monomotapa') to the north and the Torwa (or 'Butua') at Khami to the southwest.

The late-fifteenth century was characterised by civil wars, and also marks the commencement of overlap between the frontiers of archaeology and written history. The Torwa area was largely beyond the first-hand knowledge of the Portuguese, but the history of the Mutapa state is illuminated from numerous accounts of those based at Sofala or on the Zambezi who visited it from the early-sixteenth century and eventually conquered it a century later. As a result of the extensive Portuguese interaction with the state, it was also well-known in Europe at the time and appeared dominant on early maps of the African continent (Figure 1.3) (Mudenge 1988). The idea that the Mutapa state constituted a formally administered 'empire', however, is exaggerated and now widely discredited, although the maximum territorial extent of the state is the subject of disagreement in the secondary literature (Randles 1975; Beach 1980; Mudenge 1988). The Mutapa state did nonetheless exert rule and influence over a considerable area of present-day northern Zimbabwe (Figure 1.1), probably reaching the coast south of the Zambezi delta by the mid-sixteenth century (Beach 1994). Between there and the Save river, three breakaway leaders refused to acknowledge the authority of the Mutapa after being sent to control these strategically important areas, and thereafter formed the Manyika, Teve and Danda kingdoms (Figure 1.1).

The territorial extent, population, prestige, wealth and political stability of the Mutapa state underwent decline from the late-sixteenth century. Constructions of stone-built capitals ceased, civil war became incessant, and protracted leadership struggles became the norm (Pikirayi 1993). In the early-seventeenth century, a humiliating treaty was signed that made the Mutapa a vassal of the King of Portugal, and allowed increased numbers of Portuguese, who were not subject to any laws, unrestricted access to the territory and its gold mines (Newitt 1995). The Portuguese occupation was never secure, but it was only when the Rozvi, a new political force who had re-united the Torwa area, attacked Portuguese trading fairs in the Mutapa state and Manyika kingdom in 1693, that the Mutapa could re-assert its independence, while the Portuguese retreated to their Zambezi towns of Sena and Tete (Figure 1.1). By 1700 the era of Zimbabwe culture state formation had ended, and although the Rozvi were able to keep the Portuguese in line, the eighteenth century brought about the gradual decline and impoverishment of the African polities in the Zambezi-Limpopo region.

Insofar as the formation of African state structures is concerned, the Zimbabwe culture states were the exceptions to the rule by their unique presence in the ~1000 km zone inland from the Kenyan coast to the Cape until at least *c*. 1700 (Beach 1994). From the latter half of the eighteenth century onwards, however, a second focal point of socio-political transformation in southern Africa developed in present-day KwaZulu-Natal and adjacent parts of Mozambique, Swaziland, and the South African highveld (Figure 1.1), where large, centralised kingdoms emerged. At the same time, the Dutch and the British were vying for control of the Cape Colony in the southwest, while increased demand for cattle and ivory extended the trade zone further south to supply new merchant traffic. Similarly, the demand for slaves from French settlement on the Indian Ocean islands and elsewhere brought new pressures on the entire Indian Ocean coast. In the early-nineteenth century, widespread raiding and demographic upheaval affected large parts of KwaZulu-Natal, while expanding, centralised kingdoms such as the Zulu, Ndwandwe, Gaza and Ndebele consolidated their authority over others.

FIGURE 1.2 The great enclosure at Great Zimbabwe. Photograph courtesy of H. Huhtamaa.

FIGURE 1.3 Map showing the 'Monomotapa'. By Willem Janszoon Blaeu, 1635.

In the formation of these polities, renowned rulers such as Shaka Senzangakona of the Zulu used diplomacy, through enabling the voluntary submission of neighbouring chiefs, and war, through raids and confrontations, to consolidate smaller chiefdoms into the overlordship of the Zulu kingdom (Eldredge 1992, 2014; Wright

2010). The precise causes and events of this period, often termed as the '*mfecane*' or '*difaqane*', are infused with controversy for historical reasons which will become clear in the next chapter. Broadly, however, this controversy centres around the persistence of the view of nineteenth century European observers that the heightened violence and migrations at this time were a sole consequence of the excessively militaristic Zulu kingdom and its ruler, Shaka, which conveniently 'depopulated' swathes of southeast Africa for European settlement (Etherington 2001). By contrast, recent research has convincingly shown that these events occurred both prior to and during Shaka's rule, and were prompted by multiple internal and external actors (Hamilton 1995; Wright 2010; Eldredge 2014). Despite such comprehensive assessment, the lines of argument made by nineteenth and early- to mid-twentieth century writers still persist in parts of the literature, a fact which Eldredge (2014) states has had unfortunate effects on modern politics that rely upon these false assessments of African history. Nevertheless, while many agree that the magnitude of violence and devastation was exaggerated by European observers, it is undeniable that the scale of violence and migrations of this period were unprecedented in the history of southern Africa. Not only were polities in KwaZulu-Natal and on the South African highveld affected, but the raiding and population movements spread as far Zimbabwe, Zambia and Tanzania, where in the former, the Rozvi eventually succumbed to one migratory group in the 1830s.

In the half-century leading up to the onset of colonial rule in 1890, socio-political affairs became centred around the volatile relationships between African political units and the increasing presence of Europeans. The expansion of British power in KwaZulu-Natal, the treks of Dutch stock-farmers across the South African highveld, and the revival of Portuguese power in Mozambique posed profound threats to the survival of African socio-political organisation, and by 1890, much of the African continent had been colonised by European powers following the 'scramble for Africa'. Although in some cases this new structure allowed for the partial continuation of the functions of pre-colonial polities, their political and economic rights were strictly bound to conform to the objectives of the colonists (Eldredge 2014). This abruptly diminished the independence of all African polities, and ended the state formation and disaggregation that spanned much of the second millennium AD.

The main events alluded to in this introductory overview took place within two geographical sub-regions of the southern Africa (Figure 1.1). The first is the area between the Zambezi and Limpopo rivers comprising present-day Zimbabwe, as well as south-central Mozambique and parts of northern South Africa and eastern Botswana, while the second relates to present-day KwaZulu-Natal, South Africa. These areas will form the core focus of the thesis, though a slightly greater sum of attention will be lent to the Zambezi-Limpopo area due to the longer timespan, higher number of case studies, richer body of climate-society discussion and hypotheses in the literature, and the superior availability of historical sources since AD 1505. By contrast, the thesis represents the first serious attempt to re-visit climate-society connections in early-nineteenth century KwaZulu-Natal since the early-1990s (Eldredge 1992).

The rest of this introduction proceeds to outline the questions over the causes of socio-political change, with a particular focus on climatic discourses, before placing these in the context of historiographical and wider global perspectives on climate-society linkages. The final two sections define the overriding aims and research questions of the thesis, and discuss some implications of this research. The multiple arguments of justification for this research are referred to throughout these sections.

1.1.1 The causes of socio-political change

Historians and archaeologists of Africa have long debated the causal processes involved in the emergence of complex political units and the recurrent socio-political change that followed. As Beach (1994) argues, the reason for this at first appears to be simple; the mineral wealth and abundance of exportable resources such as gold and ivory were found in large quantities in the Zambezi-Limpopo area. This meant that mercantile capital flowed into this region from *c.* AD 800 onwards as opposed to the comparatively resource-poor areas of eastern and southern Africa, which in turn prompted the unequal distribution of wealth in African society, class distinction and political centralisation (Mitchell 2002). Yet this also subjected societies to external economic and geopolitical fluxes, meaning political units' hold over trade was never secure. The later development towards large political units in the KwaZulu-Natal area then similarly followed the expansion of trade into that region as a response to the increased demand for its cattle and ivory and increased wealth in imported goods (Huffman 2004). State transformation processes, however, are not so simply explained. Research elsewhere in Africa has shown that pre-colonial states developed based upon local wealth, such as in western Uganda by *c.* 1400, and in the Congo by *c.* 1000 (Beach 1994). Moreover, trade-related activities in southern Africa involved a small number of people in comparison to the main livelihood activities of subsistence crop cultivation and cattle herding, both of which have been shown to have held social, political and ritual importance in each sub-region (Murimbika 2006; Huffman 2007; Eldredge 2014).

A relatively recent general rejection of trade and external contact as the principal stimulus for the emergence and decline of centralised political structures and social change has provoked extensive debate regarding the causal mechanisms of these processes. Within various disciplines and through diverse methodological approaches, an array of explanations have been put forward. These include the aforementioned links to the Indian Ocean trade network and control over trade goods (Pwiti 1991, 2005; Huffman 2004; Sinclair et al. 2012), wealth in cattle (Garlake 1973, 1978; Denbow 1986), control over resources such as gold and ivory (Phimister 1974; Swan 2008; Huffman 2009b; Pikirayi 2013b), external economic changes affecting demand for these resources (Phimister 1976; Pwiti 1991, 2005; Eldredge 1992), the ideology of sacred leadership (Huffman 2008, 2009b), warfare and coercion (Beach 1998; Kim and Kusimba 2008;

Chirikure et al. 2013), human-induced environmental degradation (Guy 1980; Connah 2001; Pikirayi 2005), and defensive responses to colonial influence (Cobbing 1988a). In the last two decades, there has also been an upsurge in the literature on the past relationships between climate variability and human activity concerning both southern Africa and further afield (Hannaford et al. 2014). In southern Africa, precipitation variability has been causally linked to the defining moments of the rise and decline of the Mapungubwe and Zimbabwe states, and the origins of political centralisation, heightened violence and migrations in the KwaZulu-Natal area in the early-nineteenth century (Hall 1976, 1981; Guy 1980; Ballard 1986; Newitt 1988, 1995; Eldredge 1992; Huffman 1996, 2007, 2008, 2009a, 2010a; Pikirayi 2001; Tyson et al. 2002; Holmgren and Öberg 2006; Manyanga 2007; Garstang et al. 2014).

1.1.1.1 Climatic discourses and southern African state transformation

The effect of climate on human activity and wellbeing is, in the broadest sense, first mediated through its impacts on the biophysical realm. In the southern African case, the quantity and timing of precipitation are particularly implicated due to their critical role in food production and wider subsistence options (McCann 1999; Ekblom 2004). Precipitation in southeast Africa is characterised by high spatial and temporal variability. The majority of its rain falls between November and March, and it therefore constitutes the Summer Rainfall Zone (SRZ). The increasing availability and resolution of palaeoclimate proxy data in recent decades has offered unprecedented insight into climate variability beyond the relatively short instrumental record. Abrupt changes in moisture have been shown to occur in the SRZ over the long-term (multi-decadal and centennial scales), with persistent near-decadal dry and wet phases reported over the last six millennia (Ekblom et al. 2012). Similarly, high inter-annual variability of rainfall promotes frequent shorter-term wet or dry conditions which are highly significant for food security both today and in the past (Ekblom 2004). However, complexities in developing palaeoclimate records from the Southern Hemisphere low latitudes mean that this inter-annual variability is seldom reflected in proxy records, and for much of the pre-instrumental period, relatively sparse and limited resolution data are relied upon. Data limitations are discussed further in Chapter 3, yet despite these, the overall increase in knowledge has been used by many to argue that past shifts in moisture availability inferred in some natural proxy and man-made documentary climate records, were coincident with, and thus contributory to societal change (Figure 1.4).

Even prior to the development of palaeoclimate proxy data, archaeologists recognised the possibility of a longer-term role for rainfall variability in the human events of the Zambezi-Limpopo region (Summers 1960, 1969). From analyses of the instrumental record in Zimbabwe, then Rhodesia, it was commonly argued that drought conditions were experienced in the central and northern parts of the country about once in every five years (Summers 1969; Beach 1977, 1980). In his earlier work, historian David Beach was at pains to remind readers that drought played an important socio-economic role in pre-colonial Zimbabwe, yet paucity of scientific evidence limited contextualisation of scanty written observations of this phenomenon. Beach later muted his viewpoint on the significance of drought after historian John Iliffe (1990) argued that drought-induced famine alone was seldom significant in the history of Zimbabwe, and factors such as violence were more important in determining the severity of environmental stress. Malyn Newitt, however, frequently placed drought at the centre of causal explanations for major socio-political events in the Zambezi-Save area (Newitt 1988, 1995). Notwithstanding Newitt's skill in integrating climatic stress into wider socio-political and economic factors, his claims as to the magnitude and significance of drought both lack scientific corroboration and tend to go far beyond the evidence base. Similar problems have plagued investigation of causal climate-society pathways relating to political transformation in the KwaZulu-Natal area. Here, Guy (1980) and Eldredge (1992) posited that severe drought at the turn of the nineteenth century was a prime stimulant of political centralisation, while Ballard (1986) and Newitt (1995) drew on documentary and oral evidence for drought and famine to argue that this was a prime cause of the dislocations of the period.

A later branch of southeast African climate-society historiography came after a review of the climate of the last 2000 years in southern Africa conducted by Tyson and Lindesay (1992). This seminal paper advanced the hypothesis of coupled warm-wet and cool-dry conditions acting over multi-decadal and centennial timeframes. Moreover, Tyson and Lindesay made the first attempts at dating the southern African manifestations of the Medieval Climate Anomaly (MCA) and the Little Ice Age (LIA) in the northern hemisphere, then thought to be between *c*. AD 900-1300 and *c*. 1300-1850 respectively. Archaeologist Tom Huffman (1996) used this synthesis to point to an apparent coincidence of shifts between periods of warm-wet and cool-dry conditions with periods of societal change dated in the archaeological record, most notably the development of societal complexity, the rise and decline of the Mapungubwe state, the decline of Great Zimbabwe and the violence, raiding and state formation of the early-nineteenth century (Figure 1.4). Several other archaeologists, as well as climatologists, have since followed this line of thought (Pikirayi 2001; Tyson et al. 2002; Holmgren and Öberg 2006; Huffman 2007, 2008, 2009b) (Table 1.1; Figure 1.5), and climate variability now forms a prominent causal hypothesis of socio-political change in this region. These hypotheses, though, primarily stem from the *coincidence* between periods of inferred climate variability and socio-political change. As a result of this, hypotheses regarding the significance of climate variability in the pre-written record cases of Mapungubwe and Great Zimbabwe have been subject to frequent alteration in light of the development and analysis of palaeoclimate data. Moreover, it is only recently that the more complex pathways through which such climate variability may have induced societal stress have been elaborated (Murimbika 2006; Huffman 2008).

Each of these hypotheses are outlined in detail in the next chapter, yet it is already notable that these more recent historical climate-society debates are confined to the margins in discussion amongst African historians, who have tended to favour other explanations for social change outlined in Section 1.1. In part, this relates to source material, as where the climate-society hypotheses are most prominent, archaeological records dwarf the small number of Arabic documents that exist prior to the arrival of the Portuguese. Nevertheless, few historians have grappled with the abundance of documentary material in the Zambezi-Limpopo region after 1505 and in the KwaZulu-Natal area after 1824 to evaluate the socio-political significance of climate variability. On the other hand, this situation can be strongly linked to wider global perspectives in the climate-society historiography, which are examined in the next section.

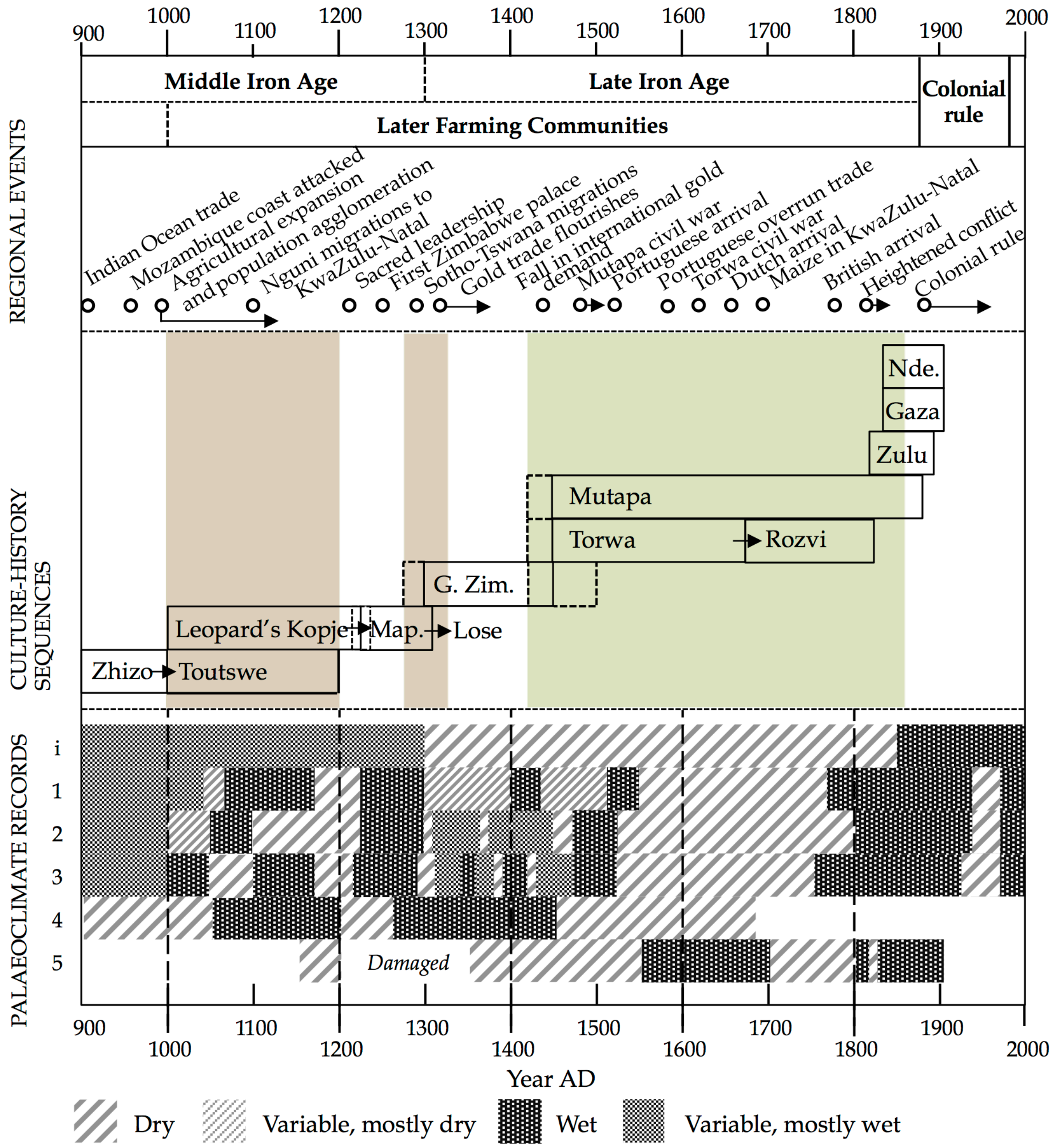

FIGURE 1.4 Timeline of selected events, culture-history sequences, and palaeoclimate variability inferred from the proxy sources mapped in Figure 1.1. Gold shading: existing climate-society hypotheses not extensively re-examined in the thesis; green shading: re-examination of existing hypotheses and original consideration of climate-society interaction. G. Zim. – Great Zimbabwe; Map. – Mapungubwe, Nde. – Ndebele.

TABLE 1.1 'A general correlation between culture and climate on the Zimbabwe plateau and adjacent regions' (after Pikirayi 2001). Note that the human and palaeoclimatic chronology has since changed.

Year AD	Climate	Major political, social and economic events
1810-1900	Cool and dry	Nguni wars, raids, migrations and settlement; abandonment of Nyanga terrace complex
1790-1810	Warm and wet	Pit enclosures and terraces in Nyanga Highlands
1675-1790	Cool and dry	Rise of the Rozvi in the south-west; Khami collapses and political power shifts to Danangombe; expulsion of the Portuguese from the Mutapa state and Manyika; depopulation in the north; Karanga migration southwards
1425-1675	Warm and wet	Abandonment of Great Zimbabwe; pit structures in Nyanga Highlands; the Torwa state emerges at Khami; the Mutapa state emerges in Mukaranga; Portuguese appear in northern Zimbabwe; civil wars and disruption in the north
1290-1425	Cool and dry	Abandonment of Mapungubwe and Toutswe; development and fall of Great Zimbabwe and the Zimbabwe state.
900-1290	Warm and wet	Intensive pastoral production and gold mining in the south-west; intensification of trade with the Indian Ocean coast; rise of Mapungubwe state in the Middle Limpopo Valley
700-900	Cool and dry	Trade with the Indian Ocean coast initiated; displacement of Zhizo population by the Leopard's Kopje farmers; emergence of chiefdoms in the south and south-west

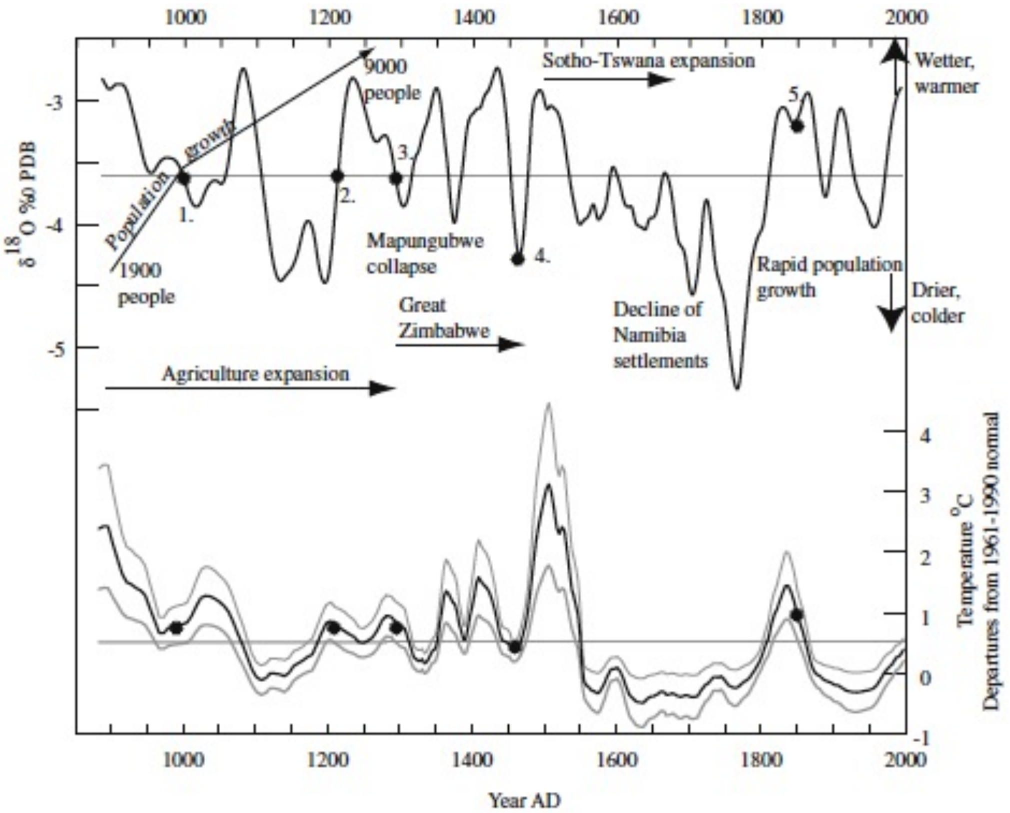

FIGURE 1.5 'Climate time series derived from analysis of stalagmites from Cold Air Cave, Makapansgat Valley, South Africa, together with historical information' (Holmgren and Öberg 2006). The top series shows $\delta^{18}O$ variations reflective of changes in temperature and moisture and the bottom series shows temperature changes in °C anomalies from 1961-1990 normal derived from changes in colour. The numbers represent: 1: shift from Schroda to K2; 2: shift from K2 to Mapungubwe; 3: decline of Mapungubwe; 4: decline of Great Zimbabwe and 5: *Difaqane/mfecane*.

1.2 Climate and history: historiographical perspectives and new paradigms

The Holocene, that is, the current geological epoch, holds numerous case studies where scholars have posited climate variability as the chief causal factor in the 'collapse' or transformation of societies (Figure 1.6). In addition to the southern African examples, case studies such as the decline of Norse settlements in Greenland and the collapse of Easter Island societies have their own considerable scholarship, and are perhaps best known for their popularisation by Jared Diamond in his volume '*Collapse*' (Diamond 2005). Nonetheless, climatic explanations for such change have been controversially received within the interpretative disciplines of history and anthropology, as well as within branches of the more positivist disciplines of climatology, archaeology and geography, with some questioning a revival of climatic determinism (Chambers and Brain 2002; O'Sullivan 2008; Liverman 2009; Livingstone 2012). In light of such claims, and in order to contextualise the southern African debate, it is necessary to give a brief historiographical background to the interface between climate, history and society.

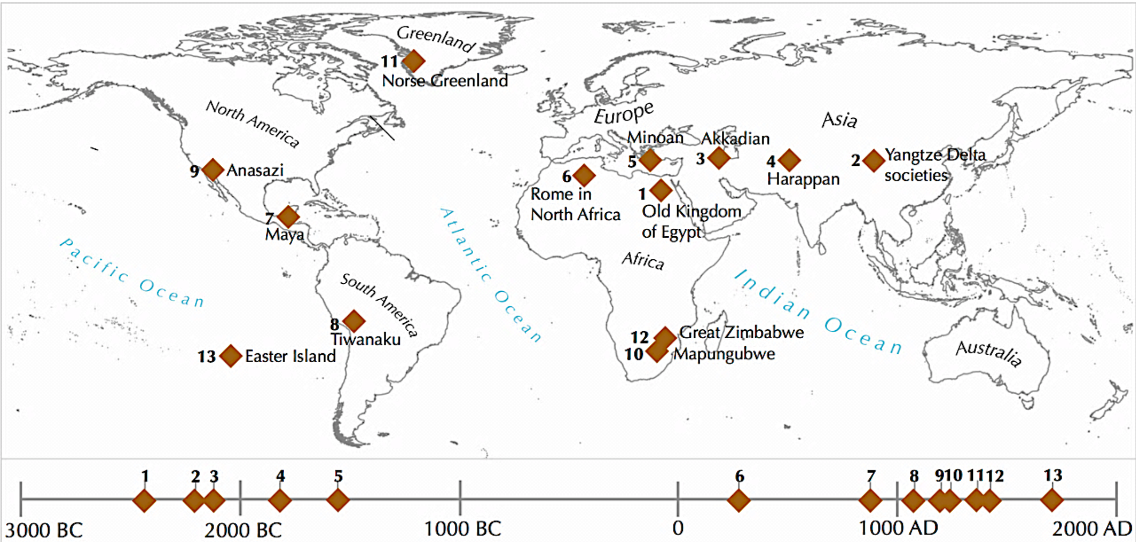

FIGURE 1.6 Prominent mid- to late-Holocene 'collapse' case studies (after Diamond 2005).

In the early-twentieth century, American and European geographers routinely emphasised the agency of climate over the agency of humans, putting forward the idea that climate was the master narrative in shaping human history (Hulme 2011a). Concerns regarding overpopulation and questions over whether European settlers could prosper in the tropics led scholars like Ellsworth Huntington in his 1915 '*Civilisation and Climate*' to propose that racial character, intellectual vigour and the ranking of civilisations were all inherently related to climate (Hulme 2011a; Livingstone 2012). In particular, analyses of regional climate-society relationships were suffused with racial sentiments in that the frequent variability of the mid-latitude weather systems was suggested to have led to an energetic character and a vigorous work ethic, while the tropical climates were associated with promoting languidness and indolence (Livingstone 2012). The British politician and writer Sydney Markham developed similar arguments in his 1942 volume '*Climate and the Energy of Nations*', where he linked climate variability to the rise and fall of past civilisations and as an explanatory variable in contemporary geopolitical issues. In the decades of post-Second World War technological sophistication that followed, climate determinism became increasingly antiquated, with the idea that humanity could control its environment becoming more prominent. As a consequence, nature-society explanations, also tainted by the heavily racial aspects of earlier scholarship, were pushed to the margins of mainstream academic geography, and led many geographers to re-align with either the natural or social sciences (Sluyter 2003; Hulme 2011a).

Over the last two decades, the increasing availability and resolution of palaeoclimate proxy data, coupled with concerns over contemporary global climate change, has contributed to a resurgence in hypotheses proclaiming the significance of climate in human history (Middleton 2012; Hannaford 2014). The rapid accumulation of palaeoenvironmental data has led archaeologists and palaeoclimatologists in particular to search for correlation, and in turn causation, between climate variability and social change. Though clearly distinct from the discredited determinism of the early-twentieth century, many argue that climate has regained its former position in explaining the performance of past societies (Coombes and Barber 2005; Livingstone 2012). While questions over a revival of determinism in southern Africa will be addressed in the next chapter, it is essential to here provide insight into the conceptual bases of the relationship between climate and society in the modern literature, and accordingly outline the premise upon which this investigation is built.

A number of scholars have pointed out the prevalent inadequacies in past climate-society studies and their theoretical underpinnings. Hannaford (2014) related the spectrum of modern approaches on historical climate-society interaction to the conceptual hierarchy presented by geographer Robert Kates (Figure 1.7), and claimed that a lack of coherent methodological and established interdisciplinary approaches for such investigation were responsible for renewed suggestions of determinism. Such conceptual and methodological problems of tying environmental change to human development have indeed been a persistent problem since Emmanuel Le Roy Ladurie's pioneering 1971 '*Times of Feast, Times of Famine*'. A frequent result of this is an approach that resembles the simple input-output model shown in Figure 1.7 (a), where climate is viewed as a monocausal determinant in societal transformation of the 'collapse'-type scenario. Coombes and Barber (2005) term this approach 'black box' determinism, and add that it is palaeoenvironmental and archaeological researchers who are most often guilty favouring correlation over examination of the complex interactive processes between climate and society. Although changes in climate can certainly have significant biophysical consequences, only tentative suggestions may be made on this basis. For example, it is not wrong to assume that shifts to a drier climate may have impacted upon crop cultivation and food supply, but little can be said about whether societal transformation was environmentally triggered from a merely correlative approach. The fundamental problem, then, is that scenarios of collapse in distant societies are not necessarily wrong, but often lack real understanding. This is because the impacts of climate variability affect complex 'socio-ecological systems' shaped by the interaction of multiple stressors, as shown in model (c) in Figure 1.7, which leads to a strongly non-linear human response (Walker et al. 2004; Folke 2006; Endfield 2012).

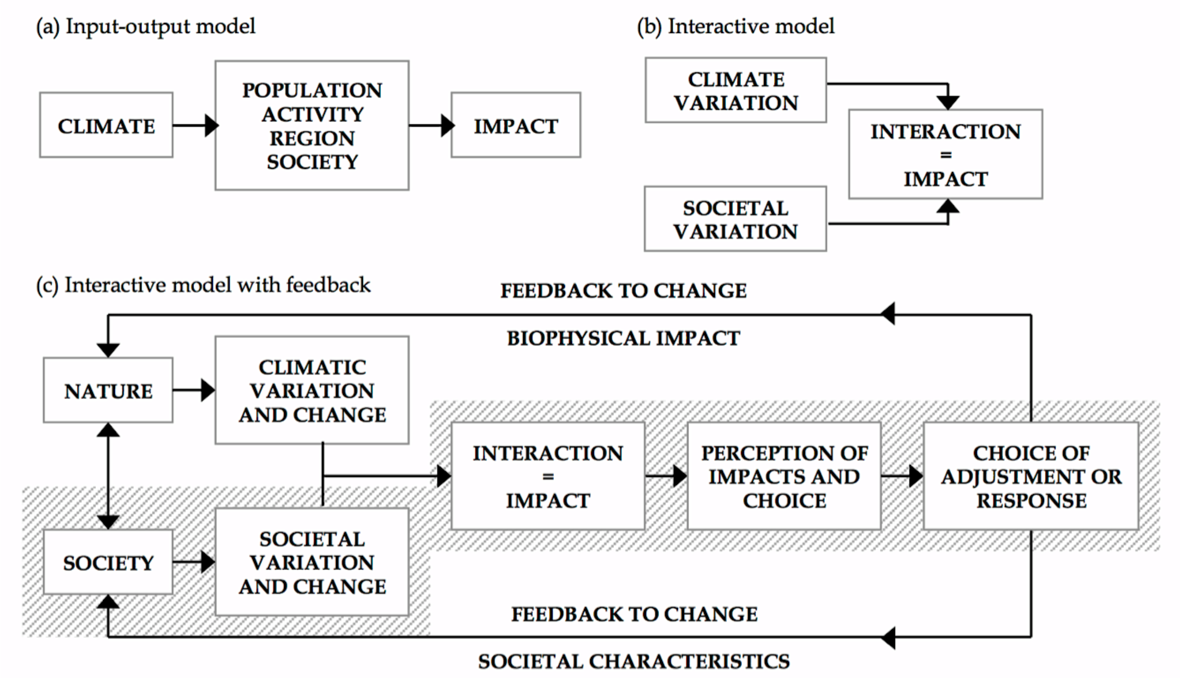

FIGURE 1.7 Hierarchy of models of climate-society relationships (modified after Kates 1985). Shading indicates key research areas relating to societal impacts.

If there exists a need for scholars to shift focus away from the more pessimistic, environmental disaster meta-narratives towards assessments that clearly decipher climate-society linkages (Endfield 2012), written history, where available, is one way through which this can be achieved (Adamson 2014). Written history offers the potential to illuminate the ways societies coped, or failed to cope with climate variability. Moreover, it provides source material to more explicitly attribute the significance of climate variability in social change amongst the complex, diverse and intertwined forces that shaped past societies that are frequently overlooked in monocausal explanations (Butzer 2012; Carey 2012; Livingstone 2012). While palaeoclimatologists and archaeologists have been accused of neglecting these aspects, it is often the case that historians and anthropologists have also failed to engage with the scientific evidence when considering climate-related factors, or have disregarded climatic aspects altogether. In many cases they are justified in doing so, as climatic shifts may be less relevant in many historical questions, yet McNeill (2014) adds that a predominant reason for this is that many historians are uneasy in assigning agency to any other forces than people, and thus arguments that attribute historical agency to non-human agents are often dismissed as environmental determinism.

As will be shown in the next chapter, recent discussion on the role of climate variability in southern African history has increased in its sophistication. Still, causal climate-related explanations still rely to a large extent upon the coincidence of incompletely understood and often ambiguous palaeoclimate datasets with societal events. In this region, the limited availability of palaeoclimatic data, and as will later be shown, numerous problems in its interpretation, have in part contributed to the lack of detailed engagement with climate-society questions among historians. Yet as southern Africa is characterised by high climate variability, environmental vulnerability, as well as a comparatively long written record, it constitutes an interesting case for the application of cross-disciplinary approaches regarding the complexity of these interactions that have moved to the fore in other regions (Endfield 2007, 2012; Bulliet 2009; Brook 2010; Pfister 2010; Dugmore et al. 2012; Ellenblum 2012; White 2012; Parker 2013; Adamson 2014; Hannaford et al. 2014). In pursuit of these aims, consideration of relatively recent paradigms such as vulnerability and resilience have been placed at the centre of the most fruitful approaches within the sub-disciplines of historical climatology and climate history (Pfister and Brazdil 2006; Butzer and Endfield 2012; Carey 2012; Nash and Adamson 2014). These are later discussed in Section 2.4.

1.3 Aims, research questions and scope

The overall aims of this thesis are fourfold, (i): to conceptualise and methodologically advance how climate variability can be tied to historical process; (ii): to investigate and reconstruct the nature of past climate variability and its uncertainties over the last thousand years in southern Africa; (iii): to explore long-term and changing African human vulnerability and response to climate variability and (iv): to move towards a more detailed understanding of the consequences of past climate variability on southern African socio-political change. These aims can be broken down into a series of overriding research questions, particularly:

1. How can evidence of pre-instrumental climate variability be theoretically and methodologically tied to southern African historical processes?
2. How did the southern African climate, particularly SRZ precipitation, vary over the last millennium and how reliable or uncertain is this?
3. How did southern African precipitation vary in the early-nineteenth century, and how can this be reconstructed?
4. What was the degree of human vulnerability to climate variability and how did this condition societal response to climatic stress throughout the early-sixteenth to early-nineteenth centuries in the Zambezi-Limpopo region?
5. Can the impacts of and responses to climate variability and stress be detected in late-eighteenth and early-nineteenth century KwaZulu-Natal, and how significant was this in the events of the period?
6. What was the overall significance of climate variability in socio-political change in both the Zambezi-Limpopo and KwaZulu-Natal areas over these timeframes?

It is important to note here that although each of the aims and research questions are topics worthy of investigation in their own right, the intrinsic value of the thesis does not lie in any individual aim, but rather in bringing these together to understand the complexity of interaction between climate and society. This means that the disciplinary, theoretical and methodological scope of this thesis is necessarily wide, and overlaps into historical climatology, climate science, climate history, historical geography, African history and climate impacts analysis. The reach of the study also branches out to other disciplines such as archaeology, imperial history, development studies, anthropology and oral history.

The organisation of this thesis is both thematic and chronological. Chapter 2 reviews the physical and human background of the study regions, and critically overviews the state of knowledge on past climate variability, socio-political transformation, and their interaction. This review chapter concludes by establishing a conceptual framework for historical climate-society analyses in a southern African context, while placing this further into the wider global context of historical climate-society critique and investigation. Chapter 3 comprises an analytical review of multi-decadal SRZ precipitation variability over the last 1200 years using proxy and documentary sources, and further evaluates evidence for the precipitation manifestations of the MCA and LIA. Chapter 4 uses a novel methodology to reconstruct early-nineteenth century southern African precipitation from wind data in ships' logbooks and modern climate reanalysis data. Chapter 5 examines human vulnerability and response to climate variability in the Zambezi-Limpopo area between *c*. 1450-1830, and discusses how this interacted with other hypothesised causal factors and contemporary events. Chapter 6 investigates written evidence for the significance of climate variability in the origins of state formation in KwaZulu-Natal and the consolidation of and instability in the Zulu kingdom in the 1820s. Chapters 7 and 8 discuss and conclude the investigation by bringing the analysis together and evaluating the role of climate variability in southeast African history.

To add a final word on scope, it has already been noted that the Zambezi-Limpopo and KwaZulu-Natal areas constitute the focus of this thesis, yet owing to space constraints, the analysis will focus predominantly on certain political units and people groups. In the region between the Zambezi and the Limpopo rivers, the thesis gives most attention to the larger political units such as the Zimbabwe and Mutapa states and the Manyika and Teve polities, as well as some more decentralised groups on the Zambezi and Mozambique coast who came to reside under the jurisdiction of the Portuguese. Clearly, a millennial timeframe stretching back to the Leopard's Kopje chiefdom is too extensive for the kind of detailed study proposed here. Therefore, while discussion of past climate variability will cover the last 1200 years in order to clarify ambiguities in the palaeoclimate record, detailed analyses of societal vulnerability and response will be mostly limited to the period after AD 1505 when more extensive written source material becomes available.

Analysis on the KwaZulu-Natal area will consider the role of climate, aided by the reconstructions presented in Chapter 4, in the origins of political centralisation in the late-eighteenth century and the processes of consolidation in the Zulu kingdom under Shaka in the early-nineteenth century. Previous scholarship on this subject has often been criticised for being 'Zulu-centric'. This thesis will, to an extent, follow this, but for different reasons to those pursued throughout most of the last two centuries. Primarily, this is because there exists a greater wealth of documentary material for a study of climate-society interaction for the Zulu kingdom in the 1820s, and when combined with oral evidence, this far outweighs that which exists for other political units such as the Ndwandwe and Ndebele. While the spatial, temporal, ethnographic and demographic scope of the thesis is necessarily restricted, it would be misleading to think that nothing of significance happened outside these frontiers and time-span, and it is therefore important to be cognisant of the other inhabitants and states that populated southern Africa.

1.4 Implications

The overriding and most significant outcome of this thesis is that it will represent one of the first concentrated attempts at cross-disciplinary investigation into the interaction between climate and southern African society prior to the twentieth century. Involved in this is the use of diverse datasets, methods, and theoretical concepts, which require a number of essential first steps that will be of wider interest, particularly for African-focussed research. Indeed, the establishment of the conceptual, theoretical and methodological foundation for this study and its case examples will advance the further investigation of past climate-society interactions in African contexts, or more generally those prior to the availability of instrumental climate records (as in Hannaford 2014; Hannaford et al. 2014). By focussing on southern Africa, this research also answers long-standing calls for interdisciplinary research on the pre-colonial period, which, with the exception of the historiography of the Cape Colony, is still lacking (Beach 1998; Chirikure et al. 2013; Eldredge 2014). The significance of the pre-colonial period is apparent in that the ramifications of its many developments remain important today. Whether in the form of the name of kingdoms, rural livelihood practices, drought coping strategies, cultural and ritual practices, or in residual forms of community identification in the twenty-first century nation state, understanding of the pre-colonial period is of importance for African communities today.

In addition to improved understanding of climate-society interactions, the analysis of the nature and uncertainties of past climate variability itself will provide state-of-the-art insight over a 1200-year period. This is not only important for consideration of societal events, but for the understanding of the long-term functioning of the earth system, which in turn improves knowledge on the limited understanding of inter-annual and multi-decadal climate variability in data-deficient regions with a short instrumental record such as southern Africa. Similarly, although recent research has begun to provide new inter-annual records for southeast Africa, this thesis will use a novel source of historical climate data to provide independent climate records for the first half of the nineteenth century. By utilising wind data from ships' logbooks, the reconstructions will also develop a novel methodology and demonstrate their potential in climate reconstruction.

The theoretical insight of this research is not only limited to understanding specific events or climatic changes, but relates to how deep-rooted and fundamental processes of nature-culture interactions operate. This debate is therefore of relevance for contemporary climate change discourses, which invariably situate Sub-Saharan Africa as the most vulnerable region to climate change (Boko et al. 2007; Niang et al. 2014). Climate model outputs, for instance, project that warming in this region 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; Niang et al. 2014). Although sophisticated model-based climate impact studies are far more complex than the simplistic approach outlined in model (a) in Figure 1.7, critics argue that understanding of the causal consequences of climate change for society remains limited (Hulme 2011a). 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 2011a). Similarly to climate determinism, 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 the need for such new lines of research at the climate-society interface in Africa (Hannaford 2014). Indeed, few have taken up the task highlighted by the IPCC (Intergovernmental Panel on Climate Change) in its Fourth Assessment Report (AR4) to address the fact 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, 450). One could therefore argue that the understanding of past climate-society relationships has shifted from the comparatively narrow attention within the disciplines of archaeology, anthropology and environmental history and taken on a new significance regarding contemporary climate change. Studies such as this one can consequently contribute to present discussions of how nature and culture shape each other, rather than the predominant examination of how nature has or will shape society, and is thus certainly a matter of significance for the framing of climate change and its impact upon policy and public debates (Hulme 2011b).

Chapter 2. The second millennium in the pre-colonial period

Marked socio-political, cultural, economic, and as will later be shown, climatic change, occurred in the second millennium AD in southern Africa prior to colonial rule. At the turn of the second millennium, the largest communities in the region were at most decentralised, small-scale chiefdoms, yet by the time the Portuguese settled at Sofala in 1505, two complex state structures with large capitals had developed and declined (Figure 1.4). Although the focus period in Chapter 5 does not extend back beyond *c.* 1450, it is crucial to consider the second millennium as a whole in the Zambezi-Limpopo area, as many of the factors connected with the origins of state formation, complex society and urbanism developed long before the fifteenth century. Any analysis of the past, though, must first provide insights into certain key frameworks if it is to be understood. This chapter therefore initially outlines the physical geography, climate system and pre-second millennium settlement of the wider study domain of southern Africa. Subsequently, the chapter will overview each focus region and period individually, both in terms of local environmental peculiarities, the economy and society of their inhabitants, and discourses on socio-political transformation.

2.1 Geography, climate and settlement

Regional environmental differences and changes had a variety of influences on human history, particularly in pre-industrial times. On the broadest scale, factors such as the spatial variability of rainfall, disease vectors, and the differential abundance of minerals presented populations with opportunities and constraints. Moreover, changes in these factors by natural variability or the exhaustion of finite resources provided further challenges. On the other hand, human innovation and agency conditioned, sometimes by buffering, while at others exacerbating, the significance of environmental change. Before attempting to analyse the nature of environmental change and the impact of such changes, the physical environment of the study domain and the natural mechanisms controlling its changes must be understood.

An absolute geographical delimitation of the study domain for the thesis is imperfect and artificial, for society was ultimately not bounded by major geographical features such as mountain ranges or rivers. Nonetheless, two main terms will be used to address the research area. 'Southern Africa' refers to the landmass of Africa south of the Zambezi (Figure 2.1), including the more arid western part of the region where farming communities were less prominent. The descriptor used more widely throughout is 'southeast Africa'. This term is alludes to the more specific domain of societal events under consideration, and broadly refers to land east of the Kalahari, northeast of the Great Kei river, and south of southern shores of Lake Malawi (Figures 1.1 and 2.1). This domain corresponds to the present-day nation states of Zimbabwe, the south-eastern part of South Africa, the southern half of Mozambique, and to a much lesser extent, eastern Botswana, southern Zambia, Swaziland and Lesotho.

FIGURE 2.1 Physical map of Africa. 1: Zambezi-Limpopo region; 2: KwaZulu-Natal area. Data sources: Natural Earth (2014); USGS SRTM (2014).

Two major physiographic features or units of southern Africa are the interior plateau and coastal lowlands, which are separated by a third major feature, the 'Great Escarpment'. In its maximum extent, the escarpment stretches from the Namibian highlands, down to the Cape Fold Mountain Belt, east to the Drakensberg, and into northern South Africa. The escarpment then re-emerges in the Eastern Highlands of Zimbabwe, which lie to the north of the lowland expanses of the Limpopo valley and Mozambique coast. Apart from these extensive lowland areas, the rest of the coast has only thin strips of lowland running inland to a maximum of ~150 km (Figure 2.1). On the contrary, the majority of the region consists of a plateau of variable height, which is at its maximum in the Drakensberg (~3500 m) and of a lesser height in the Kalahari area. Minerals are most abundant in the interior plateau regions. Iron-bearing rocks are common in much of the region, while gold and copper deposits were spread across much of Zimbabwe, parts of the Limpopo valley, and northern South Africa.

Freshwater availability is an important factor in societal development, and this differs profoundly across the region. The major catchment in southern Africa is the Zambezi, which rises in the Zambia-Angola border region and flows eastwards along the northern border of Zimbabwe into central Mozambique and then the Indian Ocean. Two other major river catchments flowing into the Indian Ocean are the Save and the Limpopo. The former mostly flows through Zimbabwe, while the latter in its ephemeral flow drains northern South Africa, Botswana and Zimbabwe. Further south, other major rivers are the Orange, Vaal and Caledon, while numerous smaller catchments flow between the Great Escarpment and the coast, including the Thukela, Phongolo, Great Kei, Great Fish and Olifants. Freshwater lakes are relatively rare in southern Africa, and are mostly restricted to the southeast coast. A number of salt pans are also found in the interior, the largest being the Makgadikgadi in Botswana.

A number of biogeographic classifications exist for southern Africa, the most widely used of which derives from Rutherford and Westfall (1988). The main units of this classification under consideration in this thesis include moist woodland (miombo), dry woodland savanna, mixed woodland savanna and grassland. Miombo spans much of the Zimbabwe plateau area, where *Brachystegia* and *Julbernardia* are among the dominant species of vegetation and often form a closed canopy (Mitchell 2002). Mean annual precipitation in this biogeographic area is generally above 500 mm, while perennial water bodies are frequent. Diverse fauna are present in miombo areas, with elephant, wildebeest, giraffe and buffalo common. Further south are the savanna areas, which constitute the most extensive unit in the region. These areas receive less abundant rainfall, and surface water is more scarce. Dry woodland savanna areas include the Zambezi and middle Limpopo valleys, which are dominated by *mopane* trees and shrubs (Pikirayi 2001). Moisture stress is common in these areas, meaning drought-resistant flora such as baobabs are common. Mixed woodland savanna (bushveld) covers most of the Mozambique lowlands, the upper Limpopo valley, low altitude areas of KwaZulu-Natal and the northern part of South Africa. Trees such as Acacia are common here, as are subtropical thornbush, scrub forest, and fruiting trees such as marula. The savanna zone supports a high diversity of mammals, with elephant, rhinoceroses, hippopotamuses, buffalo, lions, leopards, giraffes, zebras and numerous antelope species common. Grassland is found on South Africa's central plateau which forms the area of the present-day Free State, and extends into parts of Lesotho, KwaZulu-Natal and the Eastern Cape. Vegetation is dominated by grasses of both 'sweet' and 'sour' species, which offer varying palatability to cattle and prevail in the drier and wetter parts of the area respectively (Guy 1994). Trees are comparatively rare, with wild plant foods including bulbs and tubers. Fauna common to this area in pre-colonial times were the black wildebeest, springbok, and the now-extinct quagga.

2.1.1 The climate of southern Africa

Climate and its variability exert considerable influence on each of the biophysical components discussed above. As southern Africa lies within 35° of the equator, its temperatures are generally above the global mean, and provide few constraints to plant growth barring the highest altitude areas (Grove 1990). Nevertheless, the region experiences a cooler climate than others at similar latitudes. This is primarily due to its elevation and tapering geography, the latter factor making it more accessible to cooler, maritime air. The cooler parts of the region generally comprise the interior areas adjacent to the escarpment, whereas the hottest regions are low-lying areas such as the Zambezi and Limpopo valleys. Evaporation is generally high, and precipitation is the most crucial factor for surface water availability and the replenishment of aquifers. This means that it is also the most important climatic variable for societal development.

As southern Africa is situated at the interface of the temperate, subtropical and tropical climate zones, as well as the Indian, Atlantic and Southern Oceans, its precipitation is influenced by several atmospheric and oceanic systems. These are shifts in the Inter-Tropical Convergence Zone (ITCZ), the mid-latitude westerlies, sea-surface temperatures (SSTs) and the development and position of continental and oceanic anticyclones. Moreover, these modulating influences are affected by regional and hemispheric climate modes such as the El Niño Southern Oscillation (ENSO), Indian Ocean Dipole (IOD), Southern Annular Mode (SAM), and their interplay. Such factors mean that regional precipitation amounts and regimes are characterised by high spatial and temporal variability, an indication of which is given in Figure 2.2. Although parts of the region are well-watered, moisture stress and drought are the most frequent and serious environmental hazards in the region (Nicholson 1996, 2000; Ekblom et al. 2012), and are discussed further in Section 2.1.1.1.

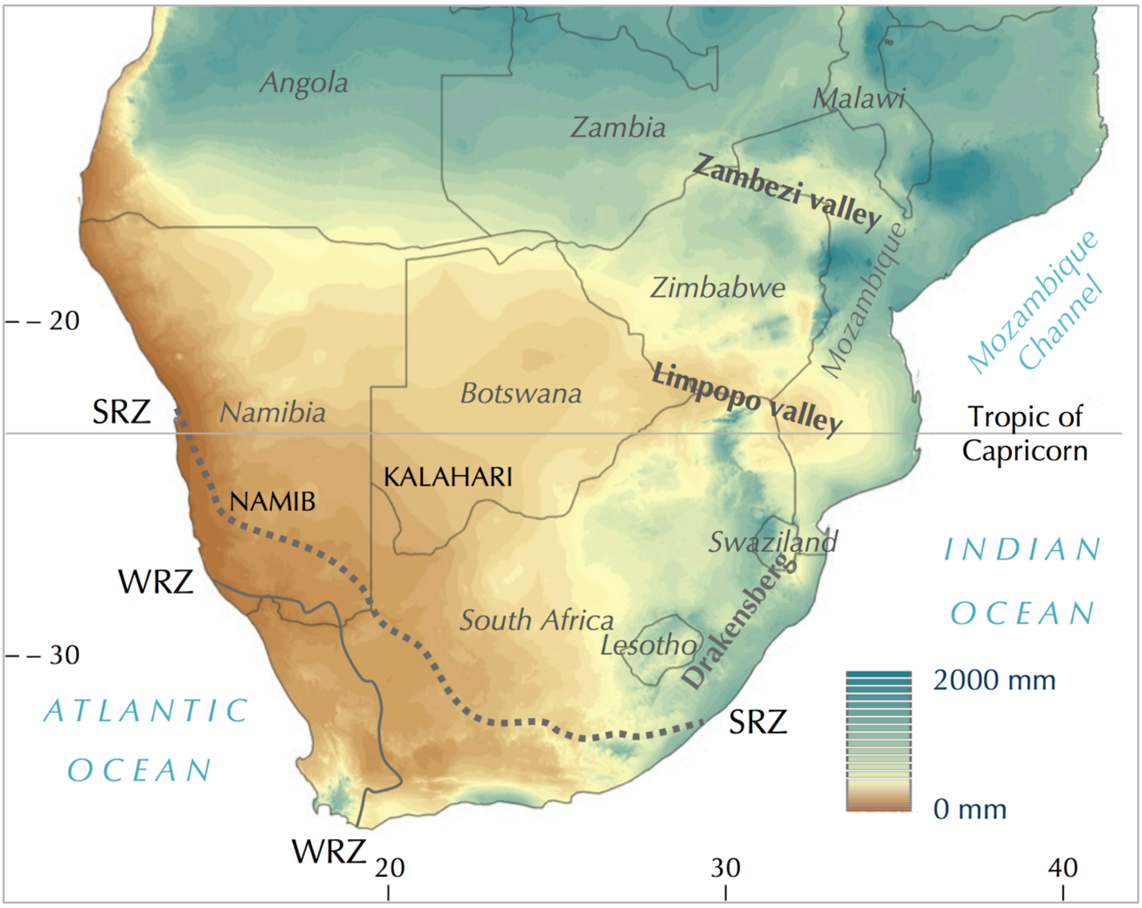

FIGURE 2.2 Spatial variability of southern African precipitation 1950-2000. Data source: WorldClim (2014).

Rainfall distribution in this region has a marked seasonality, with two main zones making up the annual rainfall cycle (Figure 2.2). In the east and the interior the SRZ is defined as where ≥66% of mean annual precipitation falls between October and March. This zone receives precipitation predominantly associated with the southern edge of the ITCZ and easterly airflow from the Indian Ocean (Nash and Grab 2010), and constitutes the primary focus region of the thesis. In the southwest, the comparatively small Winter Rainfall Zone (WRZ), where ≥66% of its precipitation falls between April and September, receives its rainfall from temperate frontal systems as the westerlies migrate equatorward each winter (Reason and Jagadeesha 2005). Between these two zones is also a narrow area that receives year-round rainfall, with maxima around spring and autumn (Chase and Meadows 2007).

Pronounced spatial variability in rainfall totals is present across the SRZ. Near the tropics, the climate is dominated by descending air associated with the poleward side of the Hadley Cells for most of the year, meaning semi-arid to arid conditions prevail with the exception of the eastern part of southern Africa. Accounting for this east to west gradient in rainfall levels (Figure 2.2) are variations in moisture source and topography, and this is further enhanced by the arid conditions arising from the cold, upwelling waters of the Benguela current off southwest Africa, and the warm Agulhas current off the southeast coast. Over the eastern portion of South Africa, including KwaZulu-Natal, the dominance of anticyclonic conditions means that moisture is derived from air masses moving eastward from the southwest Indian Ocean. Rainfall distribution, however, is strongly influenced by topographic variations (Figures 2.1 and 2.2). As this moist maritime air moves westward, much of its precipitation falls on the Drakensberg and Soutspansberg ranges, a process which is enhanced by orographic effects. These humid, high altitude areas experience an increase in precipitation with altitude of around 100 mm per 100 m, while rainy days can total 120-140 per year (Tyson and Preston-Whyte 2000). In KwaZulu-Natal, mean annual rainfall ranges from ~750 mm in the northern interior to 1250 mm along the coast and in the mountains, where local variation is caused by differences in altitude and proximity to the coast and its warming oceanic currents. Further inland, much moisture is lost due to orographic effects, resulting in a decline in moisture on the other side of the escarpment. Similarly, low-lying areas such as the Zambezi and Limpopo river valleys are dry, where ~300-500 mm is received annually, while exceptionally arid conditions are found on the coast of Namibia and the adjacent coasts of South Africa and Angola (Figure 2.2), where less than 50 mm is received annually over a period of around 10 days. Seasonal rainfall quantities are crucial to the requirements of cereal agriculture. In general, widely used staple crops of sorghum and millet require >350 mm of rain during the summer season, and >500 mm over the course of the year, with nocturnal temperatures of >15 °C (Huffman 1996, 2007). Agropastoral settlement was therefore generally limited to the miombo, savanna and grassland areas in the eastern half of southern Africa, but as will be discussed later, past precipitation changes did enable present-day drylands to be extensively settled and cultivated in the past.

In areas north of around 22° S, such as the Zimbabwe plateau, disturbances of the ITCZ, a zone of persistent low tropospheric airflow convergence, is the main agent modulating rainfall (Nicholson 2000). Over Africa, the ITCZ and associated rain belts migrate with the sun from the northern to southern hemisphere between July and January. Generally, maximum convergence, cumulus convection, cloudiness and precipitation occur equatorward of the major flow discontinuity (Tyson and Preston-Whyte 2000). Rainfall is therefore considerably more uniform in quantity in ITCZ-sensitive areas, with only localised drier areas in the Zambezi valley and the Angolan coast. Thunderstorms and intense instability showers are also common here.

SSTs in the surrounding oceans also exercise influence over SRZ rainfall variability (Reason and Jagadeesha 2005; Neukom et al. 2014). This relationship is particularly strong in the southwest Indian Ocean, where warmer SSTs are associated with increased easterlies and thus moisture convergence over southeast Africa, while cooler SSTs diminish easterliness and reduce moisture convergence. Warmer SSTs promote the formation of tropical-temperate troughs across South Africa, which are the main SRZ rainfall-producing synoptic system, and lead to increased precipitation in areas like KwaZulu-Natal, as well as further north in Zimbabwe and Mozambique (Reason and Jagadeesha 2005). Neukom et al. (2014) demonstrate the strong link of SRZ rainfall with SSTs over a wider area, and found that 40% of SST grid cells south of 20° N showed significant ($p < 0.05$) correlations with SRZ rainfall. In the WRZ, however, only 2% are significantly correlated to precipitation amounts, which are confined to smaller areas in the southern Atlantic and Indian Oceans around 40° S.

Particularly strong correlations are observed between SRZ rainfall and SSTs in the tropical Pacific by way of the El Niño Southern Oscillation (Nicholson 2000). During its cool phase, or in La Niña conditions, southeast Africa, Australia and South America typically experience synchronous wetter conditions, whereas in its warm phase, or El Niño events, these areas tend to be drier. Specifically, La Niña conditions and associated changes in atmospheric circulation in the tropical Pacific modulate the rainfall of southeast Africa by creating negative pressure anomalies over land, strengthening easterly winds, and affecting the location of the major cloud band convergence zones, which locate preferentially over southeast Africa (Tyson and Preston-Whyte 2000). By contrast, in El Niño conditions, positive pressure anomalies tend to form over southeast Africa, along with weakened Indian Ocean easterly waves and lows, while cloud bands tend to locate over Madagascar and the Indian Ocean, creating drier conditions in parts of southeast Africa. However, ENSO events do not always create anomalously wetter or drier conditions in the SRZ, as upper-level atmospheric circulation features such as the Quasi-Biennial Oscillation (QBO) also modulate its influence. Other Southern Hemisphere climate modes, such as the SAM, have a very limited influence on SRZ precipitation, but exert stronger influences on WRZ rainfall (Neukom et al. 2014).

2.1.1.1 Inter-annual to centennial variability

Though high spatial variability is apparent in the factors discussed above, southern Africa is also characterised by high temporal precipitation variability on intraseasonal, inter-annual and longer timescales. Although the mean circulation of the atmosphere generally controls the regional climate, wetter or drier monthly and seasonal conditions are predominantly associated with changes in the frequency, intensity and persistence of rainfall-producing weather systems, which are also influenced by large-scale climate modes such as the ENSO (Ratna et al. 2013). In the SRZ, synoptic-scale tropical-temperate trough systems and their associated cloud bands are a dominant contributor to seasonal rainfall. A major moisture source for tropical-temperate trough development is via easterly winds from the adjacent Indian Ocean, with strengthened easterly winds resulting in stronger moisture fluxes towards southeast Africa (Ratna et al. 2013). Inter-annual variability in the WRZ, by contrast, is influenced by the strength of the winter storm systems and disturbances forming over the South Atlantic and Southern Ocean in the mid-latitude westerlies (Chase and Meadows 2007).

In order to understand longer-term rainfall variability, extended precipitation timeseries are needed. A small number of continuous meteorological records in southern Africa were kept in the latter years of the first half of the nineteenth century, and became sufficiently dense to enable wider-scale analysis of climate variability in the latter part of the century (Hulme 1996, 2001). Prior to the meteorological record, however, man-made documentary archives and natural palaeoclimate proxies, such as tree-rings, cave speleothems and lake sediments must be drawn upon. From these records it is known that wet and dry years in the southern African SRZ tend to cluster together over near-decadal periods, and affect the entire region, with phases of this nature reported over the last six millennia (Ekblom et al. 2011, 2012). Longer pulses of rainfall variability have also been shown to cluster over periods lasting multiple decades or centuries, but evidence for this is drawn primarily from palaeoclimate proxy data, which in this region are scarce and difficult to interpret.

The challenges of reconstructing past climates from these palaeoclimate proxy data are discussed at length in Chapter 3, yet it is known from these sources that the last 2000 years have witnessed substantial variability in rainfall and temperature (Figure 1.4) (Holmgren et al. 2012; Nicholson et al. 2013; Stager et al. 2013). This long-term variability is believed to fit to a general model of atmospheric forcing, where in periods of anomalously warmer global temperatures, the ITCZ is strengthened over southern Africa, resulting in more rainfall in the SRZ, whereas the inverse occurs in periods of cooler global temperatures (Ekblom and Stabell 2008). Further linked to this is the position of the circumpolar westerlies, whereby an equatorward shift in their northern margins increases precipitation in the WRZ in southwest southern Africa, but is thought to restrict the southward mobility of the ITCZ, reducing SRZ rainfall (Stager et al. 2013). This mechanism is also believed to account for the marked long-term antiphase relationship between precipitation in the southern African SRZ and the bimodal rainfall region of East tropical Africa (Nicholson 2000; Ekblom and Stabell 2008). Moreover, in the southeast, where SSTs in the adjacent tropical Indian Ocean exert strong influence on its efficacy as a moisture source, a warmer ocean would mean strengthened south-easterly trade winds, resulting in more moisture advection coming directly from the ocean (Sundqvist et al. 2013). Complexities in developing palaeoclimate data from the southern hemisphere low latitudes, however, mean that the inter-annual variability discussed in Section 2.1.1 is seldom reflected in proxy records, and for much of the pre-instrumental period, relatively sparse and limited resolution data are relied upon.

The precise state of knowledge on palaeoclimate variability will be discussed in the later sections of this chapter and analysed in Chapter 3, yet an introduction to this is required here. Palaeoclimate datasets in southern Africa began to grow in number from the 1980s in conjunction with the objectives of the International Geosphere-Biosphere Programme, but these were generally limited to low-resolution records from pollen and faunal remains. Tyson and Lindesay (1992) conducted a review of these data, and advanced the hypothesis of coupled warm-wet and cool-dry conditions acting over multi-decadal and centennial timeframes (Table 2.1). This paper also categorised a number of periods by their predominant climatic inferences, and postulated that the southern African equivalents of the MCA and LIA in Europe lasted from about AD 900-1300 and 1300-1850, with a warming spell between about 1500-1675.

TABLE 2.1 Qualitative summaries of precipitation variability since *c.* AD 1000 from review of Tyson and Lindesay (1992) and Stager et al. (2013), with probable decadal error ranges.

Tyson and Lindesay 1992		Stager et al. 2013	
Year AD	**Climatic conditions**	**Year AD**	**Precipitation conditions**
		1860-1880	Dry
1790-1810	Warm and wet	1760-1860	Wet
1675-1780	Cool and dry	1740-1760	Dry
	↓	1670-1710	Dry
1500-1675	Warm and wet	1590-1620	Dry
		1540-1570	Dry
	↓	1470-1540	Wet
1300-1500	Cool and dry	1430-1450	Dry
		1390-1420	Wet
		1370-1390	Dry
		1340-1370	Wet
	↓	1310-1330	Dry
900-1300	Warm and wet	1220-1280	Wet
		1170-1220	Dry
		1100-1170	Wet
		1040-1090	Dry
	↓	1000-1040	Wet

A number of higher-resolution proxy data have been obtained and published since Tyson and Lindesay's study, and while general similarities have been observed, marked differences in precipitation signals and interpretation exist between these more recent records. A recent qualitative synthesis of three proxy precipitation records, including a tree-ring, lake diatom assemblage and speleothem by Stager et al. (2013) (Table 2.1) also demonstrates broad similarities with that of Tyson and Lindesay (1992). Nevertheless, Stager et al. (2013) considered only three records in their analysis, while half of one was inexplicably omitted. Moreover, even if there exists some agreement on a general picture of multi-decadal and centennial palaeoclimate variability over the last millennium in the SRZ, understanding of change on decadal and inter-annual scales is still extremely limited. Lack of data certainly plays a part in this, but this has increased in recent years, and a major problem is that there has been no regional study of the range of palaeoclimate proxies since that of Tyson and Lindesay over two decades ago.

As rainfall variability on these timescales is crucial for food production, and moisture stress is the most severe environmental hazard in the region, a major consequence of the above issues is that the limited range of data used to examine past climate-society relationships in past studies are not fit-for-purpose. Indeed, as will be shown later in this chapter, consideration of palaeoclimate variability and society has been restricted to hypotheses regarding the drying out or aridification of areas rather than the impacts of shorter-term drought. For instance, archaeological remains of farming settlement from presently arid areas such as the Limpopo valley give reason to suggest that these areas were wetter in the late-first to early-second millennium, and that past climate change did affect the sustainability of settlement in these areas. However, these debates have far too often tended to sway into the collapse-based approaches introduced in Section 1.2, contributing to the dearth of regional scholarship on the impact of environmental hazards such as drought in the historical period prior to colonial rule (broadly *c.* AD 1500-1890). In this latter period, considerably more data sources exist to analyse past climate-society interaction, which enable more consideration on the nature and impacts of drought, as well as other important climate-related factors such as excess of rain, floods and locust plagues, all of which could affect the functioning of the food systems upon which people depended (Beach 1994). Climatologically, a wider range of natural and man-made data and chronologies now exist to reconstruct decadal- or even sub-decadal scale precipitation changes in southern Africa, which enable more precise identification of periods of moisture stress. Despite this potential, it must be borne in mind that whether a marked reduction in rainfall translates to significant societal impacts depends on the situation of the population, their habitual standard of living, and their ability to accommodate food shortages, all of which are variable parameters (Goudie et al. 1996; Pfister 2010). The next sections shall critically overview environmental, economic, social, political and cultural dynamics and their changes in the two focus regions from the coming of Bantu-speaking people to southern Africa to the mid-nineteenth century, when European colonial powers begun to overpower large parts of the region.

2.1.2 Early-farming communities: migrations, settlement and livelihoods

This thesis is primarily concerned with Eastern Bantu-speaking people, particularly those who spoke Shona and Nguni (Figure 2.3). There is general agreement that Bantu-speaking groups migrated to southern Africa from the north from around the early-first millennium AD (Figure 2.3), and thereafter displaced, assimilated or traded with Khoisan-speaking hunter-gatherer groups (Phillipson 1993; Mitchell 2013). Unlike hunter-gathers, the majority of Bantu-speaking people lived in settled communities, combined cultivation with herding, forged iron, and made or used pottery. These first millennium early-farming communities were ancestral to the second millennium Shona, who comprised the majority of the population in the Zambezi-Limpopo area prior to the 1820s, and were involved in state-building activities.

FIGURE 2.3 Major languages of Africa (after Collins and Burns 2007) and hypothetical dispersion routes of Bantu languages from 1: Proto-Bantu homeland and 2: region of secondary dispersal (after Phillipson 1977). Numbers indicate successive centres.

As agropastoralists, most of these early-farming communities chose to live in an environment consisting of 'broken country', with alluvial and colluvial soils that enabled cultivation with an iron hoe (Huffman 2007). Cultivation was garden-based, and faunal remains indicate that this was centred around the principal crops of pearl millet (*Pennisetum americanum*), finger millet (*Eleusine coracana*) and sorghum (*Sorghum bicolor*) (Huffman 2007). Pulses such as groundnuts (*Voandzeia subterranean*) and cowpeas (*Vigna unguiculata*) were also grown, while the gathering of wild plants and hunting were practised as insurance against crop failure (Beach 1977, 1980; Mitchell 2013). Domestic animals, including cattle, sheep, goats, chickens and dogs formed a prominent part of subsistence strategies. Initially, sheep and goats were more numerous than cattle, but this situation began to shift from around AD 700 (Mitchell 2002). Although cattle herding was important to Shona-speaking communities, crop requirements seem to have played a greater role in the choice of settlement location. A topic that has generated significantly more discussion, however, relates to the interpretation of space *within* settlements. A predominant theory is that Eastern Bantu-speaking people organised their settlements according to a model known as the 'Central Cattle Pattern' (CCP) (Huffman 2007), which explicitly links the 'worldview' of the settlement's inhabitants to cattle for purposes such as bridewealth payments, sacrifice to ancestors, and political relations. The settlement organisation of certain groups changed with the emergence of class distinction in around the thirteenth century, where elites lived in a new 'Zimbabwe Pattern' layout, and commoners lived in homesteads organised according to the CCP (Huffman 2009b). These and other models posited by Huffman are important in understanding social organisation, but are not without their critics (Hall 1998; Badenhorst 2009; Marks 2011). For instance, while not denying their existence, the opposing view notes that they are deliberately ahistorical, and "stand in the way of any more nuanced sense of historical development, let alone of human agency" Marks (2011, 138). Throughout this thesis, consideration will be given to each of these standpoints in order to generate a dialogue that is attentive to both, rather than further dividing debate into worldview versus political process and idiosyncratic agency.

Migrations of Nguni-speaking groups from the interlacustrine region of Africa to the KwaZulu-Natal area of South Africa occurred at around AD 1100 (Huffman 2004; Parsons 2007). These migrations have been causally, although relatively speculatively, linked with climatic fluctuations on the basis of the antiphase relationship in precipitation variability between southern and East Africa. This theory implies that inverse precipitation patterns between the two regions in palaeoclimate records around these times were a dominant push factor which drove these groups to less populated areas in southern Africa (Tyson et al. 2002; Huffman 2004, 2007), yet little evidence exists to support such a theory. Nguni groups differed markedly in economy, society, politics and culture to the Shona-speaking groups in the Zambezi-Limpopo area. For instance, Huffman (2004) notes that the major difference relative to other societies in southern Africa was the dichotomy between cattle and agriculture. Although these again consisted of sorghum, the two millets, cattle, goats and sheep, Nguni-speakers "greatly exaggerate the dichotomy between men and cattle on the one hand and women and agriculture on the other", which creates a "patrilineal, pastoral arrogance" that "permeates the whole of Nguni life" (Hammond-Tooke 1993; Huffman 2004, 82).

Because of the emphasis on cattle, and the volatility of this form of wealth, Nguni society institutionalised raiding (Huffman 2004), which according to Huffman helps explain why political units prior to the nineteenth century in the KwaZulu-Natal area were limited to small-scale chiefdoms in contrast to the Zimbabwe culture states further north. Nguni settlements reflected this emphasis on pastoralism. Beehive houses, the "premier symbol of pastoralism throughout Africa" were built like pastoralists in East Africa (Huffman 2004, 83), and contrary to other agropastoral communities, settlements were located on slopes above fertile agricultural land.

This broad period from the earliest Bantu-speaking settlement in southern Africa to 1840 is termed the 'Iron Age' by some (Huffman 1970, 1972, 2007; Hall 1987; Maggs 1989; Badenhorst 2010). Despite its structural convenience, it has been noted that this term, borrowed from European prehistory, has become symbolic of older approaches to material culture and group identity (Schoeman 2013). In addition, it overemphasises the use of iron over other technologies and creates an illusory representation of societies as "static blocks rather than complex, dynamic entities" (Mitchell 2013, 657). Consequently, this thesis will use 'farming communities' or 'agropastoralists' when making broad reference to these communities.

2.2 Zambezi-Limpopo state transformation (*c.* AD 900-1840)

2.2.1 Physical geography and environment

The first and main case region, often referred to as 'Zambezia', incorporates the stretch of land bounded north to south by the Zambezi and Limpopo rivers, and east to west by the Indian Ocean and Kalahari desert (Figure 2.4). Central to this area is present-day Zimbabwe, as well as parts of Mozambique, where land is traditionally classified into lowveld, middleveld and highveld. Lowveld refers to land below 900 m, such as the low-lying, drought-prone Zambezi and Limpopo valleys. Land between 900-1250 m is classed as middleveld, and accounts for most of the plateau formation that dominates the interior, while land rising above 1250 m to around 2500 m constitutes the highveld and Eastern Highlands. East of the highlands, land runs down to the woodlands that border the Indian Ocean on the Mozambique coast, and in the southeast it steeply descends to an expanse of low-lying land that stretches as far as Maputo Bay. To the southwest, a gradual extension of middleveld reaches into the Kalahari desert.

Intrusive igneous rocks including granite, gneiss and dolerite dominate most of the plateau (Summers 1960; Pikirayi 2001). A major geological feature of the region is the mineral-rich geological formation known as the 'Great Dolerite Dyke', which straddles Zimbabwe from south to north-east, and where quantities of gold, copper and iron were mined extensively in the pre-colonial period (Phimister 1976). The soils of the region, largely determined by the underlying geology, are of a high spatial variability. Granites of the central plateau are associated with sandy, heavily textured and leached sub-soils, which offer poor fertility (Pikirayi 1993). The brown soils of the gold belt and dolerite dyke, however, are considerably more fertile, and coincide with areas of medium to high rainfall. The Zambezi, Shashe-Limpopo and Save basins all receive relatively low rainfall (Figure 2.2), and the soils here are heavily leached (Pikirayi 2001). The soils of the north-western area, drained by the Gwai-Shangani system, are mainly aeolian, and are thus shallow and infertile (Summers 1960).

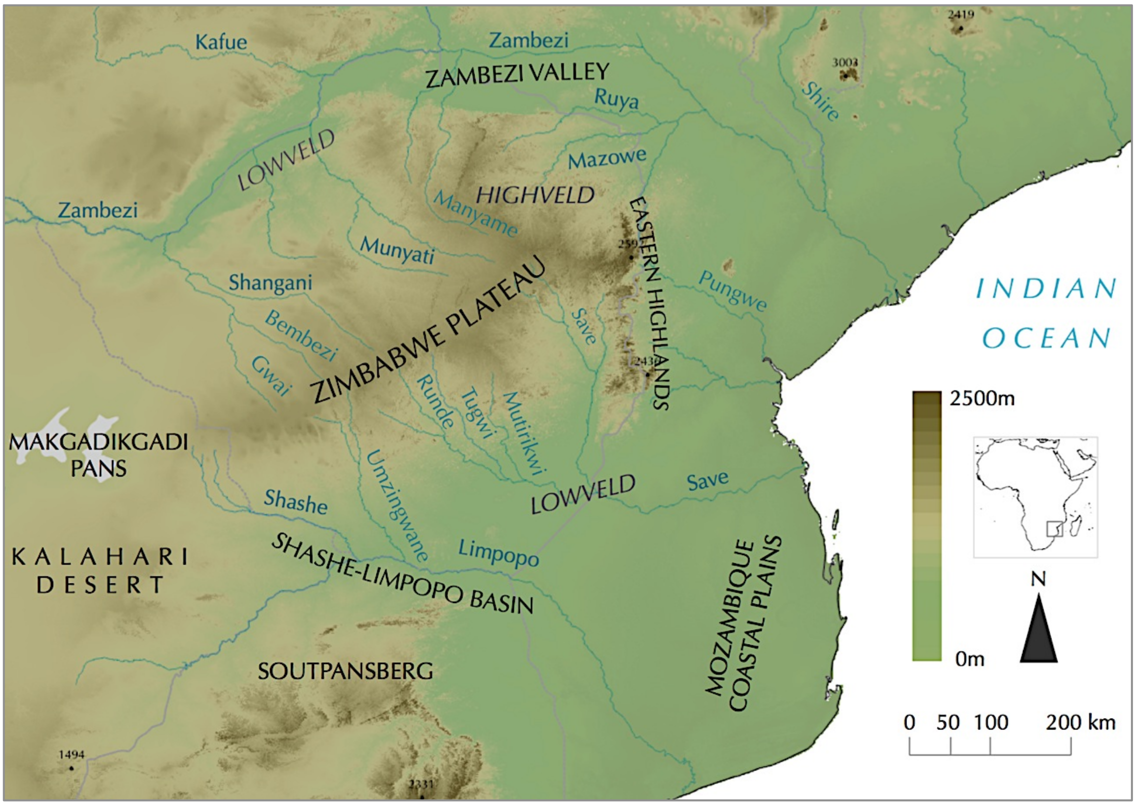

FIGURE 2.4 Physical geographical features of the greater Zambezi-Limpopo area.

The drainage system of the plateau and lowveld areas is dendritic, and the land is deeply dissected by rivers that start in wide, shallow valleys and cut down through the edge of the plateau until they merge in the Zambezi valley, the coastal plain or the southeast lowveld (Beach 1994). Of the numerous rivers, only parts of the Zambezi, Limpopo, Save, Pungwe and Runde are navigable by small crafts at certain times of the year, but this may have been different at various times over the last millennium (Mudenge 1988). Rivers such as the Tugwi-Runde and Mazowe-Ruya were also the source of the alluvial gold washed from upstream (Phimister 1974).

The vegetation is mostly made up of mixed woodland and savanna. Occasional stretches of plains of tall elephant grass are found on the plateau, while semi-tropical forests are present in the southeast of Zimbabwe and the Zambezi valley. In particular, miombo woodland is found on the granites and dolerites of the relatively wet plateau. In the south to southwest of the area, dry grass veld and semi-arid scrubland is found, and provides nutritious grazing-land to cattle all year round. Similarly, *mopane* tree savanna of the arid lowland basins and the far west provides further excellent grazing potential (Pikirayi 2001). The dominance of savanna vegetation provided suitable habitat for a wide range of fauna. Strategically important for pre-colonial communities were vast herds of elephants that were hunted for their meat and ivory, prides of lions and leopards for their skins, and innumerable other non-domestic animals for food (Beach 1977). As well as offering habitat, woodlands were important in that they provided charcoal for fuel and smelting, as well as woodwork crafts.

This basic overview of the region's physical features is useful to set the overall scene for the events of the last millennium, but when considering human development, it is essential to move beyond consideration of purely physical parameters and view both the long-term and dynamic cultural landscape of the region, as its inhabitants did not see it in such categorical terms (Beach 1980; Pikirayi 2001; Manyanga 2007). As Beach (1980) states, possibilities of preferences for certain soil types (see Sinclair 1987, 2012) must be set against factors such as precipitation, grazing potential, access to water resources, defensive suitability, and access to trade routes.

In an analysis of these broader scale environment-society connections in pre-colonial Zimbabwe, Beach (1994) identified a 'Great Crescent' of pre-colonial population which in his view reflected long-term preference for a certain kind of environment, though this was not strictly based around either soils, vegetation, precipitation or geology. Rather than a single physical feature, a range of features including a mixture of soil types, grazing, woodlands, and defence possibilities were said to have accounted for this preference. The only apparent anomaly identified by Beach was that the main goldfield formed a crescent in the opposite direction, which would imply that good farming and gold mining were only possible for a minority (Beach 1994). Yet the difficulty with this theory, or any other wider theory relating to the influence of the environment on pre-colonial society, is that there exists a lack of reliable, evenly covered archaeological data in Zimbabwe to understand demographic change in detail. Moreover, failure to incorporate important early-second millennium human activity in the Shashe-Limpopo basin (Huffman 2009b) further undermines the Great Crescent theory (Manyanga 2007). Particularly important here is long-term climate variability, which has since been strongly linked to the late-first and early-second millennium societal development in the Shashe-Limpopo basin. Indeed, although present conditions are relatively inhospitable for farming communities, the lowveld of the Limpopo and Zambezi valley do represent areas where significant human activity took place over the last millennium. As far as the rest of the region is concerned, though, the most demographically favoured areas appear to have been the middleveld and highveld areas on the plateau between 900-1500 m, whereas particular areas less favoured for settlement included the south-eastern lowveld, where low rainfall, poorly developed soils, and tsetse fly combined to discourage extensive settlement (Beach 1994; Pikirayi 2001). The area to the west of the plateau, which consists of very sandy soils, was similarly not favoured due to severe agricultural limitations. With these factors in mind, then, the basic influence of the environment on economic, social and political dynamics will be borne in mind throughout the thesis.

2.2.2 Economy and society

Portuguese written sources made frequent reference to the food systems, livelihoods, trade relations and socio-political organisation of the inhabitants of the Zambezi-Limpopo region, enabling depth to be added to archaeological records. Most previous analyses of the regional economy prior to colonial rule, however, have focussed on individual aspects such as mining or trade, or examined these as 'modes' and 'branches of production' (Beach 1977, 1980; Bhila 1982; Mudenge 1988). This general examination outlines, and to an extent, re-assesses the economy and society of the inhabitants of this region across the broad timeframe of the second millennium, which is essential background for consideration of socio-political security. Although the following is a generic and somewhat ahistorical overview, it must be remembered that not all of the inhabitants and polities in the region participated in all livelihood activities. Geographical and environmental factors, as mentioned above, were not the same in all areas, while social and technological factors likewise influenced the type of livelihoods practised in different space-time contexts. It is also essential to consider aspects such as the relative importance of the various livelihoods to different parts of society. This involves the different activities in which people spent the limited number of hours in every year, but also contrasting activities over years, decades and centuries (Beach 1977). This key concept of time will be alluded to in this initial assessment, but will be analysed at greater length in Chapter 5, where dynamic temporal changes such as climate variability, political change, resource availability, disease and global economic change are assessed in the context of socio-political formation and security.

2.2.2.1 Food system

There exists strong consensus that the most important activity involving the greatest number of people over the course of the second millennium was food production, primarily by growing crops, supplemented to various extents by the keeping of domestic animals, hunting, and gathering (Summers 1969; Phimister 1974, 1976; Beach 1977, 1980, 1994; Bhila 1982; Mudenge 1988; Pikirayi 1993, 2001; Huffman 2000, 2007). By contrast, Portuguese accounts make it clear that other livelihood activities, such as mining, trade, manufacturing and metal-working were secondary to food production, the most commonly cited of which states that:

> "The land abounds with rivers of good water, and the greater number of the Kaffirs are inclined to agricultural and pastoral pursuits, in which their riches consist" (Bocarro 1631-49, 355).

Cultivated crops primarily included those brought from the Sudanic zone north of the equator, such as sorghum, the two millets, and groundnuts. Asian crops like rice, sugar cane and bananas were already established by the time of Portuguese arrival in 1505, while the later American crops included maize and tobacco (Beach 1977). The entire list of cultivated crops, when including vegetables and local plants, is relatively long, yet there is general agreement that sorghum and millet formed the backbone of agricultural production for most of the pre-colonial period. These were used to produce a stiff grain porridge widely eaten across the region (Monclaro 1573; Beach 1977, 1994; Bhila 1982; Mudenge 1988), while most other vegetables, nuts, salt and other grains were used for relish. Despite broad agreement in these factors, the range and relative importance of cultivated crops did vary across the landscape and changed over time, but this has so far received little attention.

The cultivation process began with the preparing of fields and planting in the dry winter months. Seeds were planted at the onset of the summer rains, though the exact time of planting depended on the individual crop. Crops matured by the end of the rains and were harvested in the early part of winter. Drying and threshing followed in mid-winter; thereafter, part of the crop was put into the next cycle as seed, and that left over was stored as food for the village (Mudenge 1988). The effectiveness of grain storage played an important part in ensuring the food supply lasted until the next harvest became available, yet earlier debates around the efficacy of storage were inconclusive, primarily through lack of evidence (Beach 1977, 1980, 1994; Mudenge 1988). Beach (1977, 1980) claimed that few crops could be kept for more than two or three years, while Mudenge (1988) put this timeframe at three to five years due to the air-tight, stone-raised granaries used, which in his view lessened the significance of drought. Grains that were good for storage included sorghum and finger millet. Sorghum was also drought-resistant, though finger millet, which was more widely grown, was less drought resistant than sorghum and pearl millet. Beach (1977) conceptualised the complexity of drought impacts on agriculture in a four-year cycle:

> “If the crops sown in the early summer of Year 2 were hit by a drought, the crops sown in Year 1 and harvested in the winter of Year 2 would last until the winter of Year 3. But even if the rains of Year 3 were good, before the crop of Year 3 could be reaped in the winter of Year 4, the crop of Year 2 would have run out. The consequence of this could be terrible, and worse if there were two or more droughts in succession. It is not surprising that every year saw a certain amount of tension until it became certain that the crops were secure” (Beach 1977, 43).

As well as drought, crops were subject to rains that came too soon or too late, too much rain, locust plagues, damage by elephants, hippopotamuses and baboons, as well as frosts and floods (Pikirayi 1993, 2001). As will be shown later, documents and oral traditions do allude to the impact of drought, highlighting an inherent insecurity of the agricultural system. Yet it must be borne in mind that drought conditions were not the inter-annual norm in most parts of Zimbabwe, but have been commonly assigned an incidence of one year in five from analyses of the instrumental record (Scoones et al. 1996). Adaptive mechanisms and coping strategies were used to buffer the impact of drought, but no method could completely offset agricultural losses. For instance, people often resorted to hunting and gathering, or moved to areas less badly hit (Beach 1980; Pikirayi 2003). On the other hand, a wider range of crops could be planted, such as the more drought-resistant pearl millet, but this brought problems of storage compared to finger millet. In the event of delayed rains, a later crop could be planted, but may have been of an inferior quality to the earlier ones (Beach 1977). People could also regularly grow a larger crop, as was done in some areas when markets opened up, but aside from the limitations of storage, the growth of a surplus by a household was treated with suspicion, causing tension at the village level (Randles 1975; Mudenge 1988). Problems with transport also limited opportunities such as the trade of grain, as few navigable rivers and the rare use of oxen for transport prevented this on a significant scale (Beach 1994), but trade in foodstuffs was practised locally (Bhila 1982; Ekblom 2004). It is critical at this point to note that each of these fine-scale processes make examining the impacts of individual droughts extremely difficult where data is sparse, and new methods are required to move beyond simple extrapolations from palaeoclimate data onto an assumed unchanging fragility of an agricultural society over multi-centennial timeframes. Nevertheless, it is clear that the environmental realities of the area meant its agricultural base had fundamental insecurities, which could only be buffered so far by storage and coping strategies. Other components of societies' food systems did, however, offset this to an extent.

Domestic animals reduced food system dependence on agriculture alone, and the keeping of sheep, goats and cattle provided a source of food that both lived longer than grain could be stored and could reproduce. The proportion of these three domestic animals varied across the region, but generally goats outnumbered cows and sheep (Beach 1977, 1980; Badenhorst 2010). Sheep were much rarer with the exception of areas such as Manyika (Bhila 1982). Dogs were also kept for hunting, vermin control and security, and chickens were common, though pigs were rare outside of the Zambezi valley (Beach 1994). Unquestionably, however, the cow was regarded as the superior domestic animal (Huffman 2007). The amount of meat supplied from the cow by far exceeded that of the goat or sheep, and the social importance of cattle across southern Africa such as for payment in bride-price and tribute to rulers is well attested (Beach 1977; Garlake 1978; Huffman 1982, 2007). Factors such as raiding, disease and drought presented hazards to cattle keeping, but through careful breeding and herding it was possible to increase wealth in cattle and provide a buffer to the insecurities that came with crop cultivation. Despite its importance as a source of food, the social role of cattle meant that the primary purpose of herding was to increase its population and for powerful minorities to accumulate them (Beach 1994). Along with its elevated social importance came unequal distribution, and for the poorer segments of society stealing cattle was the most direct way to acquire wealth (Beach 1977), while cattle was given as payment to gold miners (Mudenge 1988). Beach (1977) also notes that cattle could also be sold for grain, but this was unlikely to occur unless this was in very short supply.

Wild animals provided a further source of food. Hunting had been long-established by the ancestral inhabitants of the region and from elsewhere, where techniques such as trapping were advanced. Hunting took place on individual and group levels, and in times of scarcity could involve large, organised parties (Santos 1609; Beach 1977). Portuguese documents show that the range of animals hunted by groups was enormous, yet although it provided an addition to the diet, its proportional contribution to this was limited, and it was not the central component of the food system. A risk of hunting was also that local animal populations could be depleted if communities relied on it too much, which could make the population more vulnerable to drought in the longer-term. Certainly, in the more populous and elite settlements, the proportion of wild animal to domestic animal bones show that hunting was not as important as cattle-keeping as far as sources of meat were concerned (Plug 2000).

Wild plants collected by women and children could also provide a dietary supplement, and nutrition from wild fruits, vegetables and insects was to be found in the hinterland of settlements. Gathering was particularly important in times of scarcity, where a limited grain supply forced a reliance upon wild fruits, herbs and insects especially amongst the poorer parts of society. Even locusts, a common cause of crop destruction, were a source of food, but none of these food sources could adequately replace the centrality of the staple grains to the diet and economy of most of the region's inhabitants (Beach 1977; Bhila 1982; Mudenge 1988).

2.2.2.2 Livelihoods and trade

Important resources in the village economy were salt and iron, which often had to be obtained via local trade. Although 'specialist' groups existed to procure and sell such resources, Beach (1977) states that they only practised this to supplement their existing wealth rather than rely upon their specialisation for subsistence. Salt was an essential commodity, and could be obtained by either burning and filtering certain plants or extracting and evaporating saline earth from salt springs or pans. This latter method produced the best quality salt, and key salt-producing areas such as eastern Botswana, and the Zambezi and Save valleys supplied people over a wide area. Iron was generally found in the high number of small deposits across the region (Summers 1969), and was most useful for the manufacture of the hoe, as well as for weapons. Other livelihoods such as copper-working, potting, and weaving were carried out in various parts of the landscape, while some later groups grew and sold tobacco (Beach 1977). Involvement in this local trade facilitated the build-up of stock, and thereby provided an additional buffer to offset environmental hazards.

Links to inter-continental trade were market-oriented (Mudenge 1988; Beach 1994), being heavily linked to global demand for gold, ivory, and to a lesser extent, copper (Phimister 1976; Pikirayi 2001; Pwiti 2005; Swan 2008). Trade contacts were established between the Shashe-Limpopo basin and Muslim traders at Chibuene (Figure 2.5) in the ninth century (Burke 1962; Sinclair et al. 2012), where ivory and alluvial gold was traded for cloth and beads. The mining of gold reefs begun around the thirteenth to fourteenth centuries, when trade links were also established with India (Phimister 1976; Huffman 2007). People prospected, mined, washed and milled the gold, and either local traders took this to the Indian Ocean coast, or Muslim traders came inland to buy it. Muslim coastal cities acted as middlemen in the trade until *c.*

1500, when the Portuguese started to overrun the trade. Reef mining was mostly seasonal, and was conducted by ordinary farmers in the dry season before the summer rains flooded the mines (Phimister 1976). The distribution of exploitable reef gold deposits was uneven (Figure 2.6), and those distant from it were not involved in the industry. Estimates of gold exports from Portuguese documents and archaeological remains of workings vary, but the general temporal characteristics are fairly clear. Peak production occurred between the twelfth and mid-fifteenth centuries, with a steep decline at this point, followed by a gradual decline towards the beginning of the eighteenth century, and by the mid- to late-nineteenth century nearly all payable reef deposits had been worked out (Summers 1969; Phimister 1976). The major contribution of gold mining to society was that rulers could tax both production and trade, and it therefore played a supportive role in reinforcing the political system of polities (Mudenge 1988; Mitchell 2002; Huffman 2007; Pikirayi 2013a).

FIGURE 2.5 Important sites in the Indian Ocean trade network.

Ivory was the other resource sought by inter-continental traders, though was also important as a food source (Santos 1609). Upon the killing of an elephant, the ruler usually took one of the tusks as tax, the meat was distributed among the community, and the hunter kept the other tusk. According to Beach (1977), tusks could be used to pay the bride-price of a wife, allowing more croplands to be opened up and planted by the addition of her labour to the family, or could be used to buy iron ore. Ultimately, though, ivory went to the coastal trade. The ivory trade increased in importance from around the early-sixteenth century onwards, and eventually overtook that of gold over the next centuries (Phimister 1976).

The significance of mining and trade has been both over- and understated in the literature. It is now agreed that these industries were secondary to most of the region's inhabitants, and relied upon the part-time efforts of agropastoral communities, yet it could be argued that its significance was disproportionately higher than simply the number of people involved in these economic activities would suggest. Indeed, rapid reactionary responses to trade are evident in the historical record (Beach 1994; Pwiti 2005), while imports of cloth and beads were valued forms of wealth and have been linked with augmenting and intensifying inequality and class structures in the earlier polities of this period (Huffman 2009b). The taxes acquired from these activities also provided polities with material wealth to support political structures, which in turn enabled more tribute, service and fees to be appropriated from the population. Still, mining had its limitations. Geological and technological constraints meant that only small-scale gold mining could be conducted, while the human risks associated with reef mining are widely attested in Portuguese accounts.

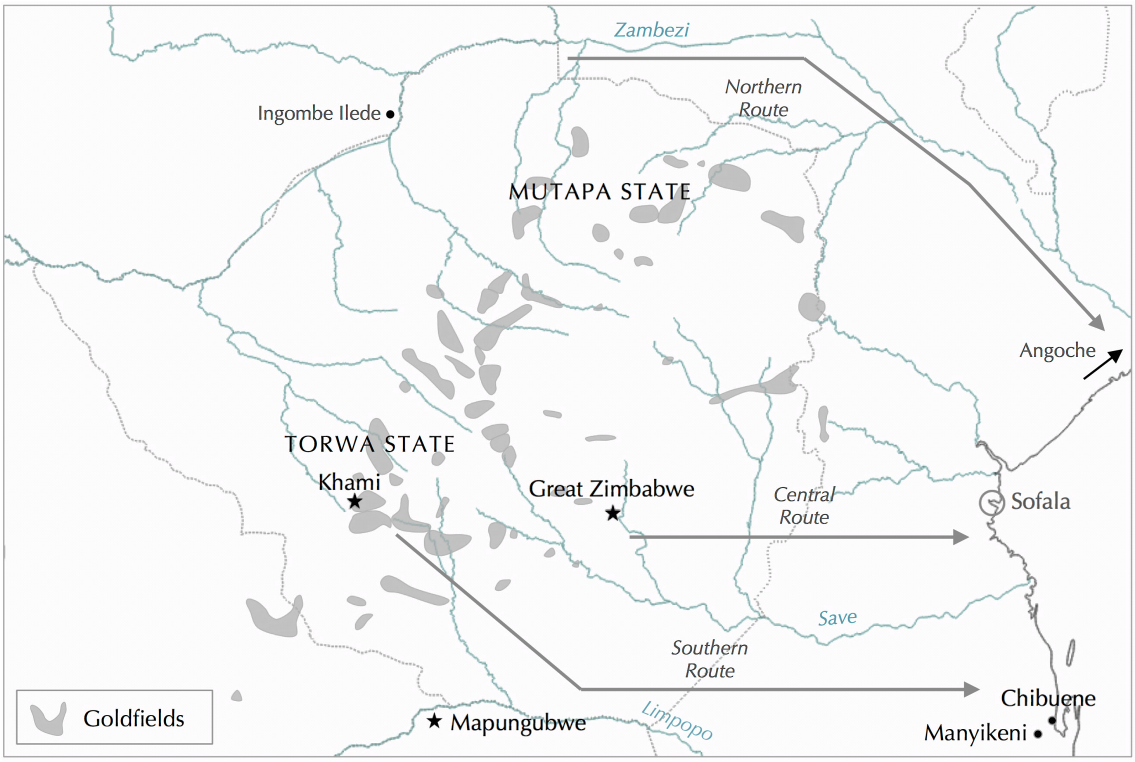

FIGURE 2.6 Major gold-producing areas and trade routes of the region (after Huffman 2009b).

2.2.2.3 Socio-political organisation

This thesis focusses primarily on complex socio-political structures, meaning it is necessary to consider the various levels of societal organisation. Mudenge (1988) outlined this on a hierarchical level – from territory, to ward, to village, to household – and claimed that this could be applied to most polities in the region, including those prior to the written record. Beach (1994), however, criticises this hierarchy as being too neat and ignorant of the fluid process of historical change. If not rigidly applicable to every inhabitant and polity of the region, though, the outline presented by Mudenge gives an insightful idea of the general structures of socio-political organisation.

The smallest social unit was that of the family or household, involving the man, his wives and children. As well as a social unit, the family represented the basic unit of the food system, the growth of crops in family gardens. Weeding and planting the gardens were tasks dominated by women, as well as stamping and grinding corn and gathering wild foods. Mudenge (1988), however, claims that it is wrong to assume that men took no part in agriculture, a point later echoed by Beach (1994), as it was their duty to clear ground for the new gardens, as well as thresh the grain crops. Cattle keeping and hunting were, by contrast, the realm of the male, reflective of the wider dominance of the male in the significant sectors of the political economy.

The village is regarded as the next level of the social system, and was headed by the most senior member of the family that founded the village. The sizes of villages varied across the landscape, with a population typically ranging from tens to several hundred, and in unusual cases into the thousands (Huffman 2007). Villages were often not permanent settlements, and shifted due to rotating land that was used for cultivation. Mudenge (1988) adds that mutual assistance was common in villages, particularly in times of scarcity and in activities such as hunting and fishing, while assistance in gardens and fields was given in return for the brewing of beer. Yet Beach (1994) asserts there was a difference in ideology and practice as far as communal work was concerned, adding that the bulk of work was done by and for the individual household, by whom the produce was kept.

A number of villages constituted a ward under the rule of a sub-chief. Territoriality was important at this level, where boundaries were defined by natural features such as rivers (Huffman 2007). The population within a ward could also attend 'work parties' as was the case at village level, which could involve several hundred people (Mudenge 1988). At the time of planting and harvesting, each village sent people to work in the sub-chief's gardens, where a surplus was enforced, meaning that the sub-chief was expected to assist with provisions in the event of crop failure.

Above the ward level was the chiefdom, ruled by a chief. These typically ranged between anything from a few hundred to several thousand square kilometres with relatively well-defined boundaries and variable populations, commonly into the tens of thousands (Huffman 2007). The chief received income from judicial fees and labour tribute, particularly in the cultivation of fields by local ward populations. Other tribute from sub-chiefs located further away included cattle, grain and gold. Hunters also paid tributes in the form of elephant tusks, meats and skins, while traders passing through a chiefdom usually had to pay tolls or present gifts to the chief (Beach 1980). Such wealth was frequently used in the inter-continental trade, from which they procured cloth and beads.

The highest level of society was the kingdom or state. States were of considerable size and population and enforced higher levels of 'service' and tribute than chiefdoms. In the Mutapa state, for instance, the population in the ward where the ruler's *zimbabwe* (stone-built capital) was located paid their tribute through labour service, which would probably have involved several thousand men and women (Conceição 1696; Mudenge 1988; Huffman 2007). Grains were also sent as tribute to the ruler, particularly from the poorer chiefdoms without gold, ivory or cattle. An important factor that impacted on the upper levels of society relates to internal rivalries and power struggles at multiple levels, which often ended in civil war (Beach 1994). At the highest level, it is known from the Mutapa state that ruler succession was often arbitrated by force, with only six out of 46 rulers being father-son successions (Mudenge 1988), and it was often those with powerful allies such as the Portuguese on the Zambezi who had a better chance to succeed (Newitt 1995). The scale of impact of wars is the subject of further debate. Mudenge (1988, 84), suggests that "perhaps succession wars did more to weaken the Mutapa state than any other single factor", whereas, Beach (1980) states that several factors acted to limit the extent of these wars, chiefly the lack of a surplus to support a military force. This meant that warfare was conducted on a relatively small-scale in most cases, although the small size of communities meant that any casualties represented a significant loss.

Political leadership was also tied to various spiritual beliefs, a prominent aspect of which that has received recent attention is rainmaking (Huffman 2007, 2008, 2009b), a ritual process conducted to bring rain that took different forms across wider Sub-Saharan Africa. Archaeological and ethnographic research (Murimbika 2006; Schoeman 2006) has provided multi-layered evidence, albeit sometimes contested (Beach 1998; Marks 2011), regarding this ideology and the corresponding 'worldview' of the governed population. This cognitive model relies on the disputed view that individual behaviour was governed by rules and regularities, and therefore that clusters of symbols in the archaeological record give meaning to social organisation (Huffman 1982, 1986a, 2007). At Mapungubwe and later Zimbabwe culture sites, sacred leadership is in this case said to be based on a mystical relationship between the leadership, ancestors and God, who made it rain. Importantly, in this interpretation, rain and agricultural success were placed in the hands of the leadership, meaning this new elite Zimbabwe Pattern rainmaking system constituted a 'nationalised' version of the previous system (Huffman 2008). Drought-induced agricultural failure could therefore have been interpreted as supernatural displeasure in the leadership. The widespread applicability of Zimbabwe Pattern rainmaking is disputed (Pikirayi and Chirikure 2011), though Huffman (2014) is of the opinion that there was a breakdown of Zimbabwe Culture sacred leadership in the Mutapa area in the sixteenth century, which was replaced by the persistent internal rivalries, power struggles and 'collateral succession' reported by Mudenge (1988) and Beach (1998).

A final word on socio-political dynamics to be considered in the later analysis relates to another inconclusive debate on pre-colonial demography. This stems from the fact that the population of the Zimbabwe plateau area was less than 900,000 in 1920 (Iliffe 1990; Beach 1994), seen as a relatively low figure, for which no single factor has been identified as dominant. Beach (1994) claims that the area was 'remarkably healthy', with the main hazards being pneumonia, dysentery, infant mortality and malaria, but none of these have been strongly linked with the restricted growth of the population. As stated above, warfare was conducted on a relatively small scale, and the extent of destruction caused by the arrival of Nguni-speaking groups in the early-nineteenth century has frequently been exaggerated. Drought and famine were suggested as an alternative reason for this (Beach 1977, 1980), as oral traditions often spoke of catastrophic famines, yet Beach (1994) states that famines were not major causes of mortality, but rather were a form of 'non-fatal' stress as people could survive on hunting, gathering and trading.

This background overlooks a number of temporal and geographical differences that were critical in influencing the vulnerability of societies to climate variability. Renewed scrutiny of Portuguese documents will be conducted in Chapter 5 in order to re-examine these factors, and some questions for this later analysis include:

- How did the type and balance of cultivated crops vary across space and time?
- How did the type and balance of domestic animals vary across space and time?
- How advanced were coping strategies against drought, and how did these differ between socio-political units?
    - Did the relative importance of hunting and gathering differ?
    - Does evidence suggest that social networks, trade and alternative livelihoods provided a robust buffer against drought?
- How widely was the perception of drought linked to the leadership?

2.2.3 Social and environmental change in the Zambezi-Limpopo area over the last millennium

The pre-colonial period in the last millennium is most often depicted as a transition from primitive to complex society, involving population increase (Table 2.2), socio-economic and political sophistication, and a trajectory of states rising and falling (Raftopoulos and Mlambo 2009). This representation has been met with criticism, particularly regarding its linearity and the focus on states alone. While this research is primarily concerned with complex state structures, it will not endeavour to reinforce this linearity and will keep factors such as inter-polity and group interaction in mind. Moreover, consideration will be given to some of the smaller polities that are well-covered by Portuguese written records, such as Teve and Manyika, and smaller communities in the vicinity of Afro-Portuguese settlements. It is also important to note here that although the term 'pre-colonial' will be frequently used, it carries a number of inadequacies, and here refers explicitly to the period prior to 1890.

2.2.3.1 Societal complexity and the 'Nile of South Africa' (c. AD 900-1220)

The development of societal 'complexity' is set at the beginning of the second millennium AD, and the Zhizo-Leopard's Kopje-Mapungubwe cultural development sequence at the Shashe-Limpopo confluence is widely believed to have played a critical role (Huffman 2000, 2008, 2009b; Pikirayi 2001; Mitchell 2002) (Figure 1.1). By the tenth century, Zhizo people had established political and economic independence in the Limpopo valley area (Huffman 1972; Hanisch 1980). Rather than agriculture, however, the siting of settlements away from floodplains and evidence for a relatively dry local climate until c. AD 1000 (Smith 2005) leads Huffman to prescribe the presence of the Zhizo population to the ivory trade (Huffman 2007). Indeed, large numbers of beads and local ivory objects found at Schroda suggest that Zhizo people were the first in the interior to directly take part in trade with the coast (Wood 2000) (Figure 2.7), while Arabic documents such as that written by Al-Mas'udi in 915 also attest to long-distance trade in gold and iron with the 'land of Sofala' (Burke 1962). According to Huffman (2007), this could refer to alluvial gold panned in the Schroda area, and the iron may have come from Zhizo settlements in the Tswapong Hills area of Botswana, while Schroda itself acted as a distribution centre for imported beads and cloth. A contemporaneous Persian account adds that the country of Sofala was invaded by the 'Wak Wak' (Indonesians) in AD 945, presumably causing disruption to the trade, and speaks of cannibals and rich goldmines in the higher elevated interior (Burke 1962).

TABLE 2.2 Population estimates for the Shashe-Limpopo basin (Huffman 2010b).

Period	Sites	Time span	Population outside capitals	Capital population	Total
Mapungubwe	122	50	6,100	5,000	11,100
Transitional	125	50	6,250	2,500	8,750
K2	160	200	2,000	1,500	3,500
Zhizo	30	100	750	300	1,075

Zhizo people maintained authority of the area for around 100 years, but most moved west to Toutswemogala in present-day Botswana when Leopard's Kopje agropastoralists moved north into the basin at around AD 1000±25 (Figure 2.8) (Denbow 1986; Denbow et al. 2008). The two groups thereafter became competitors, with the latter dominating the region and controlling the long-distance trade network (Huffman 2007). Some Zhizo people stayed in the Shashe-Limpopo area, and the Leokwe ceramic style produced by Zhizo and Leopard's Kopje people demonstrates the interaction of communities across social and ethno-linguistic boundaries (Calabrese 2000). The kin-based, ancestral Shona-speaking Leopard's Kopje society centred at K2 took over trade relations with the Indian Ocean network, and it is here that climate has been more strongly linked with the processes that eventually culminated in the rise of Mapungubwe, southern Africa's first urban centre and state capital. Primarily, this relates to the interpretation that the period AD 900-1300 was the manifestation of the regional equivalent of the MCA in Europe, which resulted in overall warmer and wetter conditions (Tyson et al. 2000). Although precipitation in this period has since been shown to be more variable than initially realised (Figure 1.4), agricultural expansion permitted by generally wetter conditions enabling population growth is thought to be key to Mapungubwe's rise (Huffman 1996, 2007, 2008, 2009b; Manyanga 2007; Smith et al. 2007). Leopard's Kopje people are thus said to have taken advantage of the favourable climate at the time, cultivating sorghum and millet on the floodplains of the Shashe River (Huffman 2008).

FIGURE 2.7 East African connections to the Indian Ocean trade network prior to *c.* AD 1500.

As well as evidence for contemporaneous wetter conditions from palaeoclimate data (Figure 1.4), this suggested climatic favourability stems from the fact that at present, large tracts of the Shashe-Limpopo basin are semi-arid, and in most years receive insufficient rainfall to support even modest subsistence cultivation. On this basis, the archaeological evidence for settlement and agricultural activity expansion from the eleventh-thirteenth centuries has been used as a primary indicator for climate-permitted human activity (Huffman 1996, 2007, 2008, 2009b). According to Huffman, flooding and its silt deposits would have been a seasonal occurrence in normal years at this time, potentially giving multiple yields of sorghum and millet in an extended growing season (Huffman 2008). In this interpretation, climate was therefore a major facilitator of the population growth that contributed to the development of societal complexity. Others, however, place less importance on climate, arguing that the pathway towards complexity was predominantly built upon a change in concept of cattle from communal property to private ownership, and its transformation into power by the distribution of herds to loyal followers (Garlake 1978; Raftopoulos and Mlambo 2009). Yet data from early-farming communities show that cattle were an important factor in economic power, status and social dominance long before K2 (Huffman 1990). In both cases, however, a growing stock of surplus wealth from the Indian Ocean trade network is frequently linked as a tipping point, augmenting and intensifying pre-existing wealth and social differentiation from cattle ownership (Voigt 1983; Mitchell 2002; Huffman 2008, 2010b; Sinclair et al. 2012).

2.2.3.2 Mapungubwe, collapse and rainmaking (c. AD 1220-1300)

At around AD 1220, the Leopard's Kopje capital, inhabited for some 200 years, abruptly shifted less than a kilometre from K2 to Mapungubwe (Figure 2.9), and with it came the development of what Huffman regards as the first 'class-based bureaucracy' in the region (Huffman 2009b). The major significance of this shift is that the K2 leader moved uphill at Mapungubwe, which was the first time that a senior leader became so physically separated from his followers in southern Africa (Gardner 1963; Huffman 2007). Explanations for this shift are few, and include an increase in cattle wealth, a re-configuring of its social value (Pikirayi 2001), and an increase in the importance of metallurgy and its tightly-controlled production in political leadership (Miller 2001). A prominent theory, however, relates to the ideology and spatial expression of sacred leadership, as outlined in Section 2.2.2.3, where rain also plays a pivotal role (Murimbika 2006; Schoeman 2006; Huffman 2008). As Mapungubwe had previously been a rainmaking hill, the leader living on the top is said to have acquired power, which served to emphasise the supernatural relationship between the ancestors, God and rain (Huffman 2007). In Huffman's view, the shift to Mapungubwe therefore represents an alteration to the existing rainmaking system and the expression of spatial patterns to accommodate the patterns of a new social order. The tying of rain-control to the Mapungubwe leadership brought with it new risks, especially as in the new worldview agricultural success became increasingly associated with rulers. It is on this basis that Huffman speculates about the impact of drier conditions reflected in certain palaeoclimate records in the early-thirteenth century (Figure 1.4) in relation to their coincidence with the shift to Mapungubwe and the origin of the new rainmaking system. This hypothesis proposes that the return of generally wetter conditions was interpreted as a supernatural sanction, facilitating the rise of the new order, and accounting for the placement of palaces atop of old rainmaking hills thereafter. Although frequently criticised for its structuralism and assumptions surrounding the notion of 'worldview', Huffman's model represents the most comprehensive model of leadership dynamics in the region, and as such is hard to dismiss (King 2011).

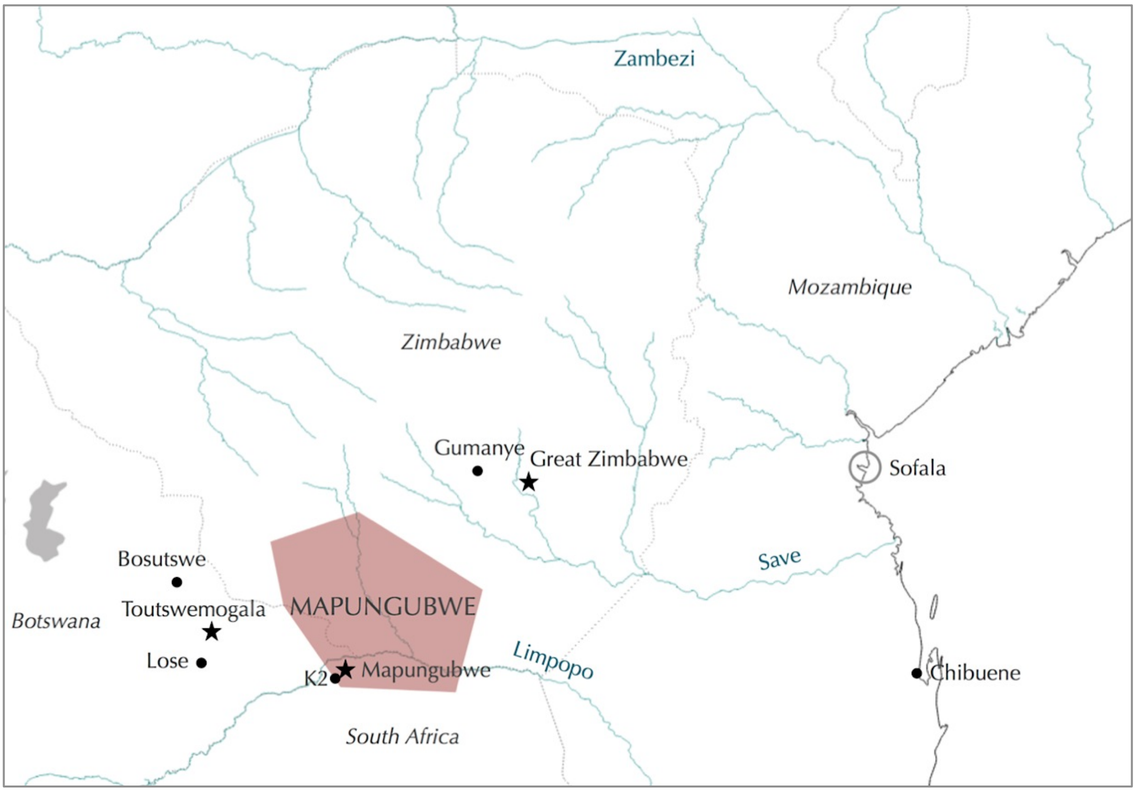

FIGURE 2.8 Approximate extent of the Mapungubwe state (~30,000 km²) (after Huffman 2007) in relation to other, contemporaneous or partly contemporaneous settlements and polities.

During its relatively short period of fluorescence (from about AD 1220 to 1300±20), Mapungubwe rose to the top of a five-tier settlement system (Huffman 2007), and formed part of a prestige goods network where cattle and military service flowed in to Mapungubwe, while glass beads and cloth were redistributed to regional centres (Mitchell 2002). Yet in accounting for the transformation of society and early state formation itself, climate has been suggested to play a pivotal role as part of a suite of factors (Huffman 1996, 2008, 2009b; Meyer 1998; Plug 2000; Tyson et al. 2002). Indeed, coupled with the palaeoecological setting of the Shashe-Limpopo basin, referred to as the 'Nile of South Africa' (Huffman 2000), rainfall is seen as the key variable, and without sufficient quantity, processes such as population increase (Table 2.2) could not have operated in the basin today (Huffman 2008).

It is perhaps not surprising, then, that a change in moisture availability has also been linked to the decline and fragmentation, or 'collapse', of the Mapungubwe state between around AD 1290-1320. Archaeologists and climatologists have strongly linked this with the apparent contemporaneous onset of the LIA inferred from the $\delta^{18}O$ palaeoclimate proxy record from the T7 stalagmite in Cold Air Cave, Makapansgat Valley, South Africa (Figure 2.9). On this basis, Tyson et al. (2002, 132) claim that "the coincidence of the Mapungubwe collapse with the end of the moist medieval warm period… strongly suggests that deteriorating climate was an important contributory factor in the decline of Mapungubwe". Similarly, in an examination of the impacts of rainfall variability on vegetation in the Shashe-Limpopo basin using the SAVANNA model, O'Connor and Kiker (2004, 49) concluded that "Mapungubwe disappeared as a result of a decrease in mean annual rainfall". In these explanations, abrupt LIA cooling and drying put an end to this time of plenty, adversely impacting the viability of floodplain agriculture on which a population of several thousand were dependent, contributing to state collapse (Huffman 2008). However, these suggestions only consider ecological dynamics, and the results are taken out of context with just passing acknowledgement made to the complex interaction of other factors. Nonetheless, Huffman (2008) asserts that in the prevailing worldview, agricultural failure was interpreted as supernatural displeasure in the king's rule, potentially leading to a succession dispute, the abandonment of the town, and perhaps even the Shashe-Limpopo basin as a whole (Huffman 2008).

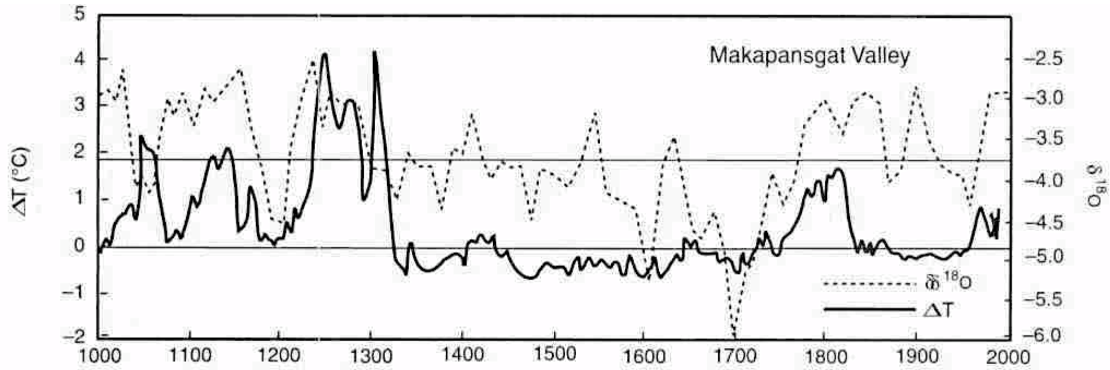

FIGURE 2.9 $\delta^{18}O$ and calibrated temperature series for the T7 stalagmite, Cold Air Cave, Makapansgat Valley, South Africa. Holmgren et al. (1999).

Pointing to the resilience of local socio-ecological systems to change, however, Manyanga (2007) and Smith et al. (2007) dispute this explanation. Manyanga provides evidence of occupation in the basin after AD 1300, suggesting that political decay was not matched at several commoner sites on the Zimbabwean side of the basin. This is put down to the resource exploitation potential of local circumscribed environments and ecological niches which offered diverse subsistence opportunities (Manyanga 2007). While arguments against environmental degradation and depopulation as an adequate causal explanation alone are convincingly made, this evidence does not fundamentally challenge the assertion of climate-driven agricultural system collapse leading to state decline. Furthermore, it is questionable to what extent a subsistence buffer of circumscribed environments could sustain the Mapungubwe state as an entity in the event of suggested sustained drier conditions. This brings the model of rainmaking and political security at the capital into focus once again, specifically the extent to which drought could have affected or destabilised the political, social and economic structure and security of the state as a whole. Others have also countered this linkage suggesting that other palaeoclimate records, including another stalagmite from Cold Air Cave, point to a later onset of the LIA at around AD 1500-1600 (Mitchell and Whitelaw 2005; Smith 2005). In this interpretation, the viability of subsistence cultivation was not under threat as climatic conditions were still relatively wet, meaning socio-economic and political choices were of more significance (Kim and Kusimba 2008).

A problematic situation here is that the conflicting signals and disputed interpretations of proxy precipitation variability have directly contributed to divergent claims regarding causation. Recent research in the fields of palaeoclimatology and historical climatology has further advanced this picture. The application of up-to-date age models and consideration of the variability between records has shown that it is less clear whether the MCA and LIA can be simply characterised as consistently warm-wet and cool-dry (Nicholson et al. 2013). This is a crucial point, as the debate surrounding the decline of Mapungubwe has been in the grip of disputes over the timing of these periods. Equally important is that further analysis of the Cold Air Cave speleothem records indicates that regional surface temperature may be a more important driver of stalagmite $\delta^{18}O$ than precipitation (Sundqvist et al. 2013). Given that considerable debate surrounding past climate–society interactions has involved these factors, these new findings warrant a re-evaluation of earlier hypotheses.

In addition to these climatic explanations, competition with the newly urbanising Great Zimbabwe, as well as changes in the dynamics of the Indian Ocean trade and the increased international demand for gold, have been linked to Mapungubwe's decline. In this view, the leaders of the Gumanye people at Great Zimbabwe were ideally placed to take control of the gold trade at a time of high demand, and therefore could have outcompeted a troubled Mapungubwe (Huffman 2009b). Some of the Mapungubwe population moved west to Lose Hill in the Toutswe area (Kiyaga-Mulindwa 1990), and defensive walling at some sites in this area may suggest competition with Great Zimbabwe, but this is speculative (Huffman 2007).

2.2.3.3 Great Zimbabwe and the Zimbabwe state (c. AD 1280-1450/1520)

Upon Mapungubwe's fragmentation, it is now generally agreed that a cultural diffusion rather than a simple northward movement of Mapungubwe people onto the Zimbabwe plateau took place. The Zimbabwe state grew out of the Gumanye culture, whose chiefdom had large quantities of cattle, but until the late-thirteenth century had only limited quantities of imported goods (Beach 1994). One suggestion is that a Gumanye dynasty built up enough power to overrun the trade between Mapungubwe and the coast, leading to the rise of the state. This could have taken place by the Gumanye rulers trying to control the trade that passed through their lands to the south-western goldfields by imposing a tax on traders, as is later recorded in sixteenth century Portuguese documents (Beach 1994). This hypothesis would imply that the early Zimbabwe state possessed the military strength to undercut and benefit from the exertions of the Mapungubwe population, which thereby contributed to the rise of the state by the possibility to divert labour from agriculture into financing skilled builders.

Another widely suggested possibility is that the plateau offered a more favourable environment and climate for the support of a large urban complex and territorial state (Pikirayi 2001; Huffman 2009b). Indeed, the spatial variability of the regional climate is one of several proposed factors relating to the enhanced economic base of the Zimbabwe state. Specifically, climatic conditions in the zone of higher rainfall along Zimbabwe's southeast escarpment are suggested to have allowed a flourishing agriculture in the hinterland of the capital (Figure 2.2.) (Huffman 2008). Nonetheless, the capital hinterland and core of the state had few special advantages for agriculture or pastoralism, while the most abundant gold reef mining areas were situated at a distance from the capital (Summers 1960), although alluvial gold may have aided the formation of the state capital and its heartland (Phimister 1974; Figure 2.10). In attempting to clarify this link between environments, resources and state formation, Pikirayi focusses on resource control. Accompanying control over trade, this line of thought points to the centralised authority of Great Zimbabwe as a product of the need to manage the variety of resource assets and environmental hazards, and perhaps crucially the gold in its hinterland (Pikirayi 2005). Similarly, Beach (1994) suggests that the construction of outlying stone-built *zimbabwe* may have acted as centres for economic as much as political purposes. For instance, the *zimbabwe* in eastern Botswana may have pursued interests in the trade from salt pans, while those in the poorer agricultural land of the west would have dealt with local goldfields. It is nevertheless important to remember that most of the population were concerned with subsistence food production, and thus *zimbabwe* reflected the interests of the elite.

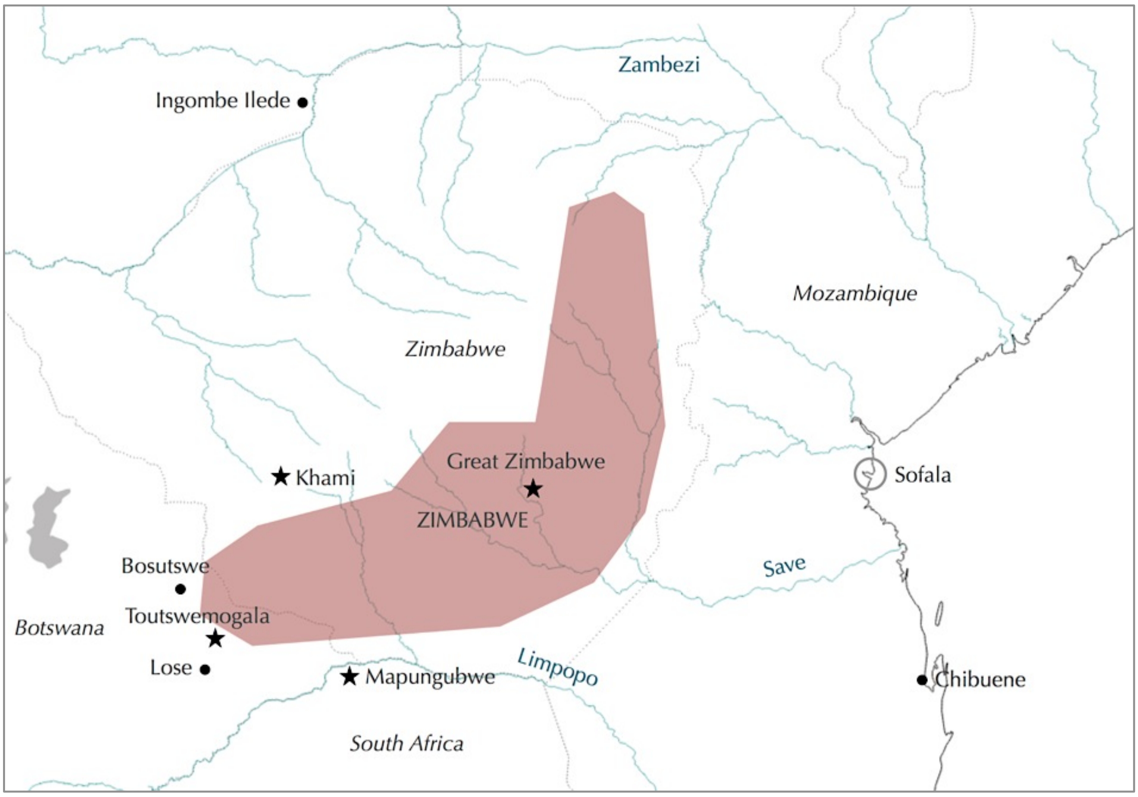

FIGURE 2.10 Approximate extent of the Zimbabwe state (after Huffman 2007) in relation to other, contemporaneous or partly contemporaneous settlements and polities.

Pikirayi further endeavours to consider the dynamism of the period, and is critical of the way this view is often negated (Pikirayi 2005). Of particular interest here is gold mining and trade, of which Great Zimbabwe was ideally situated to participate in the latter. Arabic documents such as that of ibn Battuta in 1331 make reference to gold coming from Sofala, which was sourced from the hinterland of 'Yufi', a month's journey from Sofala (Burke 1962); almost certainly a reference to the Zimbabwe plateau goldfields (Pikirayi 2013a). External sources also explain that increased state expansion in the southeast African interior in the eleventh to fourteenth centuries coincided with the substantial accumulation of wealth at East African coastal towns such as Kilwa. The contemporary demand for gold across East Africa, the Persian Gulf, India, the Far East and Europe led to increased pressure to exploit all known and workable sources, which affected the directions and intensity of commerce (Sutton 1990; Pikirayi 2013). Gold and the trade in exotic goods were subject to a volatile world market with unpredictable and abrupt price fluctuations, which Sutton (1990) states had destructive impacts on the poorly developed areas of the trading network. As well as external vulnerabilities, regional developments involving spatial shifts and competition also affected Zimbabwe's hold over the gold trade. Sometime in the fifteenth century, the Zambezi became the most important trade route in southeast Africa, and meant that long-distance trade was channelled through the north. The expansion of Ingombe Ilede in the northwest (Figure 2.10), where copper was extensively mined and traded with the Indian Ocean network, also attests to this, and coincides with the gradual decline of Great Zimbabwe's control over the gold trade.

Archaeological evidence suggests that Great Zimbabwe and the Zimbabwe state remained at the height of regional power until *c*. AD 1450 (Huffman and Vogel 1991). Although there is general agreement that the state was peripheral to mainstream developments in the area by the time Portuguese written sources become available after AD 1500, one second-hand Portuguese document (Barros 1552), possibly referring to events three decades earlier (Pikirayi 2013a), notes a continued occupation of the site for at least a further half-century. The decline of the state as a whole, however, remains dominated by speculation rather than consensus, and most scenarios focus on geopolitical and economic processes. One line of thought proposes that the height of state expansion in the late-thirteenth century set the conditions for its decline by a process of overstretch, and thus with the spatial shifts in demographic and economic power came breakaway units, the gradual loss of control of the capital hinterland and the gold trade, and the rise of successor states (Pikirayi 2005). Moreover, Phimister (1976) notes that the relatively quick exhaustion of gold deposits within the state hinterland, which possibly took just one dry season to work out a pre-colonial mine, may have been an important contributory factor. With time the Zimbabwe state may have been forced to rely upon goldfields further away, meaning control of these resources was made more difficult. As radiocarbon dates and ceramic facies show that Khami began to grow before the decline of Great Zimbabwe (Van Waarden 1987; Huffman 2009b), this possibly suggests a period of political and economic competition. Accordingly, the loss of control of the south-western goldfields in the Khami area may have harmed Great Zimbabwe's participation in the long-distance trade network.

Climate has received comparatively less attention here, yet some speculation emerged suggesting that the cool-dry conditions observed in certain palaeoclimate records in the fifteenth century (Figure 1.4) may have undermined the agricultural base of Great Zimbabwe and its growing population (Holmgren and Öberg 2006). This was later dismissed because of Great Zimbabwe's location in a high rainfall zone, as Huffman (2007) suggested that agriculture was viable even with a drier climate most of the time. Conversely, due to the conflicting signals and interpretations of palaeoclimate data at this time, others assert that the abandonment of the state occurred at a time of generally warmer and wetter conditions, meaning climate was likely not a central factor (Pikirayi 2013a). Moreover, the tight structural link between Great Zimbabwe and Mapungubwe proposed by Huffman is disputed by some on the basis that this is unsupported by the material culture at the Great Zimbabwe (Pikirayi and Chirikure 2011). Pikirayi and Chirikure also add that it would have been suicidal for a chief or leader to completely entrust rainmaking functions to himself as it would have invited political instability in times of drought, particularly if climate variability and rainmaking was indeed a significant pathway to a loss of authority at Mapungubwe.

On a different but not entirely unrelated note, Summers (1960) tentatively speculated that climate variability may have reduced the navigability of the Save river for small sea-going vessels sometime before 1500, which could have impacted upon trade patterns with the Indian Ocean network. Paucity of evidence, however, limits comment on this suggestion. Other speculative environment-related explanations include the thought that Great Zimbabwe grew too big for its local environment (Beach 1980; Connah 2002; Pikirayi 2005). In this view, the exploitative nature of sustaining a population of ~18,000 people affected the ability of the local hinterland to supply food, firewood and grazing. Connah, for instance, suggests that local population pressures could have had marked impacts on soils, vegetation and wildlife, even claiming that "without fundamental changes in technology and agricultural system, it [Great Zimbabwe] was fated to destroy itself" (Connah 2002, 256). Pikirayi takes a slightly more cautious stance and, although agreeing with the possibility of extensive ecological degradation, he urges that this was a consequence of mismanagement by the ruling elite (Pikirayi 2005). However, scant evidence supports such assumptions, and any standalone environmental collapse conclusion, regardless of the level of socio-political culpability, would seem more categorical than the available evidence allows. Also to this debate must be added the system of tribute and service mentioned in section 2.2.2.3, where harvests from the 'ward' (i.e. a further distance the immediate hinterland of the town) supported the elite. If functioning, this would have reduced the vulnerability of the rulers to local environmental problems as they could draw upon a wider area. While most of these causal factors remain at the level of informed guesswork, the contemporaneous growth of the Mutapa and Torwa states were certainly important.

2.2.3.4 The Mutapa and Torwa states and Portuguese arrival

The early- to mid-fifteenth century saw the emergence of the two successor states: the Mutapa in 'Mukaranga' in the north and the Torwa at Khami (Figure 2.11). This was followed in the early-sixteenth century by the new influence of Portuguese mercantilism after they gradually overran the Muslim traders on the Mozambique coast (Figure 2.12). The apparent direct successor to Zimbabwe was the Torwa state. Khami had become the largest functioning capital in the region, with ~13,000 people sheltered there, and was capital of a large territory (Huffman 2007). As well as frequent reference to gold, Portuguese documents allude to the abundance of cattle in the Torwa area, the keeping of which was ideally suited to its environment (Pikirayi 2001). The state also controlled copper and salt deposits around the Makgadikgadi Pans to the west, and traded for tin with Sotho-Tswana people at Rooiberg in northern South Africa (Huffman 2007). The Torwa state was undoubtedly a rival to the Mutapa state, and evidence for this is first encountered in Arabic documents written by Ahmad-ibn Madjid (1502) relating to a civil war, while the Portuguese found the Torwa state vying for control of the Zambezi valley trade routes upon their arrival (Alcáçova 1506).

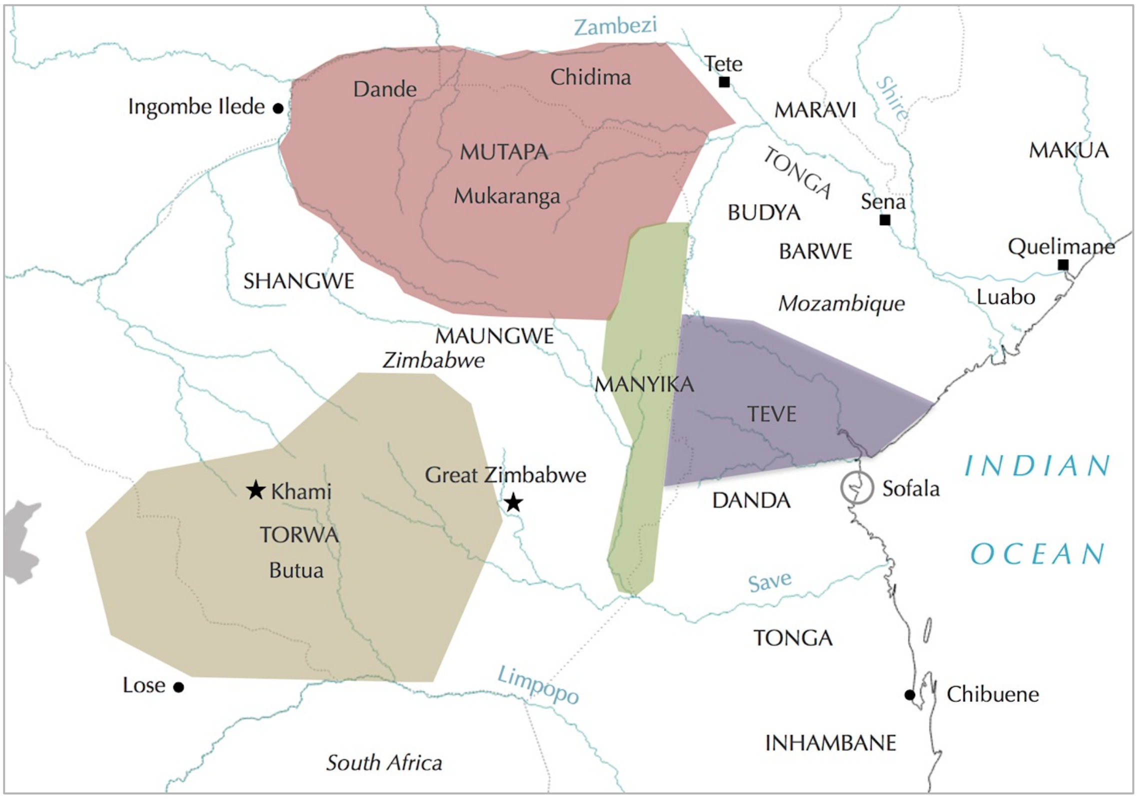

FIGURE 2.11 Approximate extent of the Torwa state (after Huffman 2007), and the Mutapa, Manyika and Teve polities (after Mudenge 1988).

Also prior to the eventual fall of Great Zimbabwe, the Mutapa state was growing in the north of the plateau (Figure 2.11), and far more is known about this polity because of the proximity of Portuguese observers. It is frequently suggested that the origins of the Mutapa dynasty lay in Great Zimbabwe, and it is here that oral traditions begin to play a role in the understanding of regional developments. Mutapa traditions speak of how their leader, Mutota, moved north from the 'Guruhuswa' region (meaning "area with tall grass") to the north (Abraham 1962; Pikirayi 2013a). As this may be identified as the south-central or south-western plateau area (Garlake 1973), some interpret this to mean that the last king at Great Zimbabwe became the first Mutapa ruler. Huffman (2007, 425), however, notes that "the present data neither support nor refute the hypothesis that a Great Zimbabwe dynasty relocated north to start the Mutapa state". Whatever the origins, there is agreement that the northward extension of the Zimbabwe culture was in some way related to economic factors, including gold, ivory and cattle (Beach 1994; Pikirayi 2013). The basis of the Mutapa economy was agriculture, while Portuguese documents make it clear that cattle retained importance, with large numbers recorded for elite ownership of cattle. The Mutapa utilised the Zambezi trade route to the coast (Figures 2.6 and 2.11), providing it with comparatively straightforward access to the inter-continental trade network. Yet the relative importance of gold mining in the Mutapa state operated on a considerably smaller scale than in the Zimbabwe state or in the contemporary Torwa polity (Phimister 1976), and the resultant limited surplus wealth is matched by the reduction in scale of prestige buildings from the sixteenth century onwards (Pikirayi 2001).

FIGURE 2.12 East African connections to the Indian Ocean trade network after *c*. AD 1500.

By the end of the fifteenth century, knowledge of events in the interior increases. The Mutapa state was expanding by 1490, and from then until 1506, a civil war took place involving a usurper, as well as the Torwa polity (Alçacova 1506; Beach 1998). Upon first contact, Portuguese accounts show that the Mutapa state occupied much of the northern plateau (Figure 2.11). Although there is evidence that the state reached the coast south of the Zambezi delta by the 1550s (Beach 1994), the state lost authority in the Eastern Highlands and on the Mozambique coast. Important in this process were the three breakaway territories of Manyika, Teve and Danda (Figure 2.11), of which Friar João dos Santos wrote:

> "The kingdom of Monomotapa is situated in the lands of Mocaranga… all of which lands formerly belonged to the empire of Monomotapa, and at present are divided into four kingdoms, viz. the kingdom of Quiteve [Teve], the Kingdom of Sedanda [Danda] and that of Tshikanga [Manyika]. This division was made by an emperor of Monomotapa, who not wishing to, or not being able to govern such distant lands, made three of his sons governors thereof" (Santos 1609, 273).

The Portuguese proved to be a key player in southeast Africa from the early-sixteenth century (Figure 2.13). They introduced guns and disease, intermarried with African communities, and impacted upon the nature of trade, food production, warfare and political succession (Newitt 1995). The first Portuguese settlement was established in 1505, when Pero d'Anhaia established a fort and factory at Sofala with the intention to control the regional gold trade. As part of the expansion of their *Estado da Índia*, forts were also established further north on Mozambique Island and after intense conflict with the Muslim inhabitants of Kilwa (Figure 2.12). The road to Portuguese commercial supremacy in southeast Africa, however, was not a simple usurping, and after only 10 years it was reported that the profits from the trade were not even sufficient to pay the overheads of the settlement (Newitt 1973). First-hand accounts such as that of Antonio Fernandes (1515) demonstrate that Muslim traders outmanoeuvred the Portuguese in the interior as they continued to trade with the Mutapa state and Manyika kingdom at *bazaars* (marketplaces) which had been developed earlier around gold mining centres.

Between *c*. 1506-1515, it was reported that the lands from the coast to Manyika, Barwe and the Mutapa state were in a state of relative peace (Almada 1516). Following this period of calm, however, the first evidence becomes available of Portuguese meddling in African politics with their backing of chief Nyamunda of the breakaway Danda polity. Some Portuguese supplied Nyamunda with firearms, after which his power grew markedly until it overran much of the territory around Sofala (Newitt 1995). Nyamunda sought to control the trade between the Portuguese, the Mutapa and Manyika in order to contain the strength of his neighbours, and so began to disrupt trade routes to and from Sofala. At the same time, gold production in the interior dropped markedly, for Portuguese traders made little effort to understand the nature of the local market, but instead sought to extract very high profits from European cloth which was not in demand (Bhila 1982). A number of the Portuguese population were also driven by individual motive. '*Sertanejos*', or backwoodsmen, undermined their gains by underselling goods to make their personal fortunes using Muslim traders as middlemen (Bhila 1982). With the trade disturbed, disagreements intensified into a civil war between the Danda and the Mutapa and Manyika polities, which left the Portuguese at Sofala under a blockade (Newitt 1973). The Portuguese were eventually forced to spend considerable effort undoing their interference, by which time Sofala had become an economic backwater (Beach 1994; Newitt 1995). Bhila (1982) also claims that drought and food shortages were a cause of the civil war on the basis of food shortages at Sofala, but the possibility and precise pathway of this linkage are unclear.

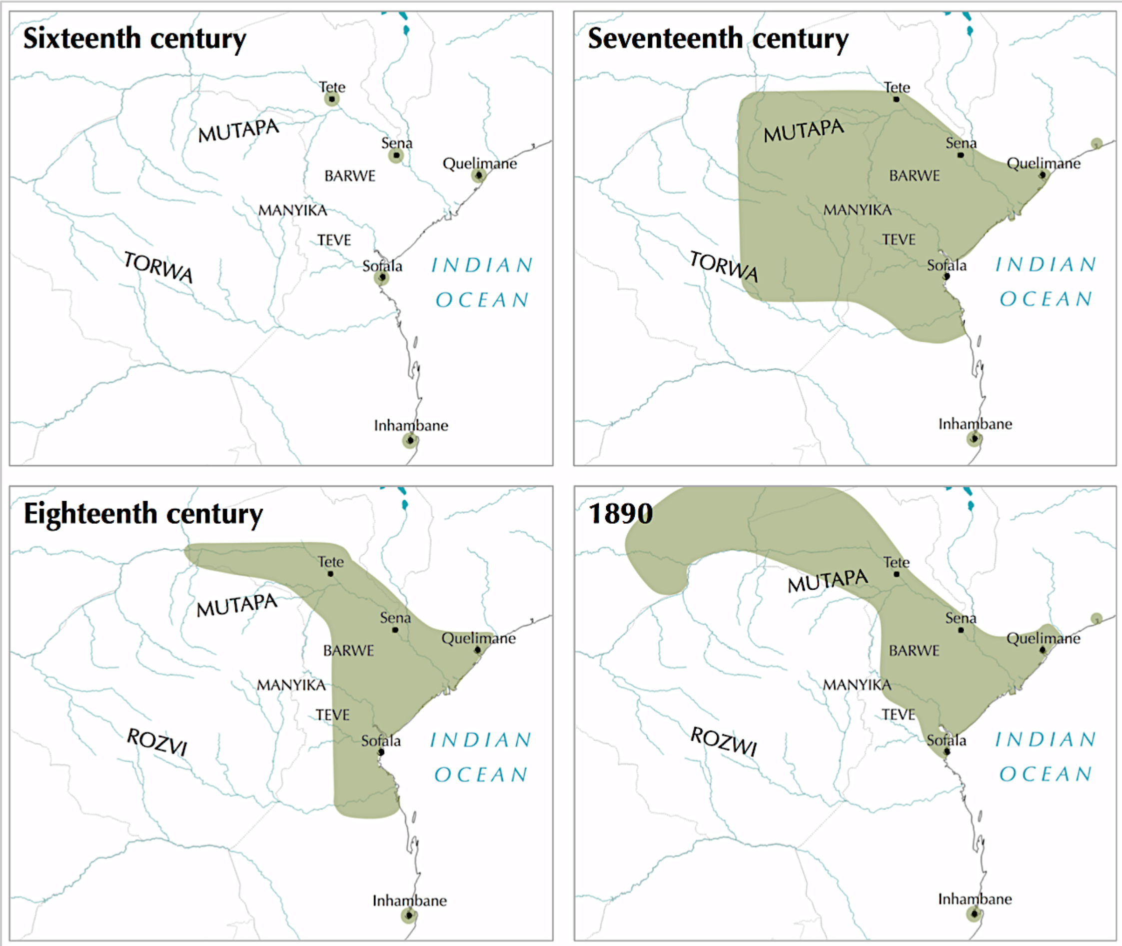

FIGURE 2.13 Portuguese influence in southeast Africa. Adapted from Newitt (1973).

By 1530-1531, a Portuguese factory had been established at Quelimane, the main entry point to the Zambezi, and Vicente Pegado ordered the founding of Sena and Tete, the first Portuguese settlements on the Zambezi (Figure 2.13). By the early-1530s the development of Mutapa-Portuguese relations were also underway. After their failed attempt at channelling trade through Sofala, the Zambezi settlements aimed to promote a deeper involvement in the gold-producing areas of the interior. In the 1570s, the Portuguese established overlordship over a number of the Tonga-speaking small-scale chiefdoms proximate to their Zambezi settlements. Although the European population was nearly always in the low hundreds, seventeenth century estimates put the number of Tonga warriors that the Portuguese could draw upon at Sena and Tete at 30,000 and 8000 respectively (Rezende 1634). This demanded food, and consequently an abundance of documentary material on food production in the Zambezi valley as the Portuguese began to expand their agricultural activities. The Mutapa state enjoyed a period of political stability from 1530-1550, with only minor conflict between the state and the Teve polity, while a revolt amongst the Zambezi Tonga communities against the Mutapa state began in *c.* 1550 (Beach 1994). Compared to other periods, though, the early- to mid-sixteenth century was relatively peaceful.

2.2.3.5 Conflict, famine and 'climatic instability' on the Zambezi (c. AD 1560-1600)

In 1560, Father Dom Gonçalo da Silveira led a Jesuit mission to the Mutapa *zimbabwe* to convert Mutapa Negomo, a young and impressionable ruler who had recently succeeded his father. Silveira's spiritual influence over the Mutapa upset a number of interests in the state. Traditional Shona leaders, a vital component in the political cohesion of the state, were dismissed as frauds by the mission (Mudenge 1988). Moreover, Muslim traders sensed the danger of having Silveira so close to the Mutapa ruler, for his intolerance of Muslims would have consequences on their presence and trading activities. Those with common interests formed an alliance and influenced Negomo into believing Silveira was a wizard who, among other things, would bring drought and famine to the country, and upon this his death was sealed. This situation made for an uneasy relationship between the Mutapa, Portuguese and Muslim populations, and contributed to the formulation of the expansionist policies and armed intervention pursued by the Portuguese for the next two decades, when widespread conflict erupted. Newitt (1995) adds this event marked the commencement of a major phase of 'climatic instability' in southeast Africa, involving recurrent famine and locust plagues in the Zambezi valley, and reports of cannibalism among the 'Zimba' north of the Zambezi (Newitt 1995; Pikirayi 2003).

In 1569, Francisco Barreto was appointed leader of an expeditionary force in the conquest of Mutapa by the Portuguese Crown and the expulsion of Muslim traders from the area. Barreto's army arrived at Sena from Mozambique Island in 1571, and their first target was the Tonga, whose revolt against the Mutapa was an inconvenience to Portuguese economic activities (Beach 1980). The Tonga hid their already depleted food supplies from the invading force, and small meat rations were all that was available to feed Barreto's army. So weak was Barreto that he relieved his frustrations by allowing a massacre of any Muslims in sight. Francisco de Monclaro, a priest who accompanied the expedition, stated that Barreto took 17 Muslims prisoner, whom he:

> "Convicted and [had] slain with strange inventions. Some were impaled alive, others tied to trees in the extreme branches thereof, the branches being forcibly brought together and then released, the victim being thus rent asunder. Others still were cut up with axes from the back, others with bombards, all this serving to strike terror and astonishment into the people of the land" (Monclaro 1573, 236).

These acts substantially reduced Muslim presence up the Zambezi, which together with growing Portuguese dominance of the coast, left them in control of the inter-continental trade. In their attempted conquest over the Mutapa state, however, the expedition had less visible success, and although the Mutapa ruler Negomo appears to have ceded some of his outlying wards adjacent to Tete to the Portuguese (Newitt 1995), a high number of the 700-strong army of musketeers perished, and only a "rabble of malcontents" returned to Sena (Mudenge 1988), Barreto died in Sena in 1573, and was succeeded as leader of the expedition by Fernando Vasco Homem, whose interest turned to the goldfields of the Manyika kingdom. His expedition set off from Sofala with 412 men, and defied the ruling Quiteve of the Teve polity by marching through his territory to reach Manyika. The Quiteve was opposed to this, fearing that his own ivory-oriented trade would be diminished if formal trade with the lucrative goldfields of Manyika was established. Conflict broke out between Homem's force and Quiteve's army, but the Portuguese triumphed and Quiteve abandoned his *zimbabwe*. Upon reaching the Manyika kingdom, Homem signed a friendship treaty which gave the Portuguese free access to the mines and to barter for gold, although the low price of gold, geological problems, and technological restrictions meant that the famed gold mining region of Manyika provided a reality check for the Portuguese:

> "Our men finding themselves in the country where report said everything was gold, expected to find it in the streets and woods, and to come away laden with it. The governor saw the difficulty with which the Kaffirs extracted the gold… the risk being so great that every day numbers were in imminent danger of being buried in the mines, it being altogether a poor and miserable business" (Couto 1616, 389).

The Portuguese force withdrew in 1575, and by the 1580s the situation in the Mutapa state itself seemed not altogether different as it was before Barreto's arrival. Yet a key socio-economic impact of expanded Portuguese-Mutapa contact was that a number of *feiras* (markets, or fairs) were established from the last quarter of the sixteenth century onwards (Figure 2.14), which formed a dominant part of trade relations on the Zambezi and in the interior. The main three *feiras* at the end of the sixteenth century in the Mutapa state were Luanze, Bocuto and Massapa, while in Manyika the most important *feira* was Chipangura, each of which was occupied by a small Portuguese population. At Massapa, near the Mutapa's *zimbabwe*, a captain was elected to ensure that the trade kept moving and that the Mutapa received presents to keep good relations. While peace and relatively smooth trading operations prevailed until the mid-1590s, the *feira* system meant that the Portuguese were closer than ever to the Mutapa state, and this proximity was matched by growing influence (Newitt 1995).

In the late 1590s, incursions of Maravi (Malawi) armies on Mukaranga became frequent, which created new instability south of the Zambezi. The encroachment of these warriors on the Mutapa state led Negomo's successor, Gatsi Rusere, to enlist the support of the Portuguese. These first invaders were pushed back, and on their retreat destroyed the food they came across so that the Mutapa-Portuguese force could not sustain its chase. In the first of a series of decisions that led Beach (1980) to question the sanity of the Mutapa ruler, Rusere had his commanding officer put to death for giving up the chase. This unpopular decision triggered a revolt, led by Matuzianhe, and relentless civil war, which led Rusere to increasingly rely upon Portuguese at the *feira* to maintain his position. At the same time, a second wave of Maravi warriors crossed the Zambezi, but were driven away by a Mutapa-Portuguese force, a result which pleased Rusere who then relaxed the ban on Portuguese carrying firearms in the state (Beach 1994). Ravaged by the ongoing civil war, Rusere once again appealed for assistance in 1606. One powerful Portuguese, Diogo Simões Madeira, raised an army to aid the Mutapa in return for concessions, among which included the ceding of all the mines in the state to the Portuguese (Newitt 1995). While this was undoubtedly a triumph for the exploitative intentions of Madeira, this was a disastrous outcome for the security of the state. Temporarily relieved, Rusere went on the offensive against the Barwe polity, and on the way attacked the Tonga who were now under Portuguese jurisdiction. At the same time, Matuzianhe made further gains against Rusere's forces, and it was only when Madeira drove back his army that Rusere could recapture his capital in 1609 (Mudenge 1988).

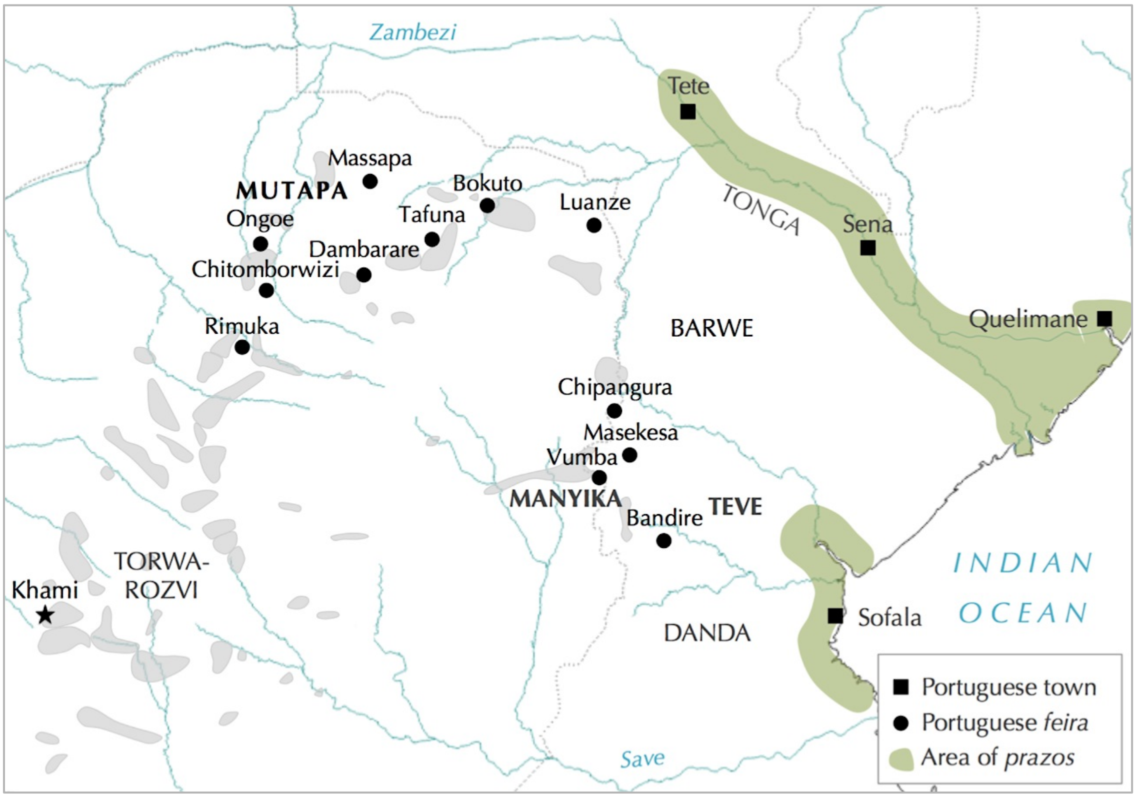

FIGURE 2.14 Portuguese *feiras* of the sixteenth and seventeenth centuries, and greater area of seventeenth century *prazo* society.

2.2.3.6 Portuguese dominance in the seventeenth century

The outcome of this intensified period of conflict was that Gatsi Rusere, now of diminished prestige, controlled a state substantially weakened by civil war on the one hand, and faced by increased Portuguese ambition after the ceding of the mines on the other. The treaty resulted in an influx of private Portuguese traders into the area, and the opening of new *feiras* and mining camps, which were later fortified and acted as centres of military activity. Rusere's attitude towards the lawless Portuguese hardened, and until his death in 1624, he maintained his rule by exploiting divisions within the factional Portuguese population. Yet the precedent of the last two and a half decades set the tone for the rest of the century, and rulers were now faced with the choice of an all-African policy to contain the power of the Portuguese, or to rely upon costly Portuguese assistance to maintain their rule (Newitt 1995). Gatsi Rusere was succeeded by his son, Nyambo Kapararidze. In 1628, Kapararidze confronted the Portuguese in the state militarily, allegedly because his tribute (*curva*) payment was delayed, but was forced to retire in 1629 after heavy losses against the high number of Tonga soldiers under Portuguese command (Mudenge 1988). The Portuguese overran Kapararidze's *zimbabwe*, and appointed Mavura, the first of whom some call the 'puppet' Mutapa rulers, as his successor. The price for this support was that the Mavura had to sign a treaty of vassalage to the Portuguese Crown, meaning the ruler was now effectively a Portuguese client. Rather than receive tribute, Mavura was expected to pay tribute to the Portuguese, who were now to have the final say in political succession in the state. Moreover, in addition to Negomo's earlier land grant around Tete, more lands surrounding the town were annexed by the Portuguese Crown and turned into estates, or *prazos* (Figure 2.14) (Mudenge 1988; Newitt 1995).

Prazos operated on a system of lease as in a manorial economy, and extended over a considerable area in the Portuguese jurisdiction (Figure 2.14). Portuguese *prazo*-holders were thus elevated to the traditional positions of chiefs, or '*senhors*', over much of the Zambezi valley and its predominantly Tonga-speaking population. *Senhors* collected tribute, controlled game rights, chose headmen, and controlled justice and the performing of certain ritual functions (Newitt 1973). As the formerly small hinterlands of Portuguese settlements expanded into large tracts of Crown-owned land, their growing numbers of inhabitants were classified into two broad groups: '*colonos*' and 'slaves' (Newitt 1973). *Colono* was the Portuguese word used to describe free Africans residing in the crown lands, whose rights to marry, have children and be allocated land were retained, while still being ruled by a village headman (Newitt 1973). The major difference, however, was that a fixed amount of tribute now had to be paid to the profit-seeking *prazo*-holder instead of an African chief. According to Newitt (1995), 'slavery' in the pre-nineteenth century Zambezian context was very much an economic term. A slaves activities ranged from tasks like mining and hoeing gardens to the administering of the *prazos*, commanding military forces, and trading expeditions. As well as those slaves taken as captives through the raiding of decentralised polities, a high number submitted to the Portuguese for security, which in turn required the upkeep of a robust food supply to hold the groups together (Newitt 1995).

Kapararidze united African feeling against the Portuguese, and along with the Manyika polity he fought back in 1631, but his eventual defeat came against Sousa de Meneses in mid-1632 (Mudenge 1988). The Portuguese then asserted authority in Manyika, where they killed the ruling Chikanga and installed another ruler on the throne, who then agreed to a vassalage treaty. Teve was also ruled by a Portuguese nominee called Peranhe, who was later renamed Dom Sebastião in gratitude of Portuguese assistance. In return for armed intervention to secure his position in the 1640s, the whole northern part of the kingdom was ceded to the Portuguese warlord Sisnando Dias Bãyao. In 1644, Bãyao and the Portuguese were also involved in a civil war in the Torwa state in an intervention which meant that they had now altered the political structure of each of the main centralised polities in the Zambezi-Limpopo region. When a junior brother failed to usurp the king, he sought help from the Portuguese, whereupon Bãyao took an army to support him in the hope of establishing new trade relations. Although it is unfortunate that no one literate was involved in the campaign, or that nobody wrote about it, it is known that Bãyao's army won (Beach 1980). Upon the sacking of Khami, Bãyao left for Sena to prepare for the new trade, but died soon after, while the army disappeared (Huffman 2007). Beach (1980) notes that after the civil war, no ruler appears to have been able to control the fragmented Torwa area, while the last date for Torwa rulers controlling the southwest was 1683.

Mutapa Mavura died in 1652 and was succeeded by his son, but in 1663, the *prazo*-holders on the Zambezi fought and killed him, upon which Mukombwe became ruler of the state. In terms of prestige, wealth and size, the decline of the Mutapa state to this point was profound. Involved in this was the gradual loss and depopulation of Mukaranga, its well-watered arable and grazing lands, and the small amount of gold that remained. Although originally backed by the Portuguese, Mukombwe adopted a more independent stance, and in 1678 he refused to recognise vassalage to Portugal. Mukombwe also seems to have encouraged the Tonga near Sena to rebel in the 1660s, and by the early-1680s the Mutapa threatened Portuguese settlement on the Zambezi.

2.2.3.7 The rise of the Rozvi and its impacts

The Rozvi at Danangombe reunited the Torwa area in the late-seventeenth century, and although much smaller (Figure 2.11), the state was built upon the foundations laid by its predecessor. The polity is best remembered for its campaigns against the Portuguese under its leader Changamire Dombolakonachingwango. The Portuguese, learning of Changamire's power, planned to combine forces with Mutapa Mukombwe and destroy him. Mukombwe invaded the Rozvi area but was easily dispersed by Changamire, and died shortly after in 1692. According to Conceição's *Treatise on the Rivers of Cuama*, the best source on the Rozvi, Changamire supported the claims of Nyakunembire as Mutapa ruler, while the Portuguese had groomed a different son of Mukombwe named Dom Pedro. Nyakunembire enlisted the help of the Rozvi to enforce his rule, and Changamire's army thereafter destroyed the *feira* of Dambarare in 1693, which caused the Portuguese in Mukaranga to flee to the Zambezi towns upon hearing the news. Changamire thereafter pursued a policy of the total expulsion of the Portuguese from the interior, and it was probably only his death in 1696 that prevented the Rozvi from marching on Sena (Newitt 2009). The Rozvi state itself continued into the early nineteenth century with an economy primarily based on agriculture and herding (Phimister 1976). Huffman (2007) argues that the Zimbabwe culture only continued to exist by way of the Rozvi state, as it was largely independent of Portuguese influence. Presumably, as sacred leadership is said to have continued in the Rozvi state, so did the tying of rain to political rule and thus the interpretation of dry spells. Where Huffman (2007, 2014) differs with others, particularly Beach (1998), is that he believes 'collateral' political succession started in the Mutapa area and with it went sacred leadership, though it is unclear whether Huffman believes that the Zimbabwe Pattern ideology of rainmaking also broke down here. This is a crucial point if the changing interpretation of dry conditions are to be understood.

After Changamire's death, rival political groups struggled for power in the Mutapa state, with one backed by the Portuguese and another by the Rozvi. Mudenge (1988) states that between 1694-1709, nine rulers took and lost the leadership, and the eventual ruler following these civil wars was Samutumbo Nyamhandu, who ruled until 1718. The politics of the state were then dominated by a persistent struggle between two 'houses': Nyamhandu and Boroma. Mudenge (1988) adds that the Rozvi were too far away to play any real role in the state after 1702, while the Portuguese were ultimately unable to take advantage, leaving the state relatively independent from around 1720 onwards. One key change during Nyamhandu's reign, however, was that the state shifted from Mukaranga to the dry Zambezi lowlands in the Chidima area (Pikirayi 2003). In Manyika, the immediate consequence of Changamire's attack on the *feira* of Masekesa was that trade now centered on Teve, which was never free of Portuguese influence despite attempts to shake it off, and before long *prazos* and gold trading centres were opened up. The Rozvi retained political authority in the Manyika kingdom for at least a decade, and probably until the mid-eighteenth century (Bhila 1982). Masekesa, however, was re-established in 1719, but under different terms to its previous operation, meaning that Manyika rulers exercised more power with Rozvi support, thus avoiding the loss of sovereignty and political dislocation of the previous century. To these ends, the era of Portuguese dominance in the African polities seemed well and truly broken (Beach 1994; Newitt 1995, 2009).

In the late-eighteenth century, political instability became predominant in the Mutapa state. Between 1751-1766, João Moreira Pereira reported that there had been six Mutapa rulers and that the country was plagued by civil war. This led to a breakdown in political authority, as central power structures could not be built up, and once again social and political organisation at the upper levels of the state became paralysed. Newitt (1995) adds that for around a decade from 1759, the middle Zambezi was affected by drought and locust swarms, which apparently led to banditry becoming commonplace, and served to disrupt trade and dislocate social networks. In addition to this, the state practically fragmented into two areas, Chidima and Dande (Figure 2.11), after the 1760s. Peace was restored in 1769, and the period from then to 1806 saw only three Mutapas. Yet this low number was not indicative of political stability, for a bitter and protracted power struggle between rivals Changara and Ganyambadzi ensued throughout much of the rest of the century. According to Mudenge (1988) and Newitt (1995), a severe drought hit the Zambezi area in 1795 and persisted until around 1800. Mudenge links this to the beginning of the end for the Rozvi state in the southwest, while in the Chidima area, the drought was reported to have impoverished traders. At the same time, a chief in the area attacked Zumbo which led to its abandonment. As a result, trade, and consequently the flow of goods into the Mutapa polity declined, while the Portuguese that did maintain contact with the state became more interested in slave raiding to feed the expanding slave trade on the Mozambique coast (Newitt 1995). Rozvi power gradually receded in the early decades of the nineteenth century, and after several encounters with movements of Nguni-speaking agropastoralists from the south, the polity succumbed (Beach 1994). The Teve and Manyika polities were also impacted by raiding in the 1830s, though Newitt (1988) claims that it was drought and famine that brought about the demise of the traditional and commercial life in the Zambezi-Limpopo area. Later in the nineteenth century, the Portuguese eventually came to overpower the Mutapa, Manyika and Teve polities.

2.2.4 Climate and Zambezi-Limpopo socio-political transformation: key questions

Changes in moisture availability have been strongly linked with moments of socio-political change in this region prior to the availability of written sources. A relatively speculative correlation of dated archaeological records and palaeoclimatic change has, to an extent, deepened in sophistication towards the consideration of socio-cultural interactions with climatic stress. Nevertheless, a considerable proportion of scholarship relies exclusively upon the ambiguous signals of a limited range of palaeoclimate proxy data to demonstrate that abrupt climatic changes were drivers of change (Hannaford 2014). These general conclusions built on correlation can be misleading, and tend to overlook the interactive relationship that exists between climate and society leading to a portrayal of humans as passive recipients of climate change. Clearly, the state of the climate itself is crucial, but is far from the only important factor. Simple cause–effect models are therefore inadequate, and must consider the socio-economic, political and cultural context for a specific area (Hannaford et al. 2014).

The upsurge in climate-society causal links in recent decades has led some critics to argue that a shift has taken place in contemporary archaeoanthropology and palaeoclimatology towards a growing ‘environmental collapse’ paradigm, which gives primacy to environmental and climatic influence (Middleton 2012). According to Middleton, three broad environmental collapse mechanisms are symptomatic of this paradigm shift. One sees climate as the primary driver of historical change; another views complex societies inducing environmental degradation and exceeding ecological carrying capacity; and the third concerns catastrophic events such as earthquakes. Others have also pointed to a resurgence in climate and environmental determinism. In a seminal paper, Hulme (2011a) notes that the quantitative nature of climate data has frequently led to an elevated position for climate as an explanatory variable in human activity, while humans are often depicted as 'dumb farmers' passively awaiting their fate. Applying this line of reasoning to the southern African past, Hulme's thesis is manifest in that quantitative and credible knowledge of past climate variability has frequently led to a direct transfer of authority regarding its consequences, in some cases allowing little for human agency, adaptation and innovation. Clear examples of this in southeast Africa relate to the abandonment of Mapungubwe and the suggested climate-driven migrations of Nguni- and Sotho-Tswana-speaking communities from East Africa to southern Africa (Tyson et al. 2002; O'Connor and Kiker 2004).

While climate has sometimes been depicted as a grand narrative, albeit perhaps unintentionally, it is equally the case that others have dismissed the role of climate as background noise, relegating environmental interaction to a footnote in human history (Hulme 2011a). For instance, in the period after 1505 when written sources become available, there has been less focussed attention regarding climate-society linkages. This in part relates to the points raised in Section 1.2, but notwithstanding the fact that cultural choices were pivotal, there is a risk of disconnecting from the reality that the climate of southern Africa is highly variable and that drought is a factor that influenced the decision-making of its pre-colonial population. The dearth of detailed historical climate-society scholarship in this period perhaps also stems from the skewed focus of the written sources towards trade and Mutapa-Portuguese relations. This has led many to prescribe the events of the sixteenth to nineteenth centuries to the destructive nature Portuguese influence (Mudenge 1988; Beach 1980, 1994; Pikirayi 2001). Certainly, the Portuguese played a key role in degrading the sovereignty and prestige of the Mutapa, Manyika and Teve polities, and serve as prime examples of the destructive influence of the Portuguese on complex African society, yet to look at the Portuguese as the only stressor is misleading, as internal processes and events had a significant influence here too. According to Hulme, these contrasting positions comprise the opposing fallacies of climate 'determinism' and 'indeterminism', where the former has commonly been adopted by geographers, palaeoclimatologists and archaeologists, and the latter by historians (Judkins et al. 2008; Hulme 2011a). Still, rather than a widespread revival of climate determinist explanations, the scepticism surrounding climatic causes may be in part due to the language employed and its narrative power. Indeed, there is inherent difficulty in understanding causality in the distant past, and the complexity in communicating findings to numerous fields and sub-fields can result in suspicion.

In spite of the above critique, it is perhaps surprising that climate has been given such limited consideration after 1500 given the continued importance of subsistence agriculture, while the seventeenth and eighteenth centuries appear to have been the coolest and driest part of the LIA (Stager et al. 2013) (Figure 2.15). The work of Newitt (1995) and Pikirayi (2003) are rare exceptions to this, yet are not without their problems. Neither study incorporates scientific data into consideration of reported climatic stress, while the specific pathways through which this stress impacted upon socio-political events is often oversimplified as 'dislocation' or 'devastation'.

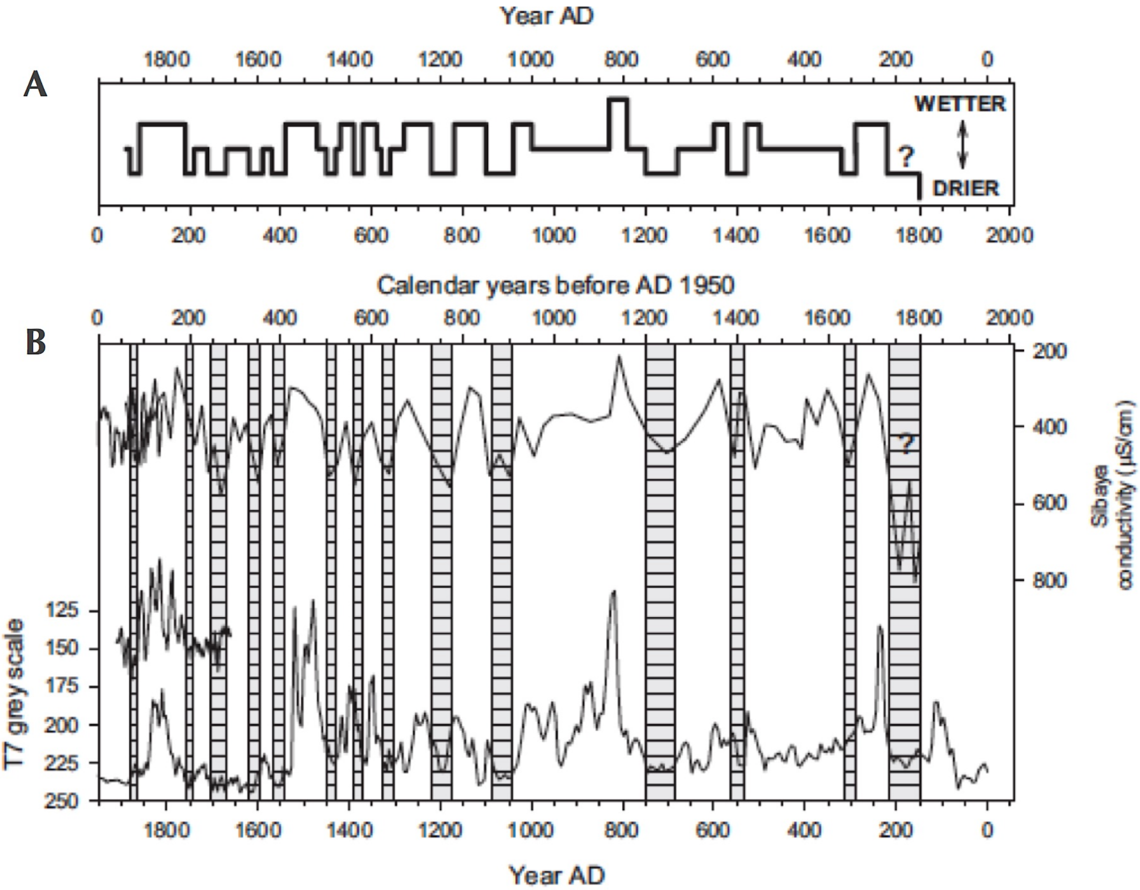

FIGURE 2.15 A. Qualitative summary of palaeoprecipitation and B. Summary of Summer Rainfall Zone palaeoprecipitation inferred from Lake Sibaya, Cold Air Cave T7 stalagmite and Karkloof tree-ring records. Grey hatched bars represent drier periods. After Stager et al. (2013).

This synthesis raises further key research questions to those highlighted at the end of Section 2.2.2, which will be addressed in Chapters 3 and 5, including:

- How might a reanalysis of the wider range of existing palaeoclimate data alter previous climate-related interpretations of socio-political change prior to 1500?
- Was climate variability a significant factor in the decline of the Zimbabwe state?
- Do proxy records of climate variability and Portuguese written records of climate-related events display correspondence between *c.* 1505-1830?
- How did the vulnerability and response of centralised political units, such as the Mutapa state, to climate variability vary and change over this period?
    - How can this be investigated over a *c.* 300 year period?
- How did Portuguese expansion affect the vulnerability of communities to climate variability in the hinterlands of Portuguese settlements, such as Sena and Tete, and later the inhabitants residing on the *prazo* lands?
    - How this compare to the centralised polities?
- What was the societal significance of climate variability in relation to factors such as Portuguese influence in southeast Africa from *c.* 1505-1830?

The next part of this chapter will provide a similar overview for the KwaZulu-Natal area, the second focus region of this thesis.

2.3 Socio-political transformation in KwaZulu-Natal (*c.* AD 1760-1840)

The years from *c*. 1760-1840 constitute a discrete period in the history of southern Africa (Wright 2010). This notion is particularly true of the predominantly Nguni-speaking population in the area that forms present-day KwaZulu-Natal in the southeast of South Africa (Figures 1.1 and 2.16), where between the mid-eighteenth century and the 1830s small-scale chiefdoms developed into centralised kingdoms, such as the Zulu, Ndwandwe, Gaza and Ndebele. This section provides environmental, economic, social and political context to this area, and synthesises hypotheses on the causes of the heightened violence, migrations and state formation in these decades.

2.3.1 Physical geography and environment

The area under consideration in much of this second part of the thesis lies between the Phongolo and Thukela rivers. However, this period was characterised by change across much of southern Africa, and therefore the greater area of concern here is the land bounded by the Great Kei river, the Kalahari Desert, Delagoa Bay and the Indian Ocean (Figure 2.16). The physiographic configuration of this area is pronounced. The Great Escarpment and the Drakensberg range – which peaks at heights of up to ~3500 m in the South Africa-Lesotho border region – separates the interior highveld from the narrow strip of low-lying coastal plain. Consequently, a series of aligned river catchments, the main being Mfolozi, Thukela, Mhlatuze, Mkuze and Phongolo, run from west to east into the Indian Ocean. These rivers have cut deep valleys on their westward journey to the ocean, the sides of which are fed by incised streams. This means that a great deal of the well-watered land eastwards of the Great Escarpment is 'broken country', often viewed as favourable for human settlement (Mitchell 2002).

The region's basement geological formations of granite and gneiss have undergone considerable tectonic disturbance and have been metamorphosed from their original forms. These formations are predominantly overlain by quartzitic sandstones (Hall 1981), commonly divided into the Beaufort, Ecca, and Natal groups. Beaufort group sandstone and mudstone forms the foothills of the Drakensberg escarpment (Figure 2.16), adjacent to which on the coastal side is Ecca group shale and sandstone and a narrow band of Dwyka tillite. This separates these groups from the older Natal group sandstone and Natal Metamorphic granite and gneiss, which dominate a ~100 km stretch of land from the coast south of Cape St Lucia. North of this, the coastal regions are mainly underlain by Drakensberg group basalt and dolerite, with a ~50 km band of silt and unconsolidated sediment dominating the coast. In contrast to the Zambezi-Limpopo area, however, non-ferrous ores are less abundant.

As is the case in the Zambezi-Limpopo region, soils are closely related to the underlying geological formations. The most fertile soils are found on the clay-rich Beaufort sediments, which have a high agricultural potential, although these soils have poor moisture retention where the land is characterised by steep slopes, as well as being highly erodible. Ecca and Dwyka sediments also provide good agricultural soils on the less steep slopes of KwaZulu-Natal. Less fertile are the Natal group sandstone and Natal granite sediments between about the Mhlatuze to Mzimvubu rivers, which are coarser and shallower. Soils on dolerite, however, provide very good agricultural potential except on steeper ground. Beyond the dunes in the area of coastal sands north of Cape St Lucia, medium-textured red soils also have high agricultural potential.

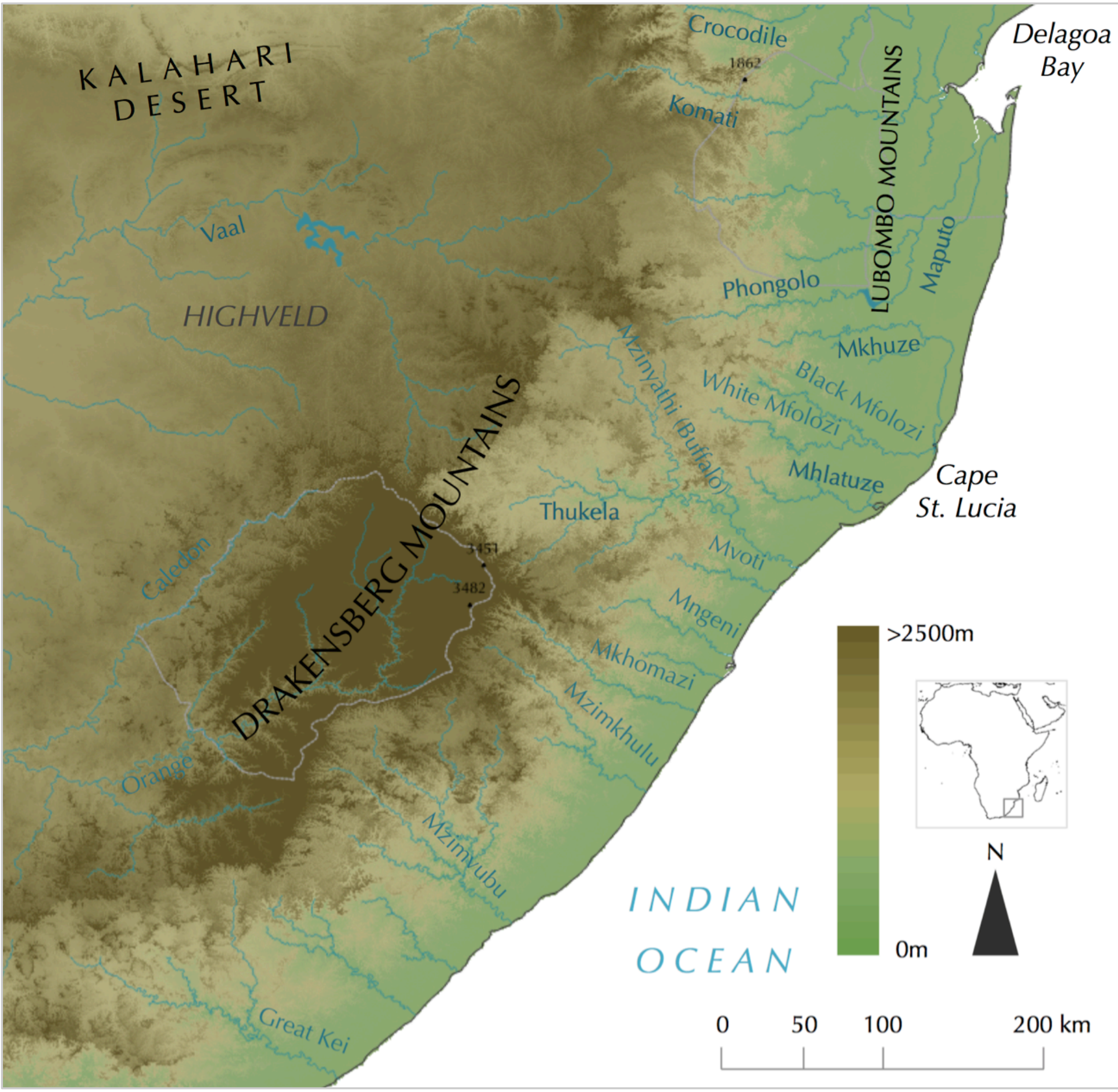

FIGURE 2.16 Physical geographical features of the greater KwaZulu-Natal area.

As well as soils, vegetation was of prime importance for grazing. A number of different vegetation types are found in KwaZulu-Natal, though these have been subject to considerable change over the second millennium by the impacts of human activity (Neumann et al. 2008). The region was heavily wooded prior to the arrival of the first farming communities; when dense bush and forest dominated the wetter coastal and higher altitude areas, while the drier river valleys and the area to the west of the Lubombo mountains (Figure 2.16) were covered with savanna-type vegetation. Much of this was replaced by grassland over the course of the second millennium, particularly inland, although the area remained sufficiently wooded to provide fuel and materials for construction (Guy 1994). In the river valleys, where rainfall is lower, savanna commonly known as bushveld is found adjacent to the rivers. In the well-watered upland areas where the sources of the rivers are found, 'sweetveld' grasses are common in the understory of forests, and provide nutritious and palatable grazing throughout the dry winter months (Guy 1980). On the contrary, 'sourveld' is found in the higher rainfall regions such as the coast and the highlands, where maximum nutrition is present only after the spring rains. Between the two types is also mixed veld, which provides good grazing for around six months in the year. Guy (1980, 1994) suggested that the high concentration of these different grazing types in KwaZulu-Natal made it an unrivalled region for stock-keeping, as herders could move cattle between the different grasses over the course of the year. Indeed, earlier archaeological evidence revealed that on a broad scale, homesteads tended to cluster in areas with access to both sweetveld and sourveld (Hall 1981). In addition, the trypanosomiasis disease carried by tsetse fly was confined to the border areas of the region and the deepest river valleys, which also made KwaZulu-Natal ideal for herding.

As well as differences in human vulnerability, the physical environment meant that drought had variable impacts upon the population of KwaZulu-Natal. As with the rest of the SRZ, drought is critical in the January to April period when grain crops are filling out, yet risk of moisture stress is comparatively lower in the coastal areas south of Cape St. Lucia (Figure 2.16). This is because these littoral areas have high humidity throughout the year, and so periods of excessive rainfall are equally harmful to human activity, where flooding of poorly drained areas of the coastal plain can reduce the area suitable for cultivation (Hall 1981). By contrast, the risk of drought is higher in the drier river valleys and highlands. Negligible rainfall is received in winter in these areas, and therefore low summer rainfall can impact negatively upon biotic productivity for several months after the immediate drought has passed. Through its differential spatial impacts, climatic stress similarly impacted stock-keeping and the balance between lowland and upland grazing, which requires nutrient supply throughout the year.

Overall, it is clear that the physical environment of KwaZulu-Natal provided certain advantages for agropastoral communities. Its humid, sub-tropical climate, permanent rivers, and varied distribution of woodland, grassland and arable land provided opportunities for mixed farming and widespread settlement, while tropical diseases were confined to its border regions. Nevertheless, climate variability, which manifested through either too little or too much rainfall, did impact upon crop cultivation and grazing in different parts of the region.

2.3.2 Economy and society

In contrast to the Zambezi-Limpopo region, written information, although limited, provides information on the economic and socio-political structure of Nguni-speaking communities before and after their transformation between the mid- to late-eighteenth and early-nineteenth centuries, if not on the process of change itself. Evidence prior to the mid-eighteenth century comes from archaeological records, historical linguistic studies and a small number of documents, all of which have considerable limitations of depth. Pre-nineteenth century written accounts are scarce in this area in comparison to the Zambezi-Limpopo region as it lay south of the Indian Ocean trade zone, and the majority derive from accounts of shipwrecked travellers. However, these exceed the quality of the aforementioned Arabic documents, and contain important information to supplement archaeological data on economic and socio-political organisation from as early as the sixteenth century. After the 1820s, a much greater body of written and oral evidence is available for KwaZulu-Natal, largely due to the increased European presence in the expanding Cape Colony. This background will therefore adopt a less 'ahistorical' approach than Section 2.2.2, and will consider the socio-political and economic situation both prior to the mid-eighteenth century and in the 1820s, when written sources make reference to socio-political structures akin to kingdoms or states.

2.3.2.1 Socio-political organisation

Written and archaeological evidence has led most scholars to rule that socio-political organisation was confined to small-scale units of varying size, population and structure before the mid-eighteenth century (Wilson and Thompson 1969; Maggs 1989; Wright and Hamilton 1989; Huffman 2004; Wright 2010). Although one writer speculates that states comparable to the Shaka's Zulu kingdom existed from an earlier date (Etherington 2001, 2004), narratives of journeys through KwaZulu-Natal and adjacent areas from the shipwrecked crews of the *Sao Thomé* (1589), the *Santo Alberto* (1593) and the *Stavenisse* (1687) do not suggest that this was the case. Similarly, a dearth of archaeological evidence for development towards state formation before the latter half of the eighteenth century reinforces this evidence (Huffman 2004), and rather implies that a high number of small-scale chiefdoms populated the area. According to Maggs (1989), the *Santo Alberto* (1593) account indicates an average width of about 15-20 km per territory, which is comparable with the polities in central KwaZulu-Natal immediately prior to late-eighteenth century state transformation, while others suggest a variable territorial extent ranging from a few hundred to several thousand square kilometres, and a population of a few hundred to several thousand individuals (Wright and Hamilton 1989).

Despite general similarities in the size and population of political units, there were important differences in their organisation. Wright and Hamilton (1989) state that in some chiefdoms, rule consisted of a more distant 'managerial' political and ritual authority, while in others, physical force played a central role under a dominant chief. Common to all units, however, was their make-up of a fluctuating number of villages and communities composed of scattered homesteads (Maggs 1989). Communal bonds were made through ties of neighbourhood, kinship, clientship and marriage, while the chiefdom as a whole was also bound together by ritual, acts of allegiance, and the redistribution of tribute from the chief to politically important followers (Wright 2010).

It is important to note that prior to the mid-eighteenth century, these chiefdoms were generally fluid and insecure entities, with frequent disputes over access to resources such as cattle and grazing land leading to peaceful and violent transition (Maggs 1989). This volatility was in part due to the decentralised nature of polities, and the lack of institutions through which chiefs could effectively command their populations. Accordingly, armed units assembled on a local basis and answered to community leaders, meaning the paramount chief struggled to exercise force over dissident or breakaway factions (Wright 2010). The extent to which coercive power, repression and exploitation could be used by powerful chiefdoms to subjugate others under direct rule was therefore generally restricted, and those that were subordinated still maintained a level of autonomy, often leaving room for fission and fragmentation (Wright and Hamilton 1989).

Several lines of evidence exist to show that marked change had taken place in the last decades of the eighteenth and the first decade of the nineteenth century. This means that when oral traditions begin to offer extensive information in the early-nineteenth century, these mostly relate to the largest groups such as the Zulu and Ndwandwe (Huffman 2004). In addition, the first literate people settled among the Zulu in 1824, when it was an established kingdom, and its forerunner, the Mthethwa polity, no longer existed. Accounts from European traders, notably Henry Francis Fynn, who arrived in Natal in 1824, and Nathanial Isaacs in 1825, provide evidence on Zulu customs, and critical analysis of these in conjunction with oral sources allows a background to be assembled on the economy and society of the Zulu and, to an extent, other political units in KwaZulu-Natal.

Oral histories indicate that in the latter third of the eighteenth century, a shift in the social and political relationships previously described began to take place (Wright 2010). The rulers of some chiefdoms in both the KwaZulu-Natal area and on the interior highveld heightened their power-bases over their own people and other groups, while raiding and conflict underwent an amplification (Wright and Hamilton 1989). In the Phongolo-Thukela area, the Ndwandwe, Mthethwa and Qwabe chiefdoms were expanding, while the Mabhudu chiefdom became established around Delagoa Bay. At the same time, many of the smaller groups had either fragmented, been incorporated into, or subjugated by, the larger polities shown in Figure 2.17 (Eldredge 1992, 2014). Archaeological evidence in the form of an increased number of huts in aggregated settlements, and an increase in stone-built settlements in the interior grasslands of KwaZulu-Natal also suggests that population growth took place during in this period (Huffman 1986b; 2004, 2007; Maggs 1989), while the territorial extent of the main polities was now considerably larger than previously.

As well as territorial expansion, Wright (2010) adds these changes entailed evolving political, social and economic relations between the rulers and ruled. A crucial development in the more centralised polities mentioned above came with the organisation and control of age-sets of young men, known in Zulu as '*amabutho*'. These groups could be controlled for purposes such as military duties and hunting, and as they grew, increased amounts of tribute could be extracted in the form of cattle, young women, and labour, which could in turn be used to expand the *amabutho* further (Guy 1994). In the Zulu kingdom *amabutho* were divided into '*amakhanda*' (barracks) across the heartland of the kingdom, while in the larger kingdoms in general, *amabutho* were used as military units for both expansive operations and to guard cattle, as well as for domestic activities such as construction and the cultivation of the chief or king's fields (Wright 2010; Eldredge 2014). *Amabutho* can therefore be viewed as a 'production unit' which operated on a reciprocal basis under the control of a chief, who in return for increased tribute was responsible for offering protection, sufficient agricultural and grazing land, and crucially the potential to build up the holdings of cattle that enabled men to establish their own homesteads. *Amabutho* were therefore a key advantage and reinforcing aspect in political power, but had to be satisfied by the paramount chief otherwise the premise of the system would be undermined. By contrast, in the less centralised chiefdoms, most of the military force remained made up of local men of all ages, as chiefs struggled to establish firm class distinctions and institutions (Guy 1994).

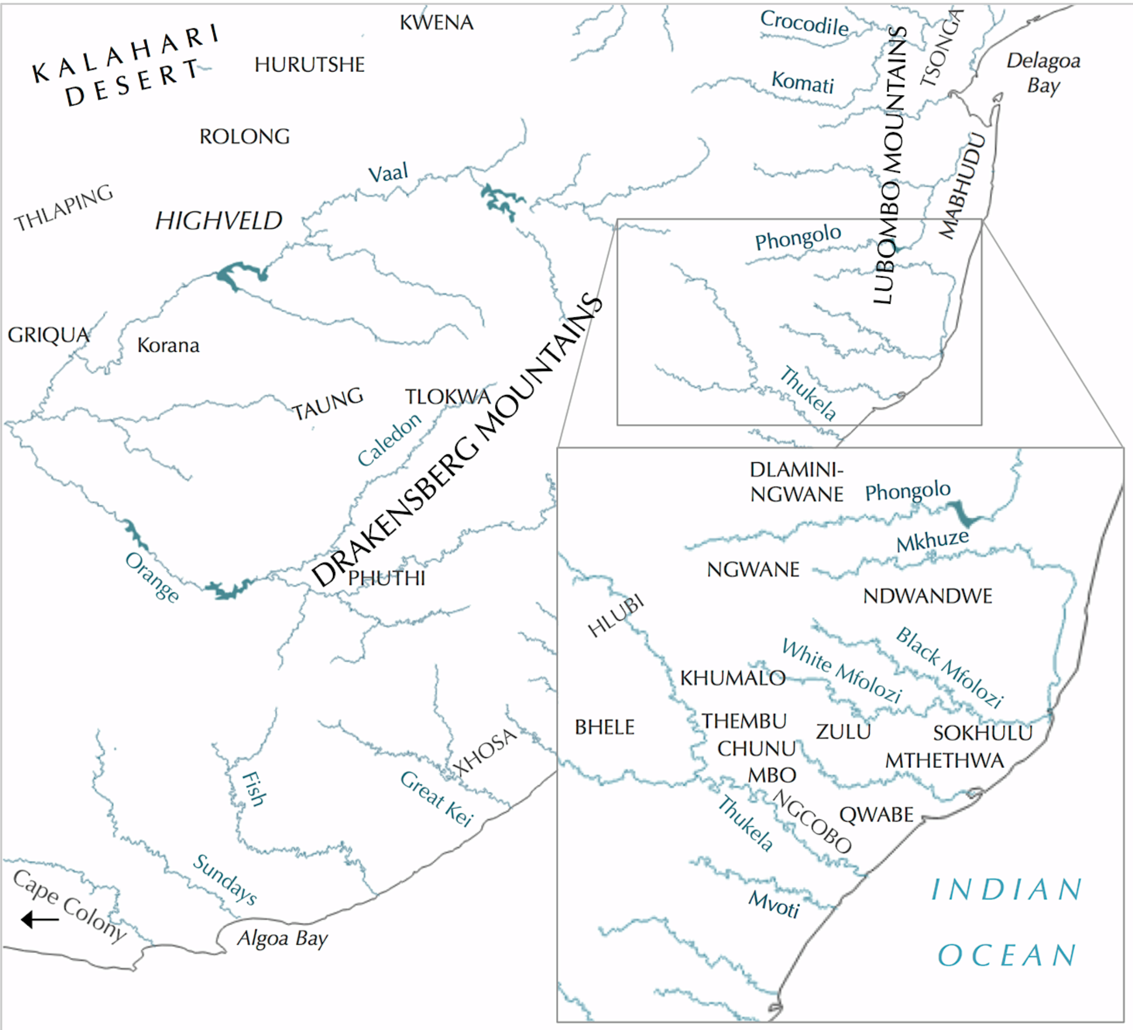

FIGURE 2.17 Some important sites and polities prior to major migrations and state formation in KwaZulu-Natal and adjacent areas.

Reflective of their increased differentiation and stratification, larger polities consisted of three social tiers (Wright 2010). The aristocracy, made up of the ruling families and a cluster of other related families formed the top level. Rulers exercised varying degrees of power, where stronger rulers like Shaka of the Zulu, Soshangane of the Gaza and Mzilikazi of the Ndebele held considerable power over *amabutho*, and were able to militarise them for defensive and aggressive means, as well as to maintain perceived dissent from within the society (Eldredge 2014). On the other hand, other rulers continued in a more managerial style, while Wright (2010) states that their polities were held together less by internal force and fear and more by external threats. The chiefs of subordinate chiefdoms, who held less power but generally retained their positions, also made up this tier. Below this were commoner families in the heartland of the kingdom. These formed the main part of the kingdom's body politic, from which young men who made-up the *amabutho* were drawn (Wright 2010; Eldredge 2014). At the bottom were poorer families of dependents who recognised political overlordship but generally did not play any role in political affairs. These members were mostly situated on the margins of the kingdom, and were seen as outsiders and inferiors by the other two tiers (Hamilton and Wright 1990; Wright 2010).

Despite the increased wealth concentration at the upper levels of society, Etherington (2001) adds that polities remained dependent on the economic and social functioning of the homestead. Increased demand for cattle, grain, women and young men were sought from these homesteads, yet there existed a delicate balance in not pushing this tribute too far, as this could undermine the system on which the society depended. Indeed, the stability of livelihoods, mostly the production of a surplus in cattle, underpinned the existence of the aristocracy. Rulers and sub-chiefs were also obliged to assist poorer homesteads in times of famine, for instance by releasing *amabutho* from service where labour was needed (Wright 2010). In the case of the Zulu, another indicator of the increasing authority of polities was that the choosing of marriage partners and the timings of marriages came to be directed by the state. This is reflective of a shift in gender relations on the whole, where wives and daughters were more firmly controlled by male homestead heads and the state itself (Eldredge 2014).

Force was not the only method of maintaining the stability of complex political units, and ideology played a more important role than force in legitimising leadership and genealogical seniority over subordinate chiefdoms (Eldredge 2014). Ritual and ceremonial routines therefore developed or acquired heightened political importance. The ruler initiated the performance of important ceremonies such as the 'first fruits' festival, which legalised the consumption of harvests. Rainmaking was also crucial in the perception of climate-related hazards, but differed to that of the Zambezi-Limpopo area, as here rainmakers, or '*inyangas*', were special doctors who attempted to influence supernatural forces through the manipulation of rain medicines (Huffman 2004). These were not simply politically important functions, but in the views of the population resembled life or death.

2.3.2.2 Food system

The food systems of communities in the KwaZulu-Natal area were not altogether dissimilar to those of the Zambezi-Limpopo region. Although a pastoral ideology dominated, agricultural produce was needed for subsistence (Huffman 2004). Sixteenth and seventeenth century shipwreck accounts make it clear that sorghum and millet were the principal crops, with sorghum probably the most widely cultivated of these, while archaeological evidence has also shown that grain was stored and sealed in flask-shaped pits dug in cattle byres (Maggs 1989). These grains were supplemented by the cultivation of vegetables and legumes, including beans, groundnuts, gourds, melons and pumpkins. Cultivation was generally tended to by women, though it is not strictly true that men took no part in cultivation (Eldredge 2014). A major change in the food system of some communities in KwaZulu-Natal, however, came with the introduction and spread of maize. Little detail is known about the dynamics of its introduction, though studies by Hall and Maggs (1979) and Maggs (1982) revealed archaeological evidence of special maize grindstones at a number of sites in the interior area of KwaZulu-Natal, and therefore suggested that these areas cultivated maize as a staple crop from the early-eighteenth century. Maize matured in around three months, required less labour and protection from birds, and in the best-watered areas with fertile soils, two or three crops could be grown in a field in one year (Eldredge 1992). This increased productivity over previous staple crops with the same labour force has accordingly been linked to population increase in areas of KwaZulu-Natal that were sparsely populated prior to the late-eighteenth century. Yet maize is more water-demanding and sensitive to water deprivation than previous staple crops, and thus its widespread adoption would have changed the dynamics of drought impacts (Hall 1976; Hall 1998; McCann 2001; Huffman 2004).

The relative importance of agricultural production in the food systems of the KwaZulu-Natal area did differ from further north. As noted in Section 2.1.2, Nguni-speaking communities placed greater emphasis on cattle and pastoral livelihoods, which were heavily linked socio-cultural customs and were the domain of the male. Shipwreck accounts all reveal an abundance of cattle in the KwaZulu-Natal area, as well as quantities of dogs, sheep and goats, though animals such as pigs and fowls were introduced later. The inhabitants of this region were skilled herders, and shifted their stock from one pasture to another, making use of sweetveld and sourveld land in different seasons (Guy 1994). Little pre-eighteenth century written evidence is available on the importance of cattle for wealth, and for ritual, family and political relations, yet such practices did extend back to this time (Huffman 2004). Nevertheless, major changes relating to cattle-keeping and food security came with the transformation of socio-political organisation. Prior to the development of *amabutho*, families lived in homesteads throughout their lives and only paid small amounts of tribute to rulers (Wright 2010). In the early-nineteenth century, though, cattle and men from these homesteads were forfeited in larger quantities to the royal capital and *amakhanda*, and were also required in the maintenance of the new social system (Eldredge 2014). This demanded that cattle were replaced, the fastest way to do so being to seize them by force from other communities (Etherington 2001). As the *amabutho* expanded, so did the dependence of the ruling houses on it for maintaining and expanding their power, which in turn meant that ever more cattle were required for redistribution as rewards. While raiding had probably been a feature of life in KwaZulu-Natal earlier than this, most scholars agree that this acquired a new dynamic in the early-nineteenth century with the rise of the *amabutho*-based polities, and eventually grew into full-scale conflict to accumulate more grazing land as well as the cattle itself (Wright 2010). Cattle were similarly key in other socio-cultural practices, notably marriage, where marriage alliances often involved high numbers of cattle exchanged as bridewealth. Thus, with more cattle a man could marry more wives.

The hunting and the gathering of wild resources were also important to Nguni-speaking communities, the former of which was conducted by men provided skins, and later, ivory for export, as well as meat. Wild plants were predominantly eaten by women and children, but were eaten by men in times of scarcity (Maggs 1989). Although KwaZulu-Natal is amply supplied with river and sea fish, oral traditions and documents assert that fish were avoided because of a taboo. Indeed, only the poorest communities living on the coast collected shellfish or speared fish found in rock pools (Wilson and Thompson 1969).

A further stressor that affected the security of the food system was drought, and when seasons or multiple years of moisture stress hit, crops were often stunted or failed altogether, meaning people had to resort to grain stores, eat cattle or subsist on wild plants and animals (Hall 1981; Eldredge 1992; Etherington 2001). Presumably, communities in better-watered areas with reliable rainfall and permanent rivers were less vulnerable, while cultivating a mix of crops and keeping a variety of domestic animals provided another good defence to food scarcity. Yet the vulnerability and resilience of communities was also affected by factors such as conflict and political instability, and coordinating response to all of these factors required a high level of organisation. Multiple food system stressors thus raise key questions of interactions between factors such as conflict, environmental stress and food insecurity, specifically the impact of climate and conflict on organised food systems. Indeed, when politically important rituals such as rainmaking and the first fruits festival are added to this, a dynamic emerges with which climate variability intersected, yet has not been given substantial treatment in the literature.

2.3.2.3 Livelihoods and trade

Basic livelihoods outside of subsistence farming were the manufacture of clothing from the hides of slaughtered cattle, and cooking utensils from glass, wood and clay. Most evidence on other livelihoods prior to the late-eighteenth century, however, centres around metal-working, where archaeological records show that iron was smelted in most villages to produce hoes and weapons (Maggs 1989). Other mineral resources in the KwaZulu-Natal area were relatively scarce, and metals such as brass and copper were obtained through trade in exchange for grain or cattle, and later tobacco, with polities on the South African highveld or in the Delagoa Bay area. Medicines and ornaments also formed part of this more local system of trade. The quantities involved were generally small, a fact which Maggs (1989) claims is reinforced by the fact that the iron, copper and brass possessed by shipwrecked parties was highly sought-after by men armed partly with iron spears and partly with wooden pikes. By the 1530s a Portuguese ship made an annual voyage from Sofala to the natural harbour of Delagoa Bay to purchase ivory. Although this trade did not penetrate further south at this time, some merchandise, such as cloth, beads and copper, did reach the area, probably indirectly from the highveld (Etherington 2001). Competition for this trade in the Delagoa Bay hinterland has been linked with the expansion of some polities in the area such as the Inhaca. Similar processes may have occurred on a much smaller scale in KwaZulu-Natal with shipwrecked travellers, who often encountered difficulty when crossing rivers in the area as a result of the attempts by chiefs to control the trade passing through his territory. While these small quantities of trade enhanced the unequal distribution of resources in the area, this appears to have made little difference to the overall organisation of livelihoods, society or politics in KwaZulu-Natal.

These livelihoods underwent change in the late-eighteenth to early-nineteenth century. Technological change was reflected in the development or introduction of different types of grindstones and iron-smelting equipment (Maggs 1989). Importantly, however, iron-smelting was no longer conducted in every settlement, which suggests that imports of metals had increased. This expansion in trade mostly occurred through Delagoa Bay, where from around the 1760s increased numbers of English, Indian and other merchants came to buy ivory from chiefs in the vicinity of the bay in exchange for cloth, beads and metal (Hedges 1978). Similarly, trade was expanding on the highveld by way of the Cape Colony, where Dutch stock farmers used the Khoekhoe as middlemen to barter beads and iron implements for cattle with chiefdoms in this area.

Although the polities in the hinterland of the Delagoa Bay were the most immediately affected by the expanding trade, political leaders in KwaZulu-Natal sought to acquire new forms of wealth to increase their status, which means that it could have been a source of competition and conflict. In the late-eighteenth century, the trade in ivory declined and the export of cattle increased as British and American whalers began to use Delagoa Bay as a base at this time, which increased the demand for a foodstuffs including cattle (Alpers 1976; Wright 2010). The humid, tsetse-infested area proximate to the bay, however, was not ideal cattle country, and meant that local chiefs looked to import cattle from the regions further south to sell to the whalers (Huffman 2004). In contrast to elephants and their tusks, cattle were fundamental to subsistence, ritual, status, wealth and ideology in homesteads across KwaZulu-Natal, and its export in any serious number would have required replacement cattle to fulfil these needs. By the mid- to late-1810s, trade in both ivory and cattle is suggested to have been lower than previously (Wright 2010), but by 1824, the Zulu kingdom was connected to another source of trade with the arrival of British traders at Port Natal. Traders travelled through the country exchanging manufactured goods, such as hoes, knives, metal cooking utensils, cloth and beads for cattle, hides and ivory. According Eldredge (2014), Shaka valued the traders' presence for their goods and the access they offered to the Cape Colony government, but he always sought to maintain tight control over their activities and was anxious that they did not trade with other rival polities. While these imported commodities were valued by the inhabitants of KwaZulu-Natal, perhaps the only new items were firearms, as most others were manufactured by craftsmen prior to this. Indeed, crafts offered a livelihood opportunity for a small part of the population without being directly dependent on cattle. This suggests that the economic impact of the Port Natal trade in the mid- to late-1820s was small. In the nineteenth century, the production of metal goods, such as hoes and spears, increased, and some who produced these items attained power through trading (Etherington 2001). On the other hand, Maggs (1989) adds that reliance upon trade for a dependable income was difficult apart from where trade routes could be controlled. Mining, crafts, manufacturing and consequently trade, were therefore at most supporting activities that involved only a small part of the population (Guy 1994).

This background overview has shown that consensus exists on the range and relative importance of economic and livelihood activities in the mid-eighteenth to early-nineteenth centuries, and has also demonstrated the level of knowledge on socio-political organisation in the early-nineteenth century. This is in contrast to the Zambezi-Limpopo region, where less detail is currently known on these factors and particularly their changes over time. Nonetheless, some key questions for investigation in Chapter 6 include:

- How did the dependence on crop cultivation and pastoralism vary between the Zulu kingdom and its subordinate polities in KwaZulu-Natal?
- How did socio-political institutions and ritual affect the perception of drought and crop failure, and how strongly was this linked to the leadership?
- How was food security affected by the interaction of climate variability and other stressors, particularly conflict and cattle raiding?
- How advanced were adaptive methods and coping strategies against drought?

While comparatively few questions are raised over spatial differences and temporal changes in economy and society in the KwaZulu-Natal area, less consensus exists on the factors that caused the transformation of social, political and economic life, as well as the impacts of heightened conflict in the early part of the nineteenth century. The next section overviews the debate and hypotheses relating to the origins and events of this transformation and conflict previously termed the '*mfecane*'.

2.3.3 Socio-political change in the late-eighteenth and early-nineteenth century

In accordance with the review of the economy and society of the KwaZulu-Natal area in the previous section, this part of the review, and indeed the later analysis in Chapter 6, will consider the developments and hypothesised climatic links of this broader period in two parts. The first will focus on the debate regarding the origins of socio-political transformation in the late-eighteenth and early-nineteenth century, while the second part will investigate the consolidation of centralised political authority and the intensification of conflict and migration in the mid-1810s to 1830. Before this, the notion of the *mfecane* as an organising concept for these processes is critically analysed.

2.3.3.1 The 'mfecane' as a concept

In the 1810s to 1830s, KwaZulu-Natal and several other areas of southern Africa were directly or indirectly affected by unprecedented demographic upheaval, social and political transformation, and intensified conflict. Scholarship relating to these events traditionally centred around the notion of the so-called *mfecane* (or *difaqane*), a term that has been used in various ways, but most implicate the rise of the Zulu kingdom as the main trigger of these dramatic changes. This paradigm stems from the pre-1980s 'settler historiography' of white South Africans, who treated these decades as a period defined by the apparent destructive expansion of the Zulu kingdom under Shaka, which supposedly initiated a destabilising chain reaction of violence, migrations and state formation. Although this was later reframed as a purely local event of African initiative by Omer-Cooper (1966), the traditional historiography argued that the resultant 'depopulation' had left lands devastated in order to advance settlers' claims as bringers of peace in an empty land (Etherington 2001).

In the late-1980s, the concept of the *mfecane* and its Zulu-centric line of explanation came under new scrutiny. This was initially led by Julian Cobbing (1988a), whose research led historians into thinking about the wider explanations for this change. The early-1990s research that followed then reframed *mfecane* debates in two major ways. Firstly, consensus emerged that it was no longer possible to view the origins of socio-political transformation in KwaZulu-Natal as an isolated period which resulted from the colonial-era notions of the 'wars of Shaka' in the 1820s. Instead, the heightened conflict at this time needed to be set in a broader, multi-causal context since around the mid-eighteenth century (Wright 2010). Secondly, it was accepted that the KwaZulu-Natal area was only one of a number of separate focal points regarding the origins of political instability, and events elsewhere, such as on the highveld, in the expanding Cape Colony, and at Delagoa Bay, were of comparable importance.

In more recent years, use of the term *mfecane* has continued by some scholars as an organising concept or has been given different meanings (Omer-Cooper 1992; Huffman 2004, 2007; Schoeman 2013). However, African historians have invariably discontinued the term altogether as many see it as being inseparable from an out-dated paradigm (Etherington 2001; Wright 2010; Eldredge 2014). In addition, the fact that there now exists widespread consensus that the wholesale attribution of contemporary events to the Zulu kingdom is undue means that there are very few merits to retaining the term as an organising concept. Indeed, the umbrella term of the *mfecane* vastly oversimplifies a complex reality of political centralisation and consolidation, social change and subordination, as well as migration and violence, into a simple cause-effect model. Furthermore, the term ignores the now widely accepted viewpoint that the events of the early-nineteenth century had their origins in the accelerated processes of socio-political change beginning in the mid- to late-eighteenth century. In this thesis, the term is dropped for these reasons.

2.3.3.2 The origins and causes of transformation in KwaZulu-Natal

If consensus exists that the origins of state transformation must be pushed back to the mid-eighteenth century, the debate around the conditions that made this period uniquely conducive to such occurrences is marked by sharper divisions. On face-value, oral traditions and written sources emphasise the ‘great man’ attributes and military innovations of rulers such as Dingiswayo of the Mthethwa and Shaka of the Zulu (Etherington 2001). Eldredge (2014), however, has shown that a number of innovations credited to Shaka in the traditions, like the use of the stabbing spear, existed before his rise to power. Furthermore, extensive work by Carolyn Hamilton and Dan Wylie has done much to improve understanding of the various images and myths created of Shaka both during his rule and in later reconstructions (Hamilton 1992, 1998; Wylie 1995). Yet even if it is accepted that strong leaders were important, it is perhaps the case that underlying structural factors provided opportunities for innovators to exploit. Numerous hypotheses on such factors have been put forward since the 1940s, which have often been categorised as ‘internal’ and ‘external’. Internal factors centre around population pressures with the introduction of maize (Gluckman 1960; Maggs 1989; Huffman 2004), deteriorating grazing land (Guy 1980; 1994), the growth of *amabutho* (Wright and Hamilton 1989; Wright 1995, 2010), and changing responses to famine and environmental crises (Eldredge 1992). On the other hand, external stimuli relate to responses to growing inter-continental trading opportunities (Smith 1969; Hedges 1978), the impact of pronounced climate variability towards the end of the LIA (Hall 1976, 1981; Huffman 2004), defensive responses to the slave trade on the Mozambique coast (Cobbing 1988a), and similar reactions to increased pressures of raiding and firearms along the frontier of the Cape Colony (Etherington 2001; Wright 2010).

Gluckman (1960) was the first to move away from the focus on great man theories, and proposed that over-population created an imbalance between population and resources that led to increased competition, political consolidation and warfare. This theory was later popularised by Omer-Cooper (1966), yet even if there is evidence for population growth, scant evidence exists to argue that a critical density had been reached. In a similar line of explanation, other scholars have suggested that either environmental degradation or climatic changes and the introduction of maize created new conditions in which societal developments occurred. Jeff Guy proposed that socio-political transformation had its roots in a coupled crisis relating to food production and environmental degradation, where inadequate grazing resources were born out of imbalances between pastoralism and grassland ecology (Guy 1980). Guy hypothesised that a decline in grassland productivity resulted from over-stocking and centuries of unscientific farming practices, which caused soil erosion, bush encroachment, and pasture deterioration on sweetveld grassland in particular. Linked to this was increasing population density, where the productive capacity of the environment was constrained as it became less possible to convert forest and bush to grass and arable land, and migration to new areas became difficult. Consequently, increased violence broke out over diminishing resources, and chiefdoms that had access to a variety of grazing types, such as the Mthethwa, Ndwandwe and Zulu, became major political units with the aid of this ecological advantage. A major issue with Guy's arguments, as with environmental degradation pathways in the decline of Great Zimbabwe, is lack of evidence, while the existence of seasonal grazing rotation goes against his argument of unscientific misuse of pastures. Moreover, if there had been 'overpopulation', then it is hard to understand why areas of fertile land, such as in southern KwaZulu-Natal, were not used for herding, or why excess cattle could not have been culled. Similarly, by overlooking cultivation, Guy's thesis does not explain why the total area of land under cultivation could not have been increased to boost food production (Hall 1981).

Martin Hall advanced thoughts on potential climatic pathways using a dendrochronological record from a Yellowwood tree felled in 1912 in the Karkloof forest, KwaZulu-Natal (Hall 1976; Figures 1.1 and 2.18). Implicit in this hypothesis is the introduction of maize to KwaZulu-Natal through Delagoa Bay sometime around the early-eighteenth century (Maggs 1982), the cultivation of which is suggested to have had twofold implications. The first, as a result of the high yields of maize relative to sorghum, is said to have increased the regional capacity for population growth. Furthermore, the extensive cultivation of maize on formerly marginal lands was said to have been made possible by a period of increased rainfall towards the end of the LIA between 1750 and 1800 inferred in the Karkloof tree-ring record (Figure 2.18). The second implication of maize cultivation, however, was that its consumers were subject to increased vulnerability due to the crop's high sensitivity to water deprivation. The heightened vulnerability of a large population is therefore said to have set the scene for the apparently drought-induced famine known to Nguni-speaking communities as the *mahlatule* famine in the early years of the nineteenth century (Guy 1980; Ballard 1986; Eldredge 1992). According to some, this famine caused a serious breakdown of social, political and economic institutions in KwaZulu-Natal, led to treks of survival in search of food and the expansion of political units in order to gain control over a wider range of grazing, which enabled them to counter the effects of local drought and food scarcity (Ballard 1986; Guy 1980).

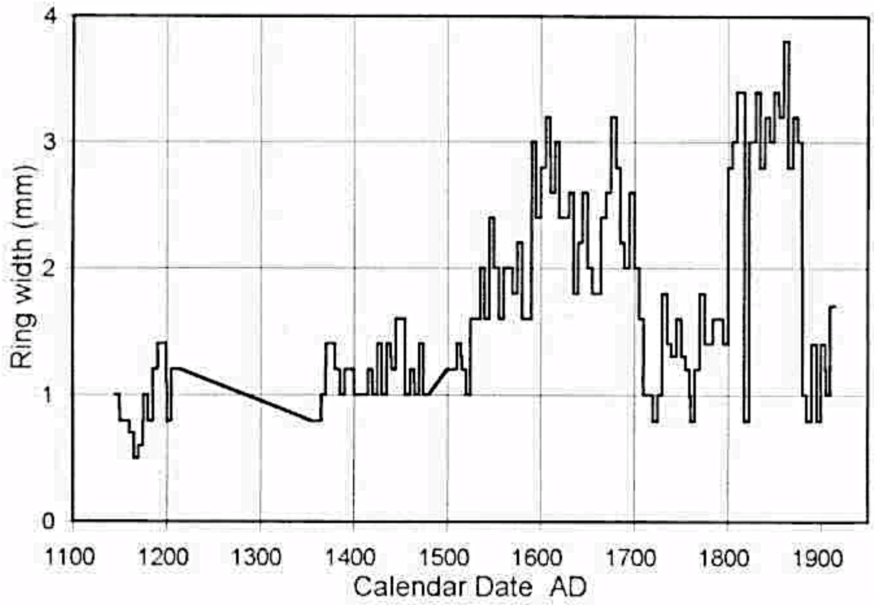

FIGURE 2.18 Karkloof Yellowwood tree-ring width curve after adjustments to the calendar dates. Wide widths relate to increased precipitation. After Hall (1976) and Vogel and Fuls (2001).

Notwithstanding uncertainties over the extent of maize cultivation in KwaZulu-Natal, a number of scholars have pointed out the seeming inadequacies with the hypothesis of drought creating or contributing to socio-political transformation in KwaZulu-Natal. Wright and Hamilton (1989) regard this possible causal pathway as speculative, while Etherington (2001) claims that drought had always been a factor facing societies, and thus it is unclear why it should have been more significant at this time. This latter view, however, makes little provision for contextual factors that made societies vulnerable to climate variability. In partial answer to this, Eldredge (1992) importantly observed that environmental and climatic stress can be part of the causal dynamics rather than a lone, monocausal driving-force mechanism. In her view, the expansion of trade stimulated increasing inequalities within and between polities, which undermined traditional strategies of averting famine by fostering an unequal distribution of food in times of scarcity (Eldredge 1992). Severe drought in the *mahlatule* famine thereby contributed to revolution and reorganisation among some political units in KwaZulu-Natal at the beginning of the nineteenth century (Eldredge 1992). Bonner (1983) also accepted the suggestion that drought could have been a contributory factor, and concluded that shortages of cattle as a result of the *mahlatule* famine led the aristocracy of the Sobhuza's Dlamini-Ngwane group to increase their control over the newly formed *amabutho* to strengthen their power.

Although some of the scenarios presented above are certainly feasible, a major problem is that the evidence-base used is relatively thin. Indeed, as is the case of the Zambezi-Limpopo region prior to written records, such scenarios can be quite realistic for the first stages but, with branching possibilities, they often become complex and separated from the evidence that exists (Beach 1998). Physical environmental and climatic hypotheses are also often postulated in very general terms, with little consideration of how pre-existing agricultural livelihoods varied or how the impacts and interpretation of the alleged climate variability differed between societies. Perhaps the biggest difficulty of the climate-related hypotheses, however, is that evidence for climate variability itself over this period has been drawn from a very limited range of sources. These include the tree-ring from the Karkloof forest (Hall 1976), which is subject to numerous problems as is later discussed in Chapter 3 (Woodborne *pers. comm.*), and a small number of oral testimonies relating to the *mahlatule* famine (Hannaford et al. 2014). Moreover, some historians have inadequately relied upon archaeological records as an indicator for both climate variability and societal change as opposed to palaeoclimate proxies. Further consideration must therefore be given to the precise pathways through which climate variability, food production and the environment influenced socio-political transformation. This means developing new chronologies of late-eighteenth and early-nineteenth century climate variability, and re-examining the written and oral sources that can shed light on the changing interplay between the food system and social and political dynamics.

A major external stimulus linked with the acceleration of state formation processes relates to the expansion of inter-continental trading opportunities at Delagoa Bay (Smith 1969; Hedges 1978). After about 1750, there was a substantial increase in the demand for ivory by European traders, at which time Delagoa Bay and its hinterland was a growing source of this trade. Around the 1780s, the demand for ivory was gradually replaced by an increase in the demand for cattle to supply European and American whaling ships. In this context, Hedges (1978) suggested that chiefdoms steered, expanded or even initially organised *amabutho* both towards elephant hunting and cattle raiding to increase their own wealth in imported commodities. The resultant competition for control of the expanding trade and subsequent rise in cattle raiding around the end of the eighteenth century has therefore been said to have undermined the social order and led to widespread violence, as cattle not only had importance for subsistence, but had high social importance in bridewealth and as tribute (Huffman 2004, 2007). Similarly, supplying the ivory trade could have been volatile as elephant populations may have declined in certain areas. Nevertheless, the booty from cattle raids, which was also redistributed to followers, may have been particularly crucial as it gave chiefs a way to satisfy their people and hold their chiefdoms together. Equally important is that the increase in the import wealth of certain chiefdoms, such as the Mabhudu polity around Delagoa Bay, and slightly later the Mthethwa, is said to have transformed political and socio-economic inequality both within and between communities (Eldredge 1992). This meant that some polities were able to extend their domination over neighbouring chiefdoms while pushing others away.

Chiefdoms such as the Mthethwa are thought to have shown particular responses to trade opportunities, and thus were wrapped up in attempts to control the trade in ivory and cattle by way of territorial expansion and the increased mobilisation of their *amabutho*. While increasing competition for trade and a possible associated intensification of conflict may have contributed to socio-political transformation, there is little evidence to suggest that this was the main cause, as other chiefdoms in the KwaZulu-Natal area with less involvement in the trade, such as the Dlamini, Hlubi and Qwabe, also expanded and developed *amabutho* at some stage. Explanations here are relatively thin, though it is possible that this expansion occurred as a defensive response to these new developments in the political economy of the region (Wright 2010). Trade was also subject to changes beyond the control of African communities. For instance, the Portuguese are known to have favoured different polities at different times both in the Zambezi-Limpopo region and in the Delagoa bay area, which apparently acted to both centralise and fragment power in both areas, as well as to increase localised conflict (Wright and Hamilton 1989; Beach 1994).

Cobbing (1988a) also suggested that the slave trade played a major role in political centralisation, and linked the entire process of state formation and regional conflict with a defensive response to its associated pressures. This hypothesis has been roundly dismissed, however, on the grounds that an extensive slave trade (over 1000 slaves exported per year) at Delagoa Bay did not begin until after 1823, when state formation processes were already well-advanced (Smith 1969; Harries 1981; Eldredge 1992; Etherington 2001). Prior to this, the principal catchment area for slaves was to the north of Delagoa Bay, where slaving operations were largely focussed on the Zambezi for export to sugar plantations on Mauritius, Reunion and the Comoros, and later for export to Brazil (Newitt 1995). As well as criticism over the evidence-base of Cobbing's claims, his arguments have also been suggested to view processes of African state transformation as entirely reactive, discrediting the notion of internal forces being responsible for change in pre-colonial African societies (Eldredge 1992). On the contrary, it is undeniable that the translation of opportunities or threats into political consolidation was solely a product of human agency and innovation, and was thereafter facilitated by the institutions of some polities that enabled their growth.

Before considering the causes and events of intensified conflict in the 1810s to 1830s, it is important to note that similar processes of transformation occurred in the Sotho-Tswana-speaking communities on the highveld. A full consideration of these events is beyond the scope of the thesis, yet there is consensus that the late-eighteenth century was marked by growing conflict among the chiefdoms in the area of the Vaal river and the southern fringes of the Kalahari (Etherington 2001). These processes have been linked with similar causes to those in KwaZulu-Natal, and include maize, trade, and defensive responses to conflict on the Cape frontier (Wright 2010).

2.3.3.3 Political consolidation and conflict in the 1810s to 1828

In comparison to the late-eighteenth century, the period of widespread insecurity in the 1810s to 1830s is relatively well-understood in terms of its chronology and events. This is because of an increase in the volume of oral traditions, particularly relating to the Zulu kingdom, while European traders wrote first-hand accounts of KwaZulu-Natal from the 1824 onwards. Before commencing a synthesis of the history these decades, it is important to refer to a recently published volume - *The Creation of the Zulu Kingdom* - by Elizabeth Eldredge. One of Eldredge's most pertinent reflections is that there now exists more scholarship on the personality of Shaka than the nature and causes of the events that took place in KwaZulu-Natal during his reign. To an extent, this is understandable, as the historiography surrounding this period was previously centred around the notion of the 'wars of Shaka'. Rejection of this concept, however, was convincingly achieved in the 1990s, yet the last decade-and-a-half has done comparatively little to advance understanding of the process of Zulu expansion during the reign of Shaka. Indeed, one could argue that the scholarship has gone beyond refutation of sole Zulu culpability towards understating the involvement of the Zulu kingdom in conflict or raiding in KwaZulu-Natal in the early part of the nineteenth century. Eldredge's work is thus refreshing because it leaves such historiographical hang-ups behind, and critically re-analyses both oral and European sources to document the events that took place in KwaZulu-Natal during the reign of Shaka.

After the *mahlatule* famine in the first years of the nineteenth century, KwaZulu-Natal was dominated by several newly emerged chiefdoms, including the Mabhudu, Ndwandwe, Mthethwa, and Qwabe (Figure 2.17). By the 1810s, competition and repeated conflict between two of these polities, the Ndwandwe under Zwide, and the Mthethwa under Dingiswayo, had grown to surpass other rivalries (Eldredge 2014). In particular, Zwide's Ndwandwe was aggressively expanding and subjugating other chiefdoms, while the Mthethwa chiefdom was less autocratic in its economic organisation, and sub-chiefs incorporated into its domain were encouraged to retain a greater degree of autonomy (Wright 2010). At this time, the Zulu chiefdom, ruled by Senzangakona, was relatively small, and was largely under the domination of Dingiswayo. Upon Senzangakona's death in 1816, Dingiswayo installed Shaka, the former's eldest son, as Zulu chief. Shaka was encouraged to restructure and strengthen his *amabutho*, and to expand his power in the Mthethwa domain to defend against the Ndwandwe (Wright and Hamilton 1989). In about 1817, an intensification of raiding between the Ndwandwe and the Mthethwa resulted in the defeat and break-up of the latter and the capture and killing of Dingiswayo, which according to Etherington (2001) gave Shaka the opportunity to establish his Zulu chiefdom as the predominant power south of the White Mfolozi and carry on the resistance against Zwide.

Shaka immediately sought to bring new chiefdoms, such as the Qwabe under Phakathwayo, under his overlordship. These confrontations are thought to have been relatively short-lived with few casualties, as Shaka sought to subdue chiefs, expropriate their cattle and incorporate their people into his orbit rather than crush them (Eldredge 1992, 2014; Etherington 2001). By 1819, however, the Ndwandwe resumed their aggression against the Zulu, causing heavy losses of cattle (Wright and Hamilton 1989). In response, Shaka withdrew his *amabutho* and cattle into the core of the kingdom, and apparently hid or destroyed crops and grain stores to prevent the

Ndwandwe pursuit. Zwide was then forced back to his capital, after which his kingdom fragmented, probably due to internal political tensions (Wright 2010).

The break-up of the Ndwandwe kingdom was marked by three groups: those under Soshangane and Zwangendaba, which moved into the Delagoa Bay area, while the other under Msane moved to the eastern part of present-day Swaziland. A group of Khumalo under their chief Mzilikazi also moved away from the conflict towards the upper Vaal river, where they seized grain, raided for cattle and incorporated people from Tswana and Sotho chiefdoms on the eastern highveld (Etherington 2001). Indeed, by 1823, Mzilikazi's Khumalo were increasingly known to Sotho-speaking people as 'Matabele', and 'Ndebele' to Nguni-speaking people, which translates as marauders (Wright 2010). Similarly, other chiefdoms such as the Thembu, Chunu, and Ngwane moved out of this zone of instability at this time (Wright 1995; Eldredge 2014). To revive his kingdom, Zwide moved north of the Phongolo into the eastern part of Swaziland, which was already under his domain after he pushed away the Dlamini. These shifts enabled Shaka's Zulu kingdom to expand north of the White Mfolozi, but most historians agree that suggestions that he ruled all the way north to Delagoa Bay are exaggerated, and it seems that his kingdom did not extend much further north of the Mkhuze river (Eldredge 2014). At this stage, Shaka still lacked the capacity to actively expand south as well as north, meaning his aim was to consolidate, stabilise and secure his borders. To meet these objectives, though, neighbouring chiefdoms needed to be either broken up, incorporated as clients into his own, or pushed away.

The dominant kingdoms between the Drakensberg and the Indian Ocean at the beginning of the 1820s seem to have been the Zulu under Shaka, the Ndwandwe under Zwide and the Gaza under Soshangane. The Ndwandwe moved again in these years, this time northwest to the Nkomati river, where Zwide established a large following by overpowering smaller chiefdoms and taking their cattle. The breakaway Gaza polity under Soshangane settled in the Delagoa Bay hinterland where they raided for food and cattle, although trade may have accounted for part of Soshangane's decision to locate there, as cattle-herding is restricted by the presence of the tsetse fly (Hedges 1978). The Gaza polity may have also raided the decentralised Tsonga-speaking communities north of Delagoa Bay for slaves, a process which was aided by their apparent weakening due to the severe drought reported by Newitt (1988) in the 1820s. Their proximity to growing Portuguese slaving, however, was a source of instability for the Gaza (Liesegang 1970). As the Ndwandwe and Zulu kingdom's were strengthening to the west and south, other rival Ndwandwe breakaway groups under Zwangendaba, Nxaba and Msane were expanding towards central Mozambique and eastern Zimbabwe, where they raided Manyika, Teve and the Sofala hinterland until being driven out by Soshangane. Instability was also widespread on the highveld at this time. This has been linked to a drought that prevailed between around 1820 to 1823, which according to Etherington (2001) interacted with new factors, such as the presence of armed Griqua and Kora raiders, and acted to exacerbate conflict by causing 'treks of survival' for food and grazing land (Ballard 1986). This drought was also picked up in the Karkloof tree-ring record from KwaZulu-Natal (Hall 1976; Vogel and Fuls 2001), where five consecutive, very narrow annual rings were found between 1817 and 1823, although the dating on this specimen is questionable (Woodborne *pers. comm.*). On current evidence, it is unclear whether this drought, or the drought in the mid- to late-1820s reported by Newitt (1988, 1995), also affected KwaZulu-Natal.

In contrast to the migratory polities described above, Eldredge (2014) notes that the Zulu continued to use force and diplomacy to expand outward from the core of their territory between the Thukela and Mkhuze river. Here, Shaka ruled over an amalgamation of previously autonomous chiefdoms, who retained their own hereditary chiefs, but answered and paid tribute to their overlord. Although the kingdom may have constituted a "zone of relative stability" (Wright 2010, 228), Eldredge (2014) argues that Shaka employed arbitrary violence towards his own people, possibly reflecting the insecure base of his power. In addition, Shaka often promoted his own candidates to assume rule over subordinate chiefdoms, reflecting the despotic nature of his rule (Eldredge 2014). This dominance was able to be asserted by the control he held over the Zulu *amabutho*, where increased booty of cattle, the incorporation of people and extension of land enabled Shaka to reciprocally demand more tribute, grow his *amabutho*, and increase the military capacity of his kingdom.

From 1824, British traders arrived at Port Natal (Figure 1.1). Eldredge (2014) has shown that Shaka, who maintained close contact with the traders, became increasingly aware and anxious of the expansion of European power through the Cape Colony. At the same time, internal instability was also causing insecurities in Shaka's hold on power. In 1826, renewed conflict with the Ndwandwe kingdom came to a head, and Shaka mounted a major offensive against the Ndwandwe under Zwide's successor, Sikhunyana. Zulu forces overwhelmed the Ndwandwe army, seizing a high quantity of cattle, and apparently also destroying grain and killing numbers of women and children (Eldredge 2014). This ultimately caused the Ndwandwe kingdom to implode, after which the Zulu and Gaza kingdoms were the dominant polities east of the Drakensberg. Yet this also opened the way for new political forces, most notably the Ndebele kingdom on the interior highveld, and the revival of the Swazi (formerly Ngwane) kingdom. Shaka's reign at this time was reaching its climax. Internal events such as the upheaval that followed the killing of his mother, Nandi, in 1827, created tension within the kingdom, and according to Eldredge (2014) were a major reason for his murder in 1828. Immediately prior to this, Shaka launched successive raids against Faku's Mpondo chiefdom to the south, carrying off high numbers of cattle, and then to the chiefdoms far to the north around Delagoa Bay, which was less successful. The motives for these decisions are unclear, particularly as Shaka's usual raiding territory was south of the Thukela (Etherington 2001), but whatever the causes, his brothers, Dingane and Mhlangana, turned back from this second expedition and stabbed Shaka to death at his then capital, Dukuza, after which Dingane assumed the leadership.

2.3.4 Climate and socio-political transformation in KwaZulu-Natal: key questions

As this abridged synthesis has shown, destruction only accounts for part of the history of this period. Rather, numerous forces appear to have prompted polities to displace, fragment and subjugate others. The provision of security in the form of cattle, crops and land were particularly key in providing internal stability, and meant that leaders could effectively mobilise their *amabutho* for aggressive or defensive means. Polities that could not provide these essentials were more vulnerable to the aggression of others, or to other forces such as climatic stress or slave-raiding.

Etherington (2001, 154) raises the point that intensified raiding south of the Drakensberg was "more a sign of success than distress… [as] famine-stricken, weak, hungry and disorganised people could not have undertaken the arduous journeys over difficult terrain which this form of long-distance raiding required". While there is perhaps some truth in this suggestion, Etherington's argument raises a more important issue. This is that unlike parts of the highveld, the literature has so often been engaged in questioning Zulu responsibility in instability that, beyond consideration of Shaka's desire to increase their wealth and grow the ranks of their *amabutho*, the question of why Zulu or Ndwandwe raids took place when and where they did has not been fully answered. More importantly for the aims of this thesis, little to no consideration has been given to the possible impacts of climate variability during the 1820s for KwaZulu-Natal itself. This is perhaps partly because it has been asserted by some historians that as the core of the Zulu kingdom was relatively well-watered, drought and food shortages were rarely a problem except in severe droughts such as the *mahlatule*. A more significant barrier to questioning the impact of climatic stress in KwaZulu-Natal at this time, though, is the paucity of written observations of weather and climate from the area. The development of further historical climate records at this time is therefore crucial to assessing climate-society interaction which has been strongly linked to contemporary events both on the highveld, and in Mozambique and the Zambezi valley. In addition to raiding, this pathway may have also been relevant to the internal instabilities in the Zulu kingdom that intensified from around 1826, for which Etherington (2001) has called for other explanations to be sought other than the quirks of Shaka's personality. Thus, a study of the interaction between climate variability, conflict and food security is overdue for the KwaZulu-Natal area. Key questions for this investigation consequently include:

- How did climate vary in KwaZulu-Natal and adjacent areas in the late-eighteenth and early-nineteenth centuries?
- Was the *mahlatule* famine drought-induced, and did it promote political centralisation amongst the Mthethwa and Ndwandwe as some have suggested?
- How did climate variability and food security affect the internal political stability, institutions and ritual practices in the Zulu kingdom in the 1820s?
- Was climate variability a significant factor in the heightened raiding across KwaZulu-Natal in the 1820s?

2.4 Connecting climate and society: a methodological framework

The preceding review has analysed the existing climatic and non-climatic hypotheses for societal change in pre-colonial southeast Africa. One of the most important points to arise from the critique is that few studies have used the extensive range of sources and approaches required to consider the nature and consequences of climate variability in any detail, meaning that a clear understanding of the changes taking place in southern African society and politics at the time is restricted. This section shall position the investigation to answer this critique in terms of its conceptual approach, data sources and broad-scale methodology. In doing so, the research areas of climate history, historical climatology, and vulnerability are centrally located in the analysis.

2.4.1 Integrative approaches to climate, history and society

The ways through which southern African historical climate-society scholarship can address the difficulties analysed above have been pointed out by Hannaford et al. (2014), and by others in a wider global context (Pfister and Brazdil 2006; Pfister 2010; Endfield 2012). The challenge of providing such integrated perspectives, however, is underscored by the fact that no discipline, methodological approach or data source is alone capable of formulating detailed linkages between human and natural systems (Berkes and Folke 1998). Thus, a fundamental requirement involves the integration of approaches from the natural and social sciences. This cross-disciplinary imperative thereby aims to improve knowledge on both the nature of past climate variability and understand its interaction with society as a linked 'socio-ecological system' (Gallopín et al. 2001). As relatively interlinked frameworks, climate history, historical climatology, vulnerability, resilience and integrated history, to name but a few, have gained momentum in their ability to link palaeoclimatic, palaeoecological, historical and archaeological sources (Redman and Kinzig 2003; Folke 2006; Constanza et al. 2007; Crumley 2007; Pfister 2010; Butzer and Endfield 2012; Carey 2012). On the basis of these frameworks, Hannaford (2014) suggested three broad areas that can contribute to the study of climate-society interactions on various spatial and temporal scales in the southern African past, which are:

1. Reconstructing and assessing past weather and climate variability;
2. Investigating the vulnerability and resilience of past economies and societies to climate variability and extremes, and;
3. Assessing the impacts of climate variability and their interaction with other factors.

These areas are outlined in their aims, sources and key research areas in Table 2.3, with further consideration of how these can be of importance for contemporary climate-society research. Before discussing how climate and society can be conceptually connected, though, it is important to outline the first research area, which is relatively independent of the latter two. On this first point, it is important to consider the nature of the climate variability or weather event in question, according to criteria such as severity, frequency and spatial range, as well as its impacts on the biosphere (Pfister 2010). Prior to the nineteenth century in southeast Africa, this relates almost entirely to proxy sources. Clearly, the production of new-high resolution proxy records and the development of better temporally resolved records from existing sites would deepen understanding in this area, yet it is mostly the interpretation of one or two sources with ambiguous signals that has been the subject of extended debate in the region. This means that an updated review of regional proxy data over this period is needed to establish a clearer picture of past precipitation variability. In this case, the incorporation of a wider range of proxy-documentary data into analyses is key, with particular reference to the criteria listed above. Moreover, this exercise should move away from blanket consideration of periods such as the MCA or LIA as wet or dry, as it has been shown that there is no evidence for multi-centennial periods over the last millennium being consistently warm-wet or cool-dry in the SRZ (Nicholson et al. 2013).

TABLE 2.3 Scope of African climate history (after Hannaford 2014).

	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, speleothems, lake sediments, coral. Global Climate Models. Other; rain gauge records.	Archaeological and written records, 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, archival sources, environmental models, resilience and systems theory.
Key research areas	**Past interaction**		
	• 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 among different groups. • Contextual interaction of impacts with other factors important to these groups.
	Past-future connections		
	• How the magnitude of past climate variability compares to that projected in the future. • 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.

From the nineteenth century onwards, a number of inter-annual documentary rainfall reconstructions are now available from different parts of the region. These chronologies consist of semi-quantitative 'wetness indices' produced from letters, journals and reports written by missionaries and colonial authorities, as well as newspapers, diaries and travelogues (Vogel 1989; Kelso and Vogel 2007; Nash and Endfield 2008; Nash and Grab 2010). A further data source for the nineteenth century is the Africa-wide precipitation database from 1801–1900 (Nicholson et al. 2012), which also consists of wetness indices for 90 regions across Africa, although the inter-annual values for each area were often classified secondary sources as opposed to the aforementioned chronologies. One other contemporaneous source that can add to these are the wind and weather observations held within the ships' logbooks of the Climatological Database of the World's Oceans (CLIWOC) (Garcia-Herrera et al. (2005a) and the English East India Company (EEIC) digitised dataset (Brohan et al. 2012), which extend back to the late-eighteenth century. As discussed in Section 2.1.1, the wind field in the southwest Indian Ocean is a key modulating factor in SRZ precipitation, whereby strengthened easterly flow generally implies increased precipitation. Thus, the fact that these logbook data surround southern Africa due to the ships' routes to the Far East means that they provide a source to reconstruct precipitation (Hannaford et al. 2014).

As previously stated, however, it is not enough to base climate impact-analysis on physical factors alone. According to Christian Pfister, the question as to "which sequences of climatic situations mattered depends upon the impacted unit and the environmental, cultural and historical context" (Pfister 2010, 28). Translating this into data availability, inter-annual records are clearly desirable, yet few are available before the nineteenth century. Although this means that a lower-resolution picture of human–climate interaction is achievable, it is possible to examine the mediating context in which climate interacted by illuminating concepts such as the vulnerability and resilience of societies and economies to climate and weather events.

2.4.2 Vulnerability, resilience and adaptive capacity

The concepts of vulnerability, resilience, and adaptive capacity are critical to assessing long-term risk and the magnitude of present weather and climate impacts, though are often overlooked when considering the past (Pfister and Brazdil 2006; Leroy 2006; Tainter 2006; McNeill 2008; Carey 2012). One body of literature, climate history, has taken up the task of applying these frameworks to the past, and a growing number of studies are beginning to illustrate how climate formed part of a dynamic interplay with a number of human and environmental factors in past events or change. This moves approach away from both the climatic determinism of the twentieth century and the 'collapse'-oriented scholarship of recent decades, and, by placing human agency at the heart of its approach, offers a more nuanced way of understanding climate-society interactions (Ogilvie 2010; Carey 2012).

Many of these studies use the socio-ecological system as their underlying concept. This coupled system theorises that societal and biophysical subsystems operate in mutual interaction, and are exposed to multiple, interacting perturbations (van der Leeuw 2001). In order to understand the impacts of stressors on these systems, they are evaluated in terms of their vulnerability, or the susceptibility to harm (Adger 2006), and resilience, or the ability of a system to achieve a desirable state in the face of change (Folke 2006). Vulnerability and resilience are not simple opposites but are complementary framings (Turner II 2010). Vulnerability seeks to understand the weakest parts of the system to disturbances, while resilience examines the characteristics of the system that make it more robust to perturbations. Moreover, adaptive capacity is a concept that links these traditions, and examines the ability of an individual, community or system to prepare for stress in advance or to adjust to the effects caused by the stresses (Engle 2011).

2.4.2.1 Vulnerability

Although vulnerability is conceptualised in different ways for different purposes, it generally has three key parameters, which are exposure, sensitivity, and adaptive capacity (Adger 2006). Exposure relates to the nature and extent to which a system experiences stresses, whether environmental or socio-political. Sensitivity involves the likelihood of a system to be changed or affected by perturbations, and adaptive capacity is the ability of a system to cope or change to manage environmental hazards or socio-political change, as well its ability to expand the range of variability with which it can cope (Adger 2006). As well as environmental exposure, then, the vulnerability of livelihoods occurs when individuals or communities have insufficient entitlements, or 'capital', or where there is a breakdown in social relations or institutional participation (Bohle et al. 1994; Adamson 2014). Adger (2006) notes that contemporary experiences of vulnerability are felt or perceived as 'insecurity'. This can both relate to a lack of food or livelihood security and persistent strife and conflict. Vulnerability is manifest at several scales, and has multi-level interactions between its components, including livelihoods and social structures, that determine the vulnerability of the socio-ecological system as a whole (Turner II et al. 2003). Other vulnerability-related terms that will be used in the later chapters are 'fragility' and 'robustness', and are used here to refer to the degree of vulnerability at the systems level. Individual vulnerabilities may occur within a robust system, although they may also undermine it and contribute to systemic fragility (Adamson 2014). A number of scholars have noted that vulnerability is not a desirable state, and is generally seen as a negative property (for instance Engle 2011). Although it will be used extensively in the later analysis chapters, this will not reinforce simply negative perspectives, as 'low vulnerability' is clearly a positive characteristic.

2.4.2.2 Resilience

Resilience, which will be used less regularly in this thesis, has its origins in the ecological sciences (Holling 1973; Engle 2011). Unlike vulnerability, resilience is an entirely internal property of a system and relates more to shifts between states in systems rather than structural changes within the system (Adamson 2014). Thus, it is not simply its opposite. This means that resilience includes concepts such as the magnitude of environmental or socio-political disturbance that a system can absorb before it changes to a radically different state, as well as the capacity for self-organisation both in advance and in response to shocks (Adger 2006). A frequent criticism of resilience, however, is that it remains less attentive to the social aspects of socio-ecological systems (Engle 2011). Moreover, as it is hard to measure, translating resilience into practice is fraught with difficulty. Like vulnerability, resilience can operate at multiple levels and scales, while loss of resilience at some scales can increase it at others (Walker et al. 2004). Resilience also relates to the opportunities that disturbance can create in terms of system renewal and the emergence of new trajectories (Smit and Wandel 2006).

2.4.2.3 Adaptive capacity

Adaptive capacity is most often seen as a bridging concept between vulnerability and resilience, and is highly influenced by socio-political factors such as social networks, governance and institutions (Engle 2011). Adaptive capacity is made up of diverse components which can alter the exposure to risks stemming from climate variability, absorb or recover the losses resulting from its impacts, and exploit new opportunities that arise in the process (Adger and Vincent 2005). The term adaptive capacity specifically relates to the *potential* for adaptation to take place, for instance by the strength of social networks, and thus strictly conveys the resources available for adaptation. Yet even if this exists, it is not always the case that individuals and communities use it effectively to adapt to climate variability. This process of adaptation itself can operate on numerous spatial scales and through various social agents, whether by individuals or the upper levels of the political unit, though these are often not independent of each other. According to Adger and Vincent (2005), however, adaptations on all levels are usually reactionary rather than anticipatory. An important difference also exists between adaptive capacity and coping strategies, which may involve a temporary change in food source or bartering for food as opposed to more formalised relief structures.

2.4.2.4 Vulnerability, resilience and adaptive capacity in southeast Africa (c. AD *1500-1830)*

The concepts outlined above will be centrally located in examining the consequences of past climate variability in southeast Africa. To infer more detailed links between climate and society, though, written source material is needed. Prior to this, conceptualising vulnerability and others elements is more difficult, and to make any sort of statements on the impact of past climate variability, comprehensive analytical models such as that in Figure 2.19 (b) are helpful (Hannaford et al. 2014). This by no means advocates a rigid, universally applicable model for a given territory or society, but is aimed at demonstrating how complex climate-society relationships can at least be conceptualised. For instance, the representation of this in Figure 2.19 presents two such models of contrasting detail in relation to the decline of Mapungubwe. Panel (a) shows a simple ecological cause-effect collapse model based on palaeoclimatic data and corroboration from the archaeological record. Here, both the limited consideration of factors and the timeframe of this model result in a pathway more indicative of environmental collapse. By contrast, (b) demonstrates the interactions between the critical components that require consideration when examining climate variability and the decline of the Mapungubwe state. In this more complex framework, the existing work on the region fits into different parts of the model. For example, the environmental setting of the state, the biophysical impacts of climate change on local vegetation, socio-cultural perception of drought, and human interaction with the environment in the form of subsistence and livelihoods.

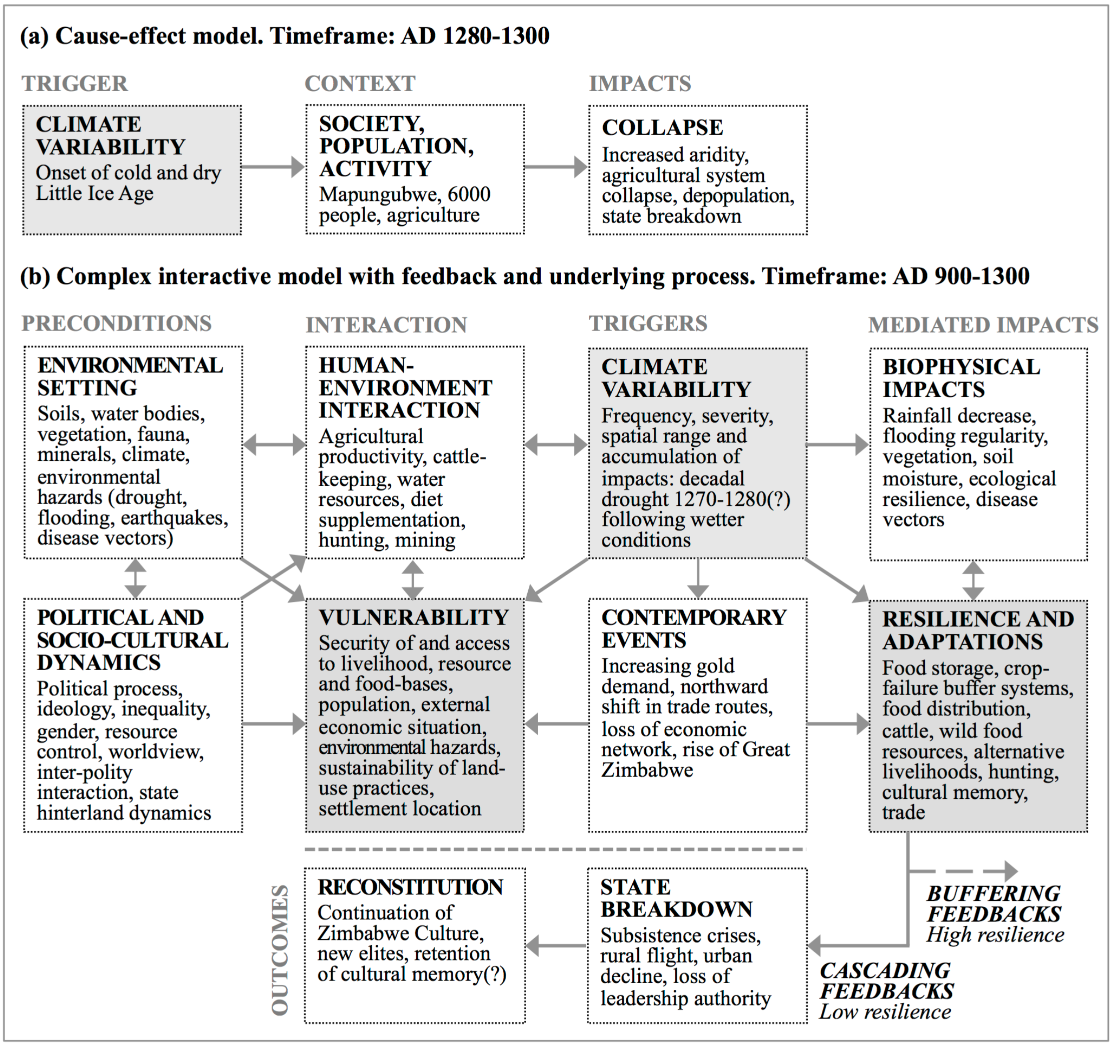

FIGURE 2.19 Simple and complex socio-environmental conceptual models relating to the decline of the Mapungubwe state (modified after Butzer 2012).

In contrast to the broader conceptual modelling approach outlined above, the availability of written sources allows the aforementioned frameworks to be utilised more extensively to uncover the various factors that affected human-climate dynamics. By illuminating vulnerability, resilience and adaptive capacity, differences in the impacts of and responses to climate variability can be evaluated both within communities and across the landscape. Moreover, differences in cultural factors, including rainmaking and ritual practices, can be integrated into these areas as suggested by Carey (2012).

In the southeast African case, a major task remains to document the differential and changing livelihood, socio-political and cultural relationships that existed with the landscape, which can offer insight into vulnerability and resilience that goes beyond previous consideration of 'favourable' environments. Of particular importance here are links between the environment and the economic base of the society in question, specifically food systems. This is imperative both as subsistence food production is widely recognised as the most important livelihood activity to the greater number of the pre-colonial population, and because food-related livelihoods are 'climate-sensitive' (Barnett and Adger 2007). A promising approach built on these factors is demonstrated by Ekblom (2012) in considering historical vulnerability and resilience in Chibuene, Mozambique. Here, written, palaeoecological and archaeological evidence for changing livelihoods, resource utilisation and economic security were examined in order to illustrate vulnerability and resilience over multi-centennial periods. Manyanga (2007) has applied a similar approach to the Shashe-Limpopo basin, where by focusing on resource exploitation in the range of micro-environments in the Mapungubwe state, new perspectives are offered regarding the subsistence options and economic base of the state beyond floodplain cultivation (Manyanga 2007). Such an approach could be fruitfully applied to political units and communities such as the Mutapa state, Manyika kingdom and Tonga populations living in the Portuguese jurisdiction, where underutilised written sources supplement archaeological and environmental data.

Furthermore, adaptive capacity and coping strategies have received little attention in southeast Africa, where practices such as food storage and distribution could have buffered or displaced external impacts in order to avert food scarcity, famine or social distress. Examining how society adapted to externally imposed change from written and oral sources may therefore yield further clues regarding the internal workings of society which affect resilience, notably human resourcefulness, the rigidity of social and political networks and adaptation strategies (Hannaford et al. 2014). Further elucidation in this area may also help to understand potential preparedness and response to environmental risk in periods prior to the availability of written sources, for instance in the decline of Great Zimbabwe. However, these factors changed over time through both external and internal reasons, such as colonial influence, warfare and changing political dynamics, and these shifting parameters, though difficult to assess, must be taken into account where possible.

Although only some areas have been suggested here, consideration of vulnerability, resilience and adaptive capacity in coupled socio-ecological systems may provide a more rewarding approach than a focus on abrupt events of change or 'collapse'. This follows the observations of James McCann, who suggested that in Africa the "real value of linking the environment to historical process may lie in a more subtle, nuanced view of how environmental conditions set a context for social and historical interaction" (McCann 1999, 268). Source material and its temporal resolution in the Zambezi-Limpopo region necessitates a focus on changes over longer-term, sub-decadal to decadal periods, while inter-annual consideration of climate-society interaction can only be achieved after the first detailed written accounts were recorded in 1824 in the KwaZulu-Natal area. Nevertheless, applying this approach over a *c*. 325 year period in the former region will allow original conclusions to be drawn on the relative and shifting importance of the factors that made some societies vulnerable to climate variability and others more resilient. This is a question of prime importance if the consequences of climate variability are to be understood.

The following four chapters will investigate the nature and consequences of past climate variability in the two focus areas. Chapter 3 will analyse a wide range of palaeoclimate datasets and documentary reconstructions to assess the dominant signals of precipitation variability in southeast Africa over the last 1200 years, and test for the presence of extended periods of warm-wet and cool-dry conditions in periods such as the MCA and LIA. This will provide background to the analysis of societal dynamics in the Zambezi-Limpopo region in particular. Chapter 4 will reconstruct late-eighteenth and early-nineteenth century precipitation variability in South Africa using ships' logbooks. These reconstructions will provide seasonal reconstructions at points in both the SRZ and WRZ, and will be used alongside other sources in analysis of climate-society interactions in the KwaZulu-Natal area. Chapter 5 will use written sources to examine the vulnerability, resilience and adaptive capacity of political units, such as the Mutapa state, and less centralised communities, such as those in the hinterlands of Portuguese settlements. This will allow assessment of the significance of climate variability in socio-political change. Chapter 6 will analyse the role of climate variability in the late-eighteenth and early-nineteenth century socio-political and economic transformation using written and oral sources relating to KwaZulu-Natal. The overall significance of climate variability in pre-colonial southeast Africa will then be discussed in Chapter 7.

Chapter 3. Precipitation variability over the last millennium

High-resolution, high-quality palaeoclimate records are required to understand spatial climate patterns and forcing processes on timescales of relevance for human societies (Jones et al. 2009; Holmgren et al. 2012; Masson-Delmotte 2013). Most high-resolution palaeoclimate records come from the polar regions or from the middle to high latitudes in the northern hemisphere, and although the number of data are growing, there remains a comparative paucity of records from the southern hemisphere low latitudes, particularly southern Africa (Figure 3.1). Indeed, a considerable proportion of the debate over the human significance of past climate variability in this region directly stems from the differing interpretations of, and ambiguities between, the few regional palaeoclimate proxy records that exist (Hannaford et al. 2014). As outlined in the previous section, this demands both the re-interrogation of palaeoclimate sources from across the region, as well as the incorporation of datasets published more recently, which are yet to be considered with respect to societal change. This chapter therefore takes the form of an analytical review, designed to address a range of questions raised, often indirectly, in the literature. Such an undertaking is overdue, the last text dedicated to this task over a millennial scale being in 1992 (Tyson and Lindesay 1992).

This investigation will consider a comprehensive range of palaeoclimate proxy sources over the last millennium from the SRZ, where the societies under examination developed. As precipitation was of principal importance to pre-colonial farming communities, the analysis will focus on this variable rather than temperature. Because these variables are often difficult to differentiate, however, this study will first examine the palaeoclimatic inferences of the available proxies, before considering the general evolution of precipitation variability over the last millennium. The incorporation and analysis of a broader range of datasets follows the work of Neukom et al. (2014), where proxy-documentary records over last 200 years in southern Africa were statistically integrated to produce multi-proxy reconstructions. Although this analysis will broadly follow this approach, there is less scope for the statistical integration of records into a millennial multi-proxy reconstruction due to their reduced resolution and quantity prior to the nineteenth century. The chapter will also evaluate the precipitation manifestations of the variably dated MCA and LIA in the southern African SRZ by applying methods used elsewhere (Osborn and Briffa 2006) to gain insight into their temporal dynamics. Documentary-reconstructed nineteenth century rainfall variability will be introduced here, but this will mostly be assessed in the next chapter to facilitate inter-annual comparison with the ships' logbook reconstructions. Furthermore, sparse written records of climate variability from the sixteenth to nineteenth century will be presented in order to facilitate independent comparison with the proxy records. To conclude, the chapter will summarise these findings on a regional level, and will consider sub-regional precipitation variability to inform the later chapters which assess the societal significance of climate variability. This means lending focus to criteria such as the spatial range of variability, rather than simply accepting the data on face-value.

3.1 Data and methods

3.1.1 Proxy-documentary sources

Southern Africa is relatively sparsely covered by palaeoclimate data, yet there are now several datasets from the region which represent changes in precipitation and/or temperature (Figures 3.1 and 3.2; Table 3.1). Unlike most other regions, however, no dominant data source exists, meaning a diverse range of proxies of varying resolution must be incorporated into any comprehensive analysis of its past climate. As the aim of this investigation is to inform past climate-society interaction, only records with an adequate resolution will be analysed, which is here defined as multi-decadal or higher.

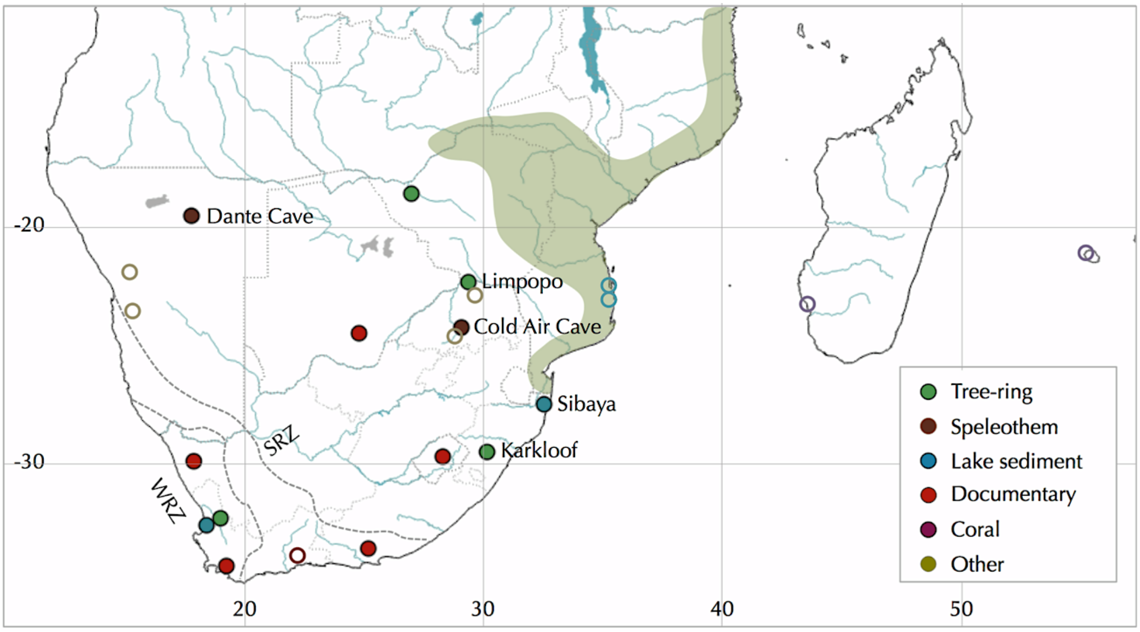

FIGURE 3.1 Spatial distribution of palaeoclimate proxy and documentary data obtained for the southern African region. The shading indicates approximate extent of Portuguese documentary sources. Reference datasets are shown as hollow dots. Labelled datasets are used extensively.

3.1.1.1 Dendrochronological records

Tree-ring studies are frequently the main source of high-resolution palaeoprecipitation indicators in regional investigations, though are relatively few in number in southern Africa. Three records are available from the SRZ, located in KwaZulu-Natal, the Limpopo Valley and northern Zimbabwe (Figure 3.1). The KwaZulu-Natal record is taken from a single Yellowwood (*Podocarpus falcatus*) tree that was felled in 1916 in the Karkloof forest. Subsequent analyses of the tree-ring growth pattern by Hall (1976) produced a ring-width curve dating back to AD 1320, the fluctuations of which were interpreted as representing past precipitation variability. While this investigation has been widely cited, the only data currently available are 7-year running mean ring-widths taken from the original published set in Hall (1976). Moreover, this record is based on a single tree, which differs from the higher sample size typically used in dendrochronological reconstructions (Jones and Mann 2004). Hall, however, argued that its location on a hill-slope in a mild environment meant that annual precipitation was the limiting factor for growth, and thus the ring-widths reflected past precipitation conditions. Further north, a 200-year chronology is available based on several samples from *Pterocarpus angolensis* trees in Mashonaland, northern Zimbabwe (Therrell et al. 2006). This record is made up of samples from three trees, and is significantly correlated with twentieth century summer rainfall in this ITCZ-sensitive region (Therrell et al. 2006). More recently, unpublished carbon isotope ratios of Baobab (*Adonsonia digitata*) tree-rings from the Limpopo region in northern South Africa have been made available for analysis (Woodborne, unpublished manuscript). This sample is made-up of carbon isotope ratios from six Baobab trees that grew over the last thousand years, and represents the longest tree-ring record in the region.

TABLE 3.1. Metadata of southern African SRZ proxy-documentary records. Resolution: ann. – annual, dec. – decadal, and cen. – centennial.

Site	Lat, Lon	Start	Res.	Proxy	Reference
Tree					
Karkloof	-29.3, 30.2	1142	7-yr.	Ring-width	Vogel et al. (2001)
Mashonaland	-18.5, 27	1796	Ann.	Ring-width	Therrell et al. (2006)
Limpopo	Several trees	1036	Ann.	Ring-width	Woodborne et al. (unpublished manuscript)
Speleothem					
Cold Air Cave T7	-24.1, 29.1	6k BP	Ann.	Isotope	Holmgren et al. (1999)
Cold Air Cave T7	-24.1, 29.1	6k BP	Ann.	Grey scale	Holmgren et al. (1999)
Cold Air Cave T7	-24.1, 29.1	1650	Ann.	Isotope	Sundqvist et al. (2013)
Cold Air Cave T8	-24.1, 29.1	25k BP	Dec.	Isotope	Holmgren et al. (2003)
Cango Cave	-33.6, 22.2	30k BP	~50	Isotope	Talma and Vogel (1992)
Dante Cave	-19.4, 17.8	5k BP	Dec.	Isotope	Sletten et al. (2013)
Lake					
Sibaya	-27.3, 32.6	800	Dec.	Diatom	Stager et al. (2013)
Nhauhache	-21.6, 35.2	2300 BP	Dec.	Diatom	Holmgren et al. (2012)
Nhaucati	-22, 35.3	400	Dec.	Diatom	Ekblom and Stabell (2008)
Documentary					
Lesotho	-	1824	Ann.	Missionary	Nash and Grab (2010)
Kalahari	-	1815	Ann.	Missionary	Nash and Endfield (2008)
Namaqualand	-	1817	Ann.	Missionary	Kelso and Vogel (2007)
Eastern Cape	-	1821	Ann.	Colonial	Vogel (1989)
Africa-wide	90 regions	1800	Ann.	Multiple	Nicholson et al. (2012)
Other					
Multi-proxy SRZ	-	1796	Ann.	Multiple	Neukom et al. (2014)
Wonderkrater	-24.4, 28.8	25k BP	Cen.	Pollen	Scott (1982)
Kuiseb River	-23.4, 15.3	2.1k BP	Cen.	Midden	Scott (1996)
Spitzkoppe	-21.8, 15.2	12k BP	~30	Midden	Chase et al. (2009)

3.1.1.2 Cave speleothems

Cave speleothems, particularly stalagmites, constitute one of the few other natural archives in low or mid-latitude regions that offer the potential for a continuous climate record spanning a long period of time (Talma and Vogel 1992; Holmgren et al. 2001).

The interpretation of climatic variables from these data, however, is difficult. There is inherent complexity in understanding and determining climatic influences on stable isotope records in stalagmites, as multiple processes at different spatial and temporal scales affect their composition (Sundqvist et al. 2013). In southeast Africa, these data have provoked considerable discussion on both the nature and consequences of past climate variability, particularly the records of stable isotope ($\delta^{18}O$ and $\delta^{13}C$) growth layers in two dated stalagmites (T7 and T8) from Cold Air Cave, Makapansgat Valley, 30 km southwest of Polokwane in northern South Africa (Figure 3.1).

Records of $\delta^{18}O$ from the T7 and T8 stalagmites were initially interpreted as representing more humid conditions, determined by cave temperature (reflective of annual temperatures outside), and the composition of the meteoric water from which it precipitated. $\delta^{18}O$ composition in stalagmites has also been linked to moisture source, transport distance, amount of precipitation, and regional air temperatures, making its precise palaeoclimate signal highly difficult to determine (Stager et al. 2013). Stalagmite $\delta^{13}C$ is related to the plants from which the CO_2 in the soil is derived (Holmgren et al. 1999). In most semi-arid parts of the southern African SRZ, barring high-altitude mountains, C_4 grasses dominate (Vogel et al. 1978). More enriched $\delta^{13}C$ values are therefore associated with a greater abundance of C_4 grasses in vegetation, and thus warmer and wetter summer conditions. Diminished grass cover is more reflective of woody C_3 vegetation, such as trees and shrubs, and thus of drier conditions (Holmgren et al. 1999; Lee-Thorp et al. 2001). Consequently, $\delta^{13}C$ is often directly linked with past precipitation, as this is a prime determinant in the relative abundance of C_4-C_3 vegetation. Still, enriched $\delta^{13}C$ can also reflect seasonality, seepage rates, soil water degassing, grazing, and light regimes (Scott and Lee-Thorp 2004; Wang et al. 2010). Moreover, the hydrological significance of changes in the relative abundance of vegetation types is not clear, as human activity also influenced SRZ vegetation during the late Holocene (Neumann et al. 2008).

An additional indicator from the Cold Air Cave T7 stalagmite is the grey scale colour branding of growth layers. These annual colour variations represent changes in the concentration of humic matter in the drip water feeding the stalagmite (Tyson et al. 2000). Darker branding is suggested to reflect increased temperatures and mobilisation of organic matter from the soil, associated with wetter summers and enhanced grass cover above the cave. By contrast, less colour branding is associated with drier periods and sparse grass (Stager et al. 2013). Holmgren et al. (2003) tested these assumptions, and found significant correlations with both area-averaged annual temperature ($r = 0.78$, $p < 0.01$) and rainfall anomalies ($r = 0.69$, $p < 0.01$). Therefore, while Stager et al. (2013) state that this series provides clear indications of palaeoprecipitation, as it is less likely to represent a wide range of ecological factors, earlier analysis indicates strong relationships to temperature as well. These complexities relating to interpretation mean that it is difficult to tie stable isotope records to single climatic variables, despite these being among the longest, most reliably dated and most finely resolved proxies from the SRZ. In addition, a subset of last 350 years of the T7 $\delta^{18}O$ dataset was re-analysed by Sundqvist et al. (2013) using high-resolution sampling of stable isotopes and an improved age model. These data will also be considered in the analysis here.

Two other speleothem records exist in southern Africa. The first of these is taken from the Cango Caves, located in the transitional year-round rainfall zone in the south of South Africa (Talma and Vogel 1992). This speleothem record is the region's oldest, and its stable isotope series has been used to infer both past temperature and precipitation. This record has been found to show limited correspondence with other SRZ records (Tyson et al. 2000), which is thought to be because of its location in the all-seasons rainfall region, an area that is influenced by atmospheric circulation and weather processes affecting both rainfall regions. Consequently, the site is sensitive to even small shifts in the position of the boundary between the two zones (Tyson and Lindesay 1992). This means that at different times, variable or inverse relationships are found between the Cango Caves speleothem record and other SRZ records. No raw data are available for the Cango Cave speleothem, and it will be used as a reference dataset. A further speleothem record has been recently developed from the Dante Caves in Namibia (Sletten et al. 2013). This record spans the last 4600 years, and in addition to oxygen and carbon stable isotope records, it provides data on the relative proportions of aragonite and calcite in layers, which are apparently sensitive to changes between wetter and drier conditions (Sletten et al. 2013). Excluding the T7 stalagmite, each of these records have a variable resolution of between 1-50 years.

3.1.1.3 Lake sediments

Data from lake sediments represent the other main source of palaeoclimate data in the southern African region. SRZ sediment records are taken from three lakes that are hydrologically 'closed', where there are no overland inlets or outlets. This means that inputs to their water budgets are entirely dependent on precipitation, which as a result of their location is mostly ITCZ-sensitive. The most recent of these lake records is a diatom record from Lake Sibaya (Stager et al. 2013), located in Maputaland, northern KwaZulu-Natal. This record represents hydrological fluctuations over the last 1800 years with a variable sampling resolution of between 1-22 years, although these dates are at more consistent intervals than the Dante Cave speleothem. Two other lakes, Nhauhache (Holmgren et al. 2012) and Nhaucati (Ekblom and Stabell 2008), are located within 10 km of one another near the town of Vilanculos in coastal Mozambique. According to Holmgren et al. (2012), these dune lakes respond quickly to climate fluctuations, and may be more suitable for palaeoclimate inference than interior lake basins, as the hydrology of inland lakes may be complex and influenced by larger regional or local aquifers. Nonetheless, uncertainty from zones of rapid and/or discontinuous sedimentation is a factor in these cores (Ekblom and Stabell 2008). Raw data for these two lakes are unavailable, therefore their moisture inferences will be assessed qualitatively (Figure 3.2).

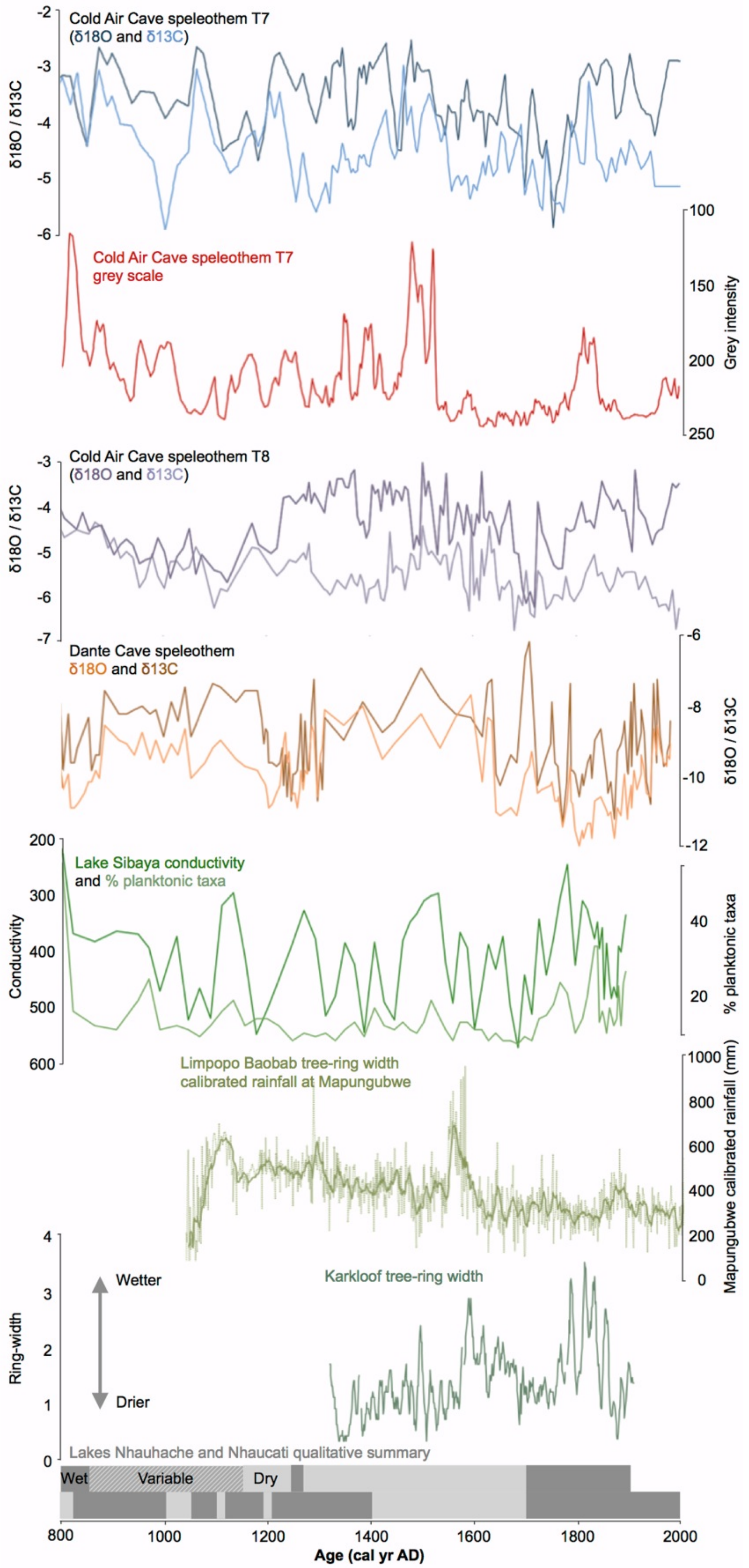

FIGURE 3.2. Summer Rainfall Zone proxies AD 800-2000.

3.1.1.4 Documentary reconstructions

As well as natural proxy archives, a number of semi-quantitative documentary reconstructions of nineteenth century precipitation variability exist in different parts of the region. SRZ rainy season reconstructions are available for Lesotho (Nash and Grab 2010), the Kalahari (Nash and Endfield 2008) and the Eastern Cape (Vogel 1989), and were produced from letters, journals and reports written by missionaries and colonial authorities, as well as newspapers, diaries and travelogues. Observations in each of the reconstructions were classified into five categories on a -2 to +2 scale, equating to very dry, relatively dry, normal, relatively wet, and very wet, dependent on the prevalent documented climatic conditions in each rainy season. A further annual nineteenth century semi-quantitative 'wetness index' was developed by Nicholson et al. (2012), covering 90 regions across the African continent. This index incorporates rainfall station records, documentary data (often secondary), and other natural proxies, which were analysed and combined to give a 'wetness' score on a seven-class scale of -3 to +3 for each geographical region. Each region was determined on the basis of homogenous spatial patterns of inter-annual twentieth century rainfall variability. This record also relies on statistical inference for regions and periods with insufficient data based upon 'equivalent regions' in the instrumental record.

3.1.1.5 Other proxies

Among the other sources of palaeoclimate data are the SRZ multi-proxy reconstruction for the last two centuries (Neukom et al. 2014). These records were statistically produced using ensemble-based principal component regression. The data used from across the SRZ include each of the documentary datasets (Vogel 1989; Kelso and Vogel 2007; Nash and Endfield 2008; Nash and Grab 2010), the *Pterocarpus angolensis* tree-rings from northern Zimbabwe (Therrell et al. 2006), the Ifaty Reef coral record (Zinke et al. 2004), and rainfall station datasets from across the region. Datasets used solely for reference include nitrogen isotope ratios from bone assemblages excavated at archaeological sites in the Limpopo Valley from AD 800 to 1800 (Smith 2005; Smith et al. 2007), and fossilised rock hyrax (*Procavia capensis*) middens from the margins of the Namib Desert, which offer stable carbon and nitrogen isotope records spanning the last 12,000 years. These latter records have been developed at two sites: the first in the Kuiseb River Basin (Scott 1996), and the latter in the Spitzkoppe range (Chase et al. 2009) (Figure 3.1), but will not be used at the forefront of the investigation into SRZ climate variability, as they are both near the SRZ-WRZ boundary and are located in a considerably drier part of Namibia than the Dante Cave speleothem records. Other natural proxies, such as pollen records from Wonderkrater (Scott 1982), Tate Vondo (Scott 1987) and Wonderwerk (Brook et al. 2010) are too low resolution, or are affected by late-Holocene human influence, and are not used at the front of the analysis. Coral records of SST variability (Zinke et al. 2004) will also not be used in this analysis, as the scope of the thesis rules out any thorough consideration of climate modes.

3.1.2 Supplementary written sources

Sixteenth to nineteenth century European documents are available to supplement proxy-documentary records in the SRZ. These predominantly Portuguese records centre on the area of present-day Zimbabwe and Mozambique, with a particular focus along the coastal areas and Zambezi river (Figure 3.1). The sources are held within translated source compilations in the British Library (Theal 1898-1903; da Silva Rego and Baxter 1962-1975; Freeman-Grenville 1962), and the Department of History at the University of Zimbabwe (Beach and Noronha 1980), the former of which have been assessed for possible climate-related evidence by Ekblom (2004). Full details on these written source volumes are outlined in Chapter 5, Section 5.1.

Portuguese observers' descriptions of the environment mostly relate to atmospheric factors, including rainfall, floods, dry and wet spells, storms, frost, snowfalls, climate-related events such as the presence of plague locusts, and frequent references to food scarcity and famines. It should be noted, however, that the data from the Portuguese documents are comparatively sporadic and scanty when compared to those used for the nineteenth century reconstructions in the region. Indeed, while northern Zimbabwe and the lower Zambezi were in contact with the Portuguese from the beginning of the sixteenth century, there is little meteorological information in contrast to references to economic aspects such as gold resources and ivory, the exploitation of which reflected the primary purpose of the Portuguese presence in the region (Beach 1980, 1994; Pikirayi 2003).

3.1.3 Analysing regional precipitation variability

The overriding aim of this analysis is to use the full and best available range of regional data to understand the evolution of SRZ precipitation variability over the last millennium. While assessment of southern Africa's precipitation history is challenging, the comparison of state-of-the-art, high-resolution records means that dependence on individual records with inherent ambiguity is reduced. Nevertheless, a number of quantitative and qualitative methods must be applied to adequately assess the moisture inferences of complex palaeoclimate records.

3.1.3.1 Comparison of proxy-documentary data

To establish the general coherence between the records shown in Table 3.1, inter-annual correlations will be conducted where possible. Where records are not of annual resolution, however, the inter-annual record will be degraded to match that of the lower-resolution proxy to facilitate statistical comparison. This means that inter-annual records can be correlated with non-inter-annual proxies, but non-annually resolved proxies with varying sampling resolutions cannot be compared with each other. While degrading the inter-annual records to match the resolution of unevenly dated proxies may not be a precise measure of their correspondence, the resultant r values give an idea of the general coherence between these records. Furthermore, inter-annual records will be smoothed to 30-year running means and correlated to determine the level of agreement with lower frequency variability. As the period common to the longest, highest-resolution proxies is 1036-1890, correlations will be calculated over this period.

The main line of investigation in this chapter concerns the general evolution of precipitation variability over the last millennium. As the relative lack of high-resolution data rules out an integrated SRZ multi-proxy reconstruction, periods of coherence and reduced correspondence will primarily be qualitatively explored to reveal the dominant precipitation signals and periods of uncertainty. This will also show whether precipitation changes were coherent on a large spatial scale, or whether local variability was more prevalent at certain locations or time periods. This approach follows those of Tyson and Lindesay (1992); Holmgren et al. (1999); Tyson et al. (2000, 2002); Nicholson et al. (2013) and Stager et al. (2013), also in southern African contexts. Further statistical analysis, such as t-tests, will be conducted on individual inter-annual records to reveal if significant differences exist between centennial periods. The magnitude of centennial wet and dry conditions will also be revealed by examining the number of years ±1 standard deviation from the common mean of the period 1036-1890, while 30-year running standard deviations will be performed to analyse periods of high and low variability within and between the annual records.

The chapter will also examine evidence for, and analyse the temporal characteristics and magnitude of, the regional precipitation manifestations of the MCA and LIA, broadly defined in the literature as AD 900-1200 for the MCA, and either AD 1300-1800 or AD 1500-1800 for the LIA. This is an important proposition to test, as the global extent of these eras are highly debated, while the variability within these periods is not fully understood (Nicholson et al. 2013). Although visual comparison of proxies is helpful in understanding periods of coherence between records, the implications of periods such as the MCA and LIA cannot be adequately compared by this technique alone. To enable a clearer, regional representation of the temporal characteristics and magnitude of the MCA and LIA, this study will analyse the signals of multiple proxies by assessing their temporal characteristics in relation to certain statistical thresholds, in part following the approach of Osborn and Briffa (2006). This first requires inter-annual proxies to be smoothed to remove variations on timescales shorter than 20 years, and then normalised to have zero mean and standard deviation. Thereafter, the dominant moisture inferences of the proxy records are analysed by plotting the proportion of records where data in any given year exceed ±1 or ±2 standard deviations from the common period mean of 1036-1890, as well as the number of years above or below this mean itself. The proportion of records exceeding these thresholds over the 1200-year period will then enable consideration of the temporal extent and magnitude of the MCA and LIA to be considered. A major restriction of this analysis, however, is that only four of the proxy records that extend back to AD 800 are inter-annual. For the purposes of incorporating the higher number of non-annually resolved proxies into this general assessment, and to understand their dominant signals for societal consideration, a modified variant of this method will also be applied insofar as the dates of the non-annually resolved proxies will here be assumed to be 'mid-points'. This means that if the dated sample value is above the 1036-1890 mean, an equal number of years either side of this date are also assumed to be above the mean, and it is thus plotted accordingly. While there are uncertainties in these assumptions, there is no other method to integrate the high number of non-annually resolved SRZ data into the analysis, and consequently their incorporation for consideration of society is favoured over their exclusion. Therefore, the results of this analysis for inter-annual records alone will be compared to the same assessment which incorporates the non-annually resolved proxies.

Nineteenth century climate variability will be introduced and compared in this chapter, congruent with the debates over the significance of rainfall variability in political centralisation and conflict in KwaZulu-Natal. To date, only sparse written reference to climatic conditions and the Karkloof tree-ring record have been considered in this debate. This chapter will introduce the range of natural, and particularly documentary data sources published since the last major analysis of climate-society interactions in this period (Eldredge 1992). Furthermore, the Africa-wide precipitation database of Nicholson et al. (2012) will be compared to a range of proxy-documentary datasets to assess their coherence. This comparison will particularly focus on the first two decades of the nineteenth century, as they are not covered by most of the other documentary records. This introductory analysis will thereby allow identification of key knowledge gaps for Chapter 4, where early-nineteenth century rainfall reconstructions are derived from ships' logbook data.

3.1.3.2 Independent comparison from written sources

The main source of independent comparison for the palaeoclimate proxy data will be written observations of weather- and climate-related variables, or climatic stress, from the Zambezi-Limpopo area (Figure 3.1). Although relatively sparse, these documents represent a rare instance of written observations in the Sub-Saharan African interior prior to the nineteenth century, and thus provide a unique source of cross-comparison over a multi-centennial timescale. Initial consideration of these documents for weather- and climate-related variables was undertaken by Pikirayi (2003) and Ekblom (2004). These conclusions are re-assessed here, while this chapter will investigate the full range of translated documents available, making it the most comprehensive analysis of these sources for climatological investigation.

Additional documented observations will be added to the chronology of possible weather events and climatological observations compiled by Ekblom (2004) and Ekblom and Stabell (2008) between AD 1500-1900, while the suggested representations of climatic stress will be re-analysed. The documented observations are recorded verbatim, and each will be subject to critical analysis regarding its context, meaning and significance. Confidence intervals are given for each documented observation following the methodology of Kelso and Vogel (2007). These ratings range from 1-3, where 1 means that the classification is questionable, because only the impacts of a climatic conditions were noted by the observers, rather than the specific climatic condition itself, while a rating of 3 is given where a number of observers referred to a climatic condition with specific dates and locations. The results table from this part of the investigation will be presented in this chapter to facilitate cross-comparison with palaeoclimate data. However, critical analysis, illustrative quotes and the rationale of judgement on possible climatic evidence is fully outlined in Chapter 5 and Appendix A. This is because most of these references overlap with the discussion on the human significance of climate variability, or derive from references to famine rather than drought itself.

Documented climatic stress will be compared to proxy reconstructions to test their coherence with major wet and dry periods. This will serve as a source of independent comparison for the palaeoclimate data analysed prior to this, and will provide broad insight into the relationship between the nature and recorded impacts of climate variability over a multi-centennial timeframe. Nevertheless, it should be noted that the brief durations of drought, mostly on the order of a year or two, make exact comparisons with proxy records difficult. Moreover, an absence of observations on climate or extreme events may not mean that they did not occur, as the written records are also a reflection of the shifting focus, interest and expansion of the Portuguese presence in southeast Africa. Thus, while there are definite limitations to the extent of the documented observations on weather and climate, the historical documents that do exist contain valuable and highly unique information on the landscape and climate, which requires incorporation with palaeoclimate data in this period.

3.1.3.3 Societal implications

To conclude the chapter, a brief assessment of how its findings can be used to inform consideration of societal development will be made. Drawing on previous criticisms (Hannaford et al. 2014), this analysis will particularly focus on AD 1500-1830, where the reliance upon coincidence and cognitive archaeology can be transformed into a deeper understanding of the interaction between climatic and societal spheres. For instance, although the MCA and LIA may clearly have been important events for society, they were not deterministic, and were characterised by considerable variability (Nicholson et al. 2013). It will therefore be asked how this enriched complexity of past precipitation dynamics can be used to inform the historical analysis chapters. Caution must be applied, however, not to direct the later lines of historical research based on analysis of climatic evidence alone.

3.2 Summer rainfall zone precipitation variability

The key climatic events in the longest and highest-resolution proxies (Figure 3.2) will hereafter be discussed on a minimum of decadal timescales over the last 1200 years. First, however, results from the correlation analysis will be assessed to further establish the proxies that are most likely to represent palaeoprecipitation.

3.2.1 Establishing proxy palaeoprecipitation

To understand the general correspondence between records and their potential precipitation inferences, three sets of correlations were performed. The first, shown in Table 3.2, reveals the correlations of the inter-annual records over the common period of 1036-1890. As expected, the T7 stalagmite $\delta^{18}O$, $\delta^{13}C$ and grey-scale records demonstrate relatively strong agreement, and alone give little indication of the differential precipitation-temperature signals of each variable. It is potentially significant, however, that the T7 $\delta^{18}O$ shows an increase in isotopic values in the latter half of the twentieth century (Figure 3.2), which is consistent with the nature of global temperature change since 1950. This direction of change is also observed in the T8 $\delta^{18}O$ record, but not in the other T7/T8 variables, and may reaffirm previous studies that link stalagmite $\delta^{18}O$ mainly to temperature but caution its use as a precipitation proxy.

TABLE 3.2 Inter-annual correlation values between proxy records over the common period of 1036-1890. Shaded values are significant at $p < 0.01$. Note that the T7 grey scale record has an inverted scale, thus negative correlations represent co-variance. The Karkloof record is correlated from 1310-1890 and the Mashonaland record is correlated from 1796-1996.

	T7 $\delta^{18}O$	T7 $\delta^{13}C$	T7 grey-scale	Baobab	Karkloof	Mashonaland
T7 $\delta^{18}O$	-					
T7 $\delta^{13}C$	0.45	-				
T7 grey-scale	-0.43	-0.35	-			
Baobab	0.06	-0.02	-0.01	-		
Karkloof	0.00	-0.05	0.10	-0.39	-	
Mashonaland	0.07	0.05	-0.16	-0.05	0.19	-

No significant correlations are present between the T7 records and the Baobab record. 30-year running correlations (Figure 3.3) demonstrate that precipitation in certain periods does significantly co-vary between these records, but this is limited to multi-decadal periods such as in the early 1600s, and never for more than a century. This may indicate that the Limpopo Baobab record is generally more illustrative of local precipitation variability, or could relate to either dating disparities or the influence of other climatic (or non-climatic) variables or processes on the stalagmite isotopes. To enable statistical comparison with the Karkloof record, the other four records were reduced to 7-year running means and correlated over the period 1320-1890. Where results are significant, they show inverse relationships between the

Baobab record (r = -0.39, p <0.01) and inferred precipitation in the grey-scale record (r = 0.1, p <0.01, note the inverted scale) (Table 3.2). These inverse correlations, particularly between the Baobab and Karkloof record, are noteworthy, as one might expect a positive relationship between SRZ tree-ring records. It is therefore possible that as the Karkloof record has no supporting data from the same location, and because of the age of the dataset (Hall 1976), dating errors strongly influence the series (Tyson 1986). However, significant positive correlations are present between the Mashonaland tree-ring and the Karkloof record over their common 200-year correlation period, as well as between the Mashonaland tree-rings and the T7 grey scale record (Table 3.2).

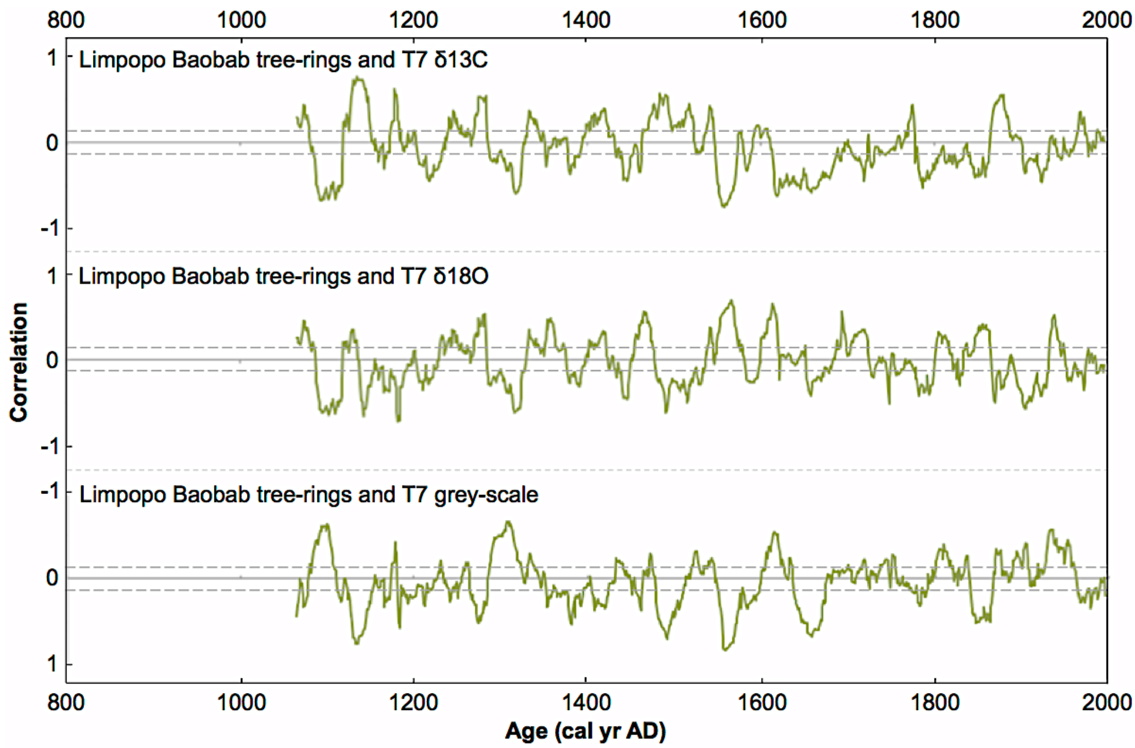

FIGURE 3.3. Running (30-year) correlations between the Limpopo Baobab record and the T7 stalagmite proxies. Dashed lines indicate significance thresholds.

The second set of correlations, given in Table 3.3, assess lower-frequency coherence between the 30-year running means of these inter-annual records. Slightly stronger relationships are observed between the T7 records, yet no statistically significant correlations are present with the Limpopo Baobab record, which may again suggest that local variability is more important in this record.

TABLE 3.3 Correlation of 30-year running means of inter-annual proxy records over the common period of 1036-1890. Shaded values are significant at p <0.01. Note that the T7 grey scale record has an inverted scale, thus negative correlations represent co-variance.

	T7 $\delta^{18}O$	T7 $\delta^{13}C$	T7 grey-scale	Baobab
T7 $\delta^{18}O$	-	0.47	-0.49	0.05
T7 $\delta^{13}C$	0.47	-	-0.45	0.02
T7 grey	-0.49	-0.45	-	-0.02
Baobab	0.05	0.02	-0.02	-

The final correlations test the relationships between the non-annually resolved proxies and the degraded annually-resolved records, as well as the association between the different non-annually resolved proxies from the same sites (Table 3.4). Most proxies from the same sites show significant and relatively strong correlations, the only exception being the T7 and T8 stalagmite records, where no significant correlations are found between T7 $\delta^{18}O$ and T8 $\delta^{13}C$, T7 $\delta^{13}C$ and T8 $\delta^{13}C$, and T7 grey-scale and T8 $\delta^{13}C$, the latter of which is marginally insignificant. The varying strength and significance of correlations of proxies from the same site reinforces the complexities of understanding precipitation signals in isotope records from speleothems, and restricts conclusions on the relative importance of each record for consideration of precipitation. Nevertheless, that the T7 grey-scale record demonstrates coherence with a number of other records further suggests that it is representative of regional precipitation. While each of the other T7/T8 records may be of use in establishing local and regional precipitation signals, caution will be applied due to the ambiguity of their signals. This is particularly relevant for the $\delta^{18}O$ records, which have been suggested to be more representative of temperature in the literature (Stager et al. 2013; Sundqvist et al. 2013). Correlations between the two Sibaya diatom records and the two Dante Cave speleothem isotope records are strong ($r = -0.45$ and $r = 0.64$, $p < 0.01$ respectively).

TABLE 3.4 Correlations of non-annually resolved records with degraded inter-annual records over the common mean period of 1036-1890. Shaded values are significant at $p < 0.01$. Note that the T7 grey scale and Sibaya conductivity records have inverted scales, thus negative correlations represent co-variance. The Mashonaland record is correlated from 1796-1996.

	T8 $\delta^{18}O$	**T8 $\delta^{13}C$**	**Sibaya conductivity**	**Sibaya % planktonic**	**Dante Cave $\delta^{18}O$**	**Dante Cave $\delta^{13}C$**
Intra-site	T8 records: 0.30		Sibaya records: -0.45		Dante records: 0.64	
T7 $\delta^{18}O$	0.4	0.19	0.09	-0.04	0.06	-0.11
T7 $\delta^{13}C$	0.09	0.01	-0.02	0.07	0.05	0.09
T7 grey-scale	-0.26	-0.17	0.36	-0.13	0.05	0.09
Baobab	0.13	0.13	0.08	-0.18	0.42	0.1
Mashonaland	-0.02	-0.01	-0.32	0.34	-0.26	-0.34

Table 3.4 also reveals two significant correlations between sites, including between the T7 grey-scale and Lake Sibaya conductivity record ($r = 0.36$, $p < 0.01$), and the Limpopo Baobab and Dante Cave stalagmite $\delta^{18}O$ record ($r = 0.42$, $p < 0.01$) (Figure 3.4). This positive correlation of proxies from distant sites may signify that they are representative of wider precipitation variability across the SRZ. Nevertheless, the apparent high co-variance between the degraded Baobab record with Dante Cave $\delta^{18}O$ may be a result of the uneven distribution of dating in the Dante Cave stalagmite, which has 50-year gaps in some places, and the resultant masking of important lower frequency variability in the Baobab record. This is particularly evident in the 1500s, where high inter-annual variability is observed in the Baobab record, yet only three dates are available in the Dante Cave stalagmites. This is reflected in the limited visual

correspondence in panel (b) in Figure 3.4. While the dating of the Lake Sibaya diatom variables is also uneven, this is to a far lesser extent than the Dante Cave speleothem record, and hence its co-variance with the T7 grey-scale record is more reliable and visually clear (Panel (a), Figure 3.4). Limited statistical correspondence could also relate to the relative importance of local precipitation variability and the various rain-producing processes that operate in different parts of the region such as the ITCZ and the strength of the Indian Ocean winds. For instance, the Mashonaland tree-rings may lack significant correlations with other records due to the primary influence of the ITCZ in this area's precipitation. This is reinforced in the positive but insignificant correlations with the ITCZ-sensitive Lake Sibaya record (r = 0.34).

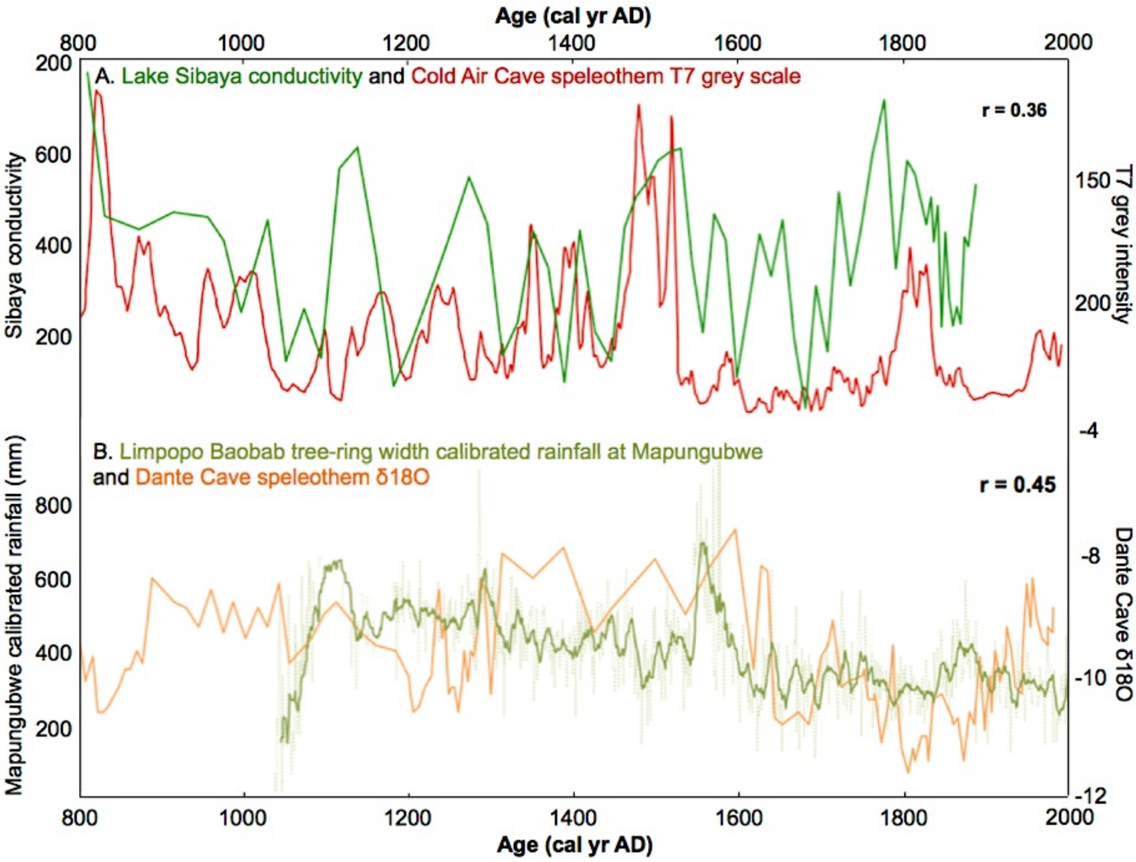

FIGURE 3.4. Significant inter-site correlations between inter-annual and non-annually resolved proxy records.

Considering the literature and this initial analysis, the records to be used with higher confidence as palaeoprecipitation indicators are the T7 grey-scale series, the Baobab tree-rings, the Lake Sibaya conductivity and % planktonic records, and the Mashonaland tree-rings. Stalagmite $\delta^{18}O$ is usually associated with temperature, and while stalagmite $\delta^{13}C$ is conceptually linked to precipitation, poor inter-site correspondence suggests that a number of climatic or non-climatic variables influence both of these proxies. Caution will thus be applied when relating these proxies to rainfall. Similarly, caution will be used when considering the Karkloof record, as uncertainty arises from the reliance on a single specimen. With these concerns kept in mind, the next section analyses precipitation variability since AD 800.

3.2.2 Precipitation variability since AD 800

Visual examination of multi-decadal scale variability between southern African proxy records over the last 1200 years reveals periods of general correspondence (Figure 3.5). The direction of overall change in inferred precipitation conditions is negative, and is particularly strong in the Limpopo Baobab's and both of the Cold Air Cave stalagmite $\delta^{13}C$ records. This is in contrast to the Cold Air Cave $\delta^{18}O$ records, which show either an increase in inferred warm-wet conditions or no overall change. At the beginning of the analysis period, relatively warmer and wetter conditions (relative to the 1036-1890 mean) appear to predominate in several records from *c.* AD 800-1200, possibly suggestive of a region-wide MCA, although considerable variability is found within this timeframe. The ninth century, the first in the period under consideration, is shown to be relatively wet in most records, particularly in the T7 $\delta^{13}C$ and grey scale records, where 87 and 71 years exceed +1 standard deviations from 1036-1890 mean respectively. Between *c.* AD 800-830, each of the available Cold Air Cave records show warmer and wetter conditions relative to the 1036-1890 mean, with wetter conditions also shown at Lake Nhauhache. At *c.* AD 830, an abrupt shift to relatively cool-dry conditions took place in the T7 isotope and grey scale values, and the Dante Cave isotopes, prevailing until *c.* AD 850. An abrupt increase in $\delta^{18}O$ and $\delta^{13}C$ in the T7 and Dante Cave speleothem records was thereafter sustained until *c.* AD 900. The T7 grey scale and T8 $\delta^{13}C$ timeseries shift to wetter conditions slightly earlier (*c.* AD 880). Decreased diatom conductivity at Lake Sibaya further indicates that the SRZ was wetter than average, and Lakes Nhauhache and Nhaucati corroborate this. This period of relative wetness, reflected in each of the proxies, persisted until around AD 970.

From *c.* AD 970-1020, the most depleted $\delta^{13}C$ values occur in the T7 stalagmite, while T7 $\delta^{18}O$ values were only marginally below average. Although T7 grey intensity and Dante Cave isotope values in this 50-year period appear to suggest wetter conditions, the T8 $\delta^{18}O$ and $\delta^{13}C$ variables reflect the cool-dry conditions suggested in the T7 isotope values. A period of above average conductivity, suggestive of drier conditions, is also shown in the Lake Sibaya conductivity record. No coherent signal is present between records in the decadal period between *c.* AD 1020-1030. In the two decades after, normal conditions relative to the 1036-1890 mean predominate in the T7 isotope and T8 $\delta^{13}C$ records, although T7 grey intensity trends towards drier conditions in the same timeframe. Markedly drier conditions at around AD 1050 are inferred from the Lake Sibaya conductivity record, the Dante Cave speleothem isotopes, and lake levels at Nhauhache and Nhaucati, suggesting generally drier regional conditions. Similarly, the latter part of this period marks the driest conditions in the entire Baobab record, which commences in AD 1036. These dry conditions extended to *c.* AD 1070 in the Baobab record, and *c.* AD 1110 in the Lake Sibaya conductivity and T7 grey scale records. In the T7 isotopes and T8 $\delta^{13}C$ chronologies, values remained above average until *c.* AD 1090, while the Dante Cave speleothem isotopes began to trend towards wetter conditions around *c*. AD 1050, indicating a degree of regional incoherence over the extent of this possible dry spell (Figure 3.5).

Regional correspondence in inferred precipitation is relatively poor at the beginning of the twelfth century, with a number of ambiguities between records. From *c*. AD 1100-1140, dry conditions are observed in each of the Cold Air Cave speleothem datasets. Over the same timeframe, markedly wetter conditions are present in the Baobab record, while the Lake Sibaya conductivity record abruptly shifts from very dry to very wet, with a similar but less abrupt trend at Lake Nhaucati from *c*. AD 1100. The sediment core from Lake Nhauhache, on the other hand, indicates variable but trending towards drier conditions. The Dante Cave speleothem isotopic values peak at *c*. AD 1100, and although conditions trend towards cool-dry, they mostly remain above the 1036-1890 mean until *c*. AD 1200. The period from *c*. AD 1140-1180 shows conditions in the T7 isotope records trending towards wetter conditions. Similarly, the T7 grey scale record suggests wetter conditions, as does the T8 $\delta^{13}C$ record, while the T8 $\delta^{18}O$ values are trending towards inferred warmer conditions. The Baobab record continues to show wetter conditions in this period, as does the Lake Nhaucati record. The diatom conductivity record from Lake Sibaya infers the second-highest stand in wet conditions over the 1200-year period at *c*. AD 1150, before an abrupt decline to very dry conditions at *c*. AD 1180. These later dry conditions are also inferred from the Lake Nhauhache core, and from *c*. AD 1170-1190 in the T7 isotopes. An overall variable agreement in palaeoprecipitation is observed in the twelfth century. In the Baobab record, for instance, 25 years exceed +1 standard deviation from the 1036-1890, while no years exceed these thresholds in the T7 variables.

A higher degree of correspondence in wet and dry conditions is present between nearly all records throughout the thirteenth century. Drier conditions persist into the first two decades of the century in most records excluding the Limpopo Baobab's and T8 $\delta^{13}C$, which show a relatively low variability and sustained wet conditions throughout the century. At *c*. AD 1220, the T7 grey scale, T8 isotope and Lake Sibaya records show an abrupt increase in inferred precipitation, with this occurring two decades earlier in the T7 isotopes. Wetter conditions were sustained in the Lake Sibaya diatom until around AD 1300, but in the T8 $\delta^{13}C$ record, a decline set in at around AD 1280. In the T7 records, this began at *c*. AD 1270 and persisted until at least *c*. AD 1300. The isotopic records from Dante Cave in Namibia show less coherence with the other SRZ records in this century. Here, an abrupt decline in isotopic values onset at about AD 1200, and was punctuated only by short periods of warm-wet conditions until a recovery in *c*. AD 1320. The wetter nature of the 1200s is reflected in that 34 and 31 years exceed +1 standard deviations of the 1036-1890 in the T7 $\delta^{13}C$ and Baobab records respectively.

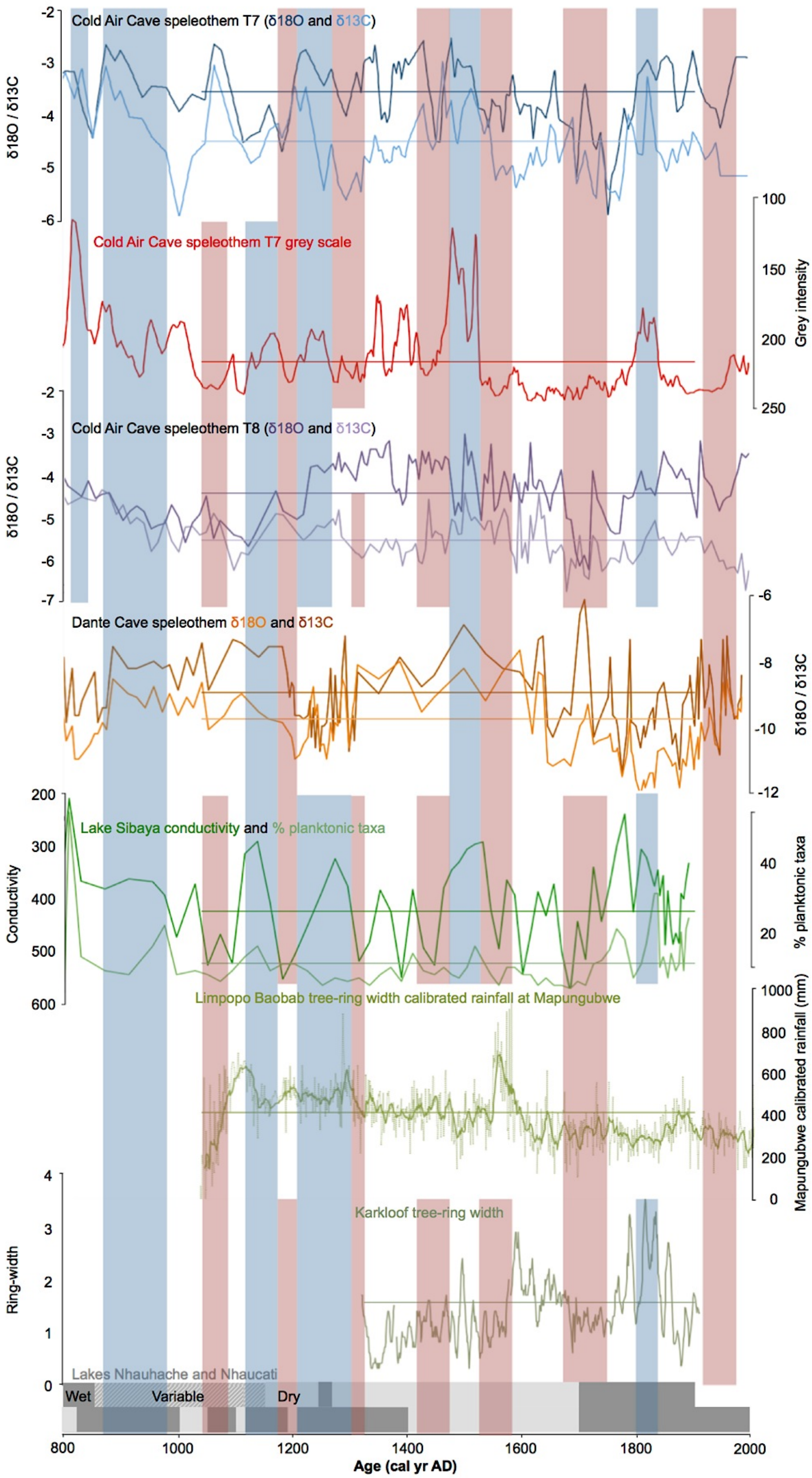

FIGURE 3.5 Main coherence of wet and dry periods, blue shading indicates correspondence of wet periods, and red shading dry periods. Mean lines represent 1036-1890 means.

Reasonable regional coherence in dry conditions is observed in the early decades of the fourteenth century, yet it is unclear from simple observation of Figure 3.5 and the previous palaeoclimate literature whether this constitutes the onset of a sustained reduction in precipitation associated with the regional LIA. At the beginning of the fourteenth century, conditions trended towards drier at Sibaya and in the Limpopo Baobab record, with very dry conditions observed at Sibaya from around AD 1310-1330. Although the Baobab values are still above the 1036-1890 mean at this time, they show their lowest values since *c.* AD 1080. Both the T7 and T8 $\delta^{13}C$ records infer drier conditions until *c.* AD 1330, as does the T7 grey scale series. The $\delta^{18}O$ records for both Cold Air Cave stalagmites, however, show increased values suggestive of warmer conditions. Drier conditions are also observed at Lake Nhauhache, though Lake Nhaucati continued to show wetter conditions until around AD 1400 before drying out completely (Ekblom and Stabell 2008). The Dante Cave speleothem isotopes suggest relatively warm-wet conditions until *c.* AD 1400, while isotopic data of faunal remains from the Shashe-Limpopo basin (Smith 2005) show that rainfall remained steady until at least *c.* AD 1415. In most other records, relatively drier conditions prevailed until at least *c.* AD 1380. In the last two decades of this century, though, the records are characterised by a high degree of ambiguity, with an equal split between proxies inferring warm-wet and cool-dry conditions.

Ambiguity between records continues into the fifteenth century. No dominant signal is shown until *c.* AD 1430, where generally dry conditions are observed through to *c.* AD 1450. Particularly abrupt shifts towards cool-dry conditions are shown in the T7 isotopes and towards dry conditions the Lake Sibaya conductivity record, while a less severe but equally abrupt drop is observed in T8 $\delta^{13}C$. Generally drier conditions are present in the T7 grey scale record, and narrow ring-widths predominate in the Karkloof record. The only proxies with relatively warm-wet conditions here are the T8 $\delta^{18}O$ and the Baobab. At around AD 1450, a recovery towards markedly wetter conditions began in numerous records. The strongest and most abrupt of these are witnessed in the T7 isotope and grey scale records, T8 $\delta^{13}C$, the Dante Cave isotopes, and conductivity at Lake Sibaya. These conditions appear to last until *c.* AD 1480 in these records, and thereafter undergo a decline through to the end of the fifteenth century. The T7 isotopes undergo a decline from the inferred very warm-wet conditions to relatively warm-wet, and this is also the case in the T7 grey scale record. T8 $\delta^{18}O$ experienced a decline to below average conditions, followed by a recovery to the highest values in the series at *c.* AD 1500. T8 $\delta^{13}C$ trends towards wetter conditions in this 20-year timeframe, as does the Sibaya conductivity record, albeit more abruptly. By contrast, the Baobab record trends towards drier conditions, with the lowest rainfall observed since the eleventh century at *c.* AD 1480. As will be illustrated later, a high degree of variability is present in the Karkloof record in these two decades, with an abrupt shift from very dry to very wet conditions.

At *c.* AD 1500, conditions were wet or trending towards wet in most records, the exception being the Karkloof tree-ring, where an abrupt decline in ring-width is followed by an abrupt return to normal conditions. The Baobab record also shows an increase in precipitation, but this is only slight and reflects a return to normal conditions relative to the mean. At around AD 1520, each of the Cold Air Cave speleothem variables, Dante Cave speleothem $\delta^{13}C$, and the Karkloof tree-ring undergo an abrupt decline in inferred precipitation and/or temperature, with the T7 grey scale series showing the greatest proportional abrupt shift to dry conditions out of any record over the 1200-year period. This decline is also reflected in the Sibaya diatom at *c.* AD 1530. Average conditions relative to the 1036-1890 mean, however, remain dominant in the Baobab. Recovery towards normal or slightly wetter than mean conditions did not begin until *c.* AD 1570 in most records excluding the Baobab, where an abrupt increase to the wettest conditions of the entire record lasted until *c.* AD 1560, after which conditions remained wet, but trended towards drier until *c.* AD 1600. These wetter conditions followed after *c.* AD 1570 in most other records, excluding the T7 $\delta^{13}C$ and grey-scale records, where inferred-precipitation remained below average. In this century, the Baobab and T7 $\delta^{13}C$ records show 22 and 28 years respectively exceeding +1 standard deviation from the common mean, while the T7 $\delta^{13}C$ record also shows 22 years exceeding -1 standard deviation from the common mean.

Dry conditions prevailed from *c.* AD 1600-1640 in nearly all records, the only exceptions being slightly earlier recoveries in the T8 isotopes, and a period of increased ring growth in the Karkloof tree at *c.* AD 1620. This period also shows the highest grey intensity value of the entire record, inferring the lowest precipitation. A slight recovery in precipitation occurs in all records from *c.* AD 1640-1670, excluding the T7 grey scale record, conditions then trend towards very cool-dry in all records apart from T7 $\delta^{18}O$. This period, lasting until around AD 1720, is the coolest and driest period in the T8 speleothem and Sibaya conductivity records, the second driest in the Limpopo Baobab record, and the joint driest in the T7 grey scale record. This appears to unambiguously indicate that this period was the driest part of the LIA in the region. It is not until *c.* AD 1710, though, that this abrupt decline starts in the T7 isotope records, where conditions do not begin to fully recover until *c.* AD 1790. The extent of cool-dry conditions across the region in the eighteenth century is particularly widespread, with persistent dry conditions observed in each record, punctuated only by a short period of wetter conditions in the Sibaya record at around AD 1730. Other records not shown here, such as the Cango Caves speleothem (Talma and Vogel 1992), also correspond to these suggestions. Recovery to near-normal conditions begins in most records at *c.* AD 1790, although the Sibaya record shows an earlier recovery at *c.* AD 1750. The severity of these seventeenth century drier conditions is evidenced in that 38 and 36 years in the T7 grey scale and Baobab records respectively exceed -1 standard deviations from the 1036-1890 mean. In the eighteenth century, the number of years exceeding this threshold remains high at 34 in the Baobab record, but is higher in the T7 $\delta^{13}C$ series at 49 years.

3.2.2.1 The nineteenth century: proxy-documentary variability

The availability of documentary records from the second and third decades of the nineteenth century onwards strongly increases the resolution of palaeoprecipitation variability reconstructions (Figure 3.6). Prior to this, in most proxy records, markedly wetter conditions are suggested between *c.* AD 1790-1820. At Sibaya, in the T7 and T8 $\delta^{13}C$ records, the Dante Cave isotopes, and in the Karkloof tree-ring, this was punctuated by a short dry spell of varying severity in the last decade of the eighteenth century, possibly representative of the dry spell linked to the *mahlatule* famine in KwaZulu-Natal. Of the documentary reconstructions, only the Kalahari chronology commences before 1820, and also shows normal or wetter conditions in the late-1810s. The Baobab reconstruction, however, shows sustained and stable dry conditions after a slight recovery in the last decade of the eighteenth century (Figure 3.6). Relatively drier conditions are also evident in the first two decades of the nineteenth century in the Mashonaland tree-ring series from northern Zimbabwe (Therrell et al. 2006) (Figure 3.6). In the 1820s, relatively dry conditions dominate in the documentary reconstructions from the Kalahari and the Eastern Cape, though no evidence of drier conditions was found from Lesotho in this decade. In the same decade, most proxy records remain relatively wet but are trending towards drier conditions.

In the year 1830, the Karkloof and Mashonaland tree-ring records show a very wet year, which is also picked up in the Kalahari reconstruction and the multi-proxy reconstruction of Neukom et al. (2014) (Figure 3.6). In the few years following this, though, an abrupt decline in precipitation occurs in every proxy record except for the Baobab and the multi-proxy reconstruction, where in the latter, relatively wet conditions lasted until *c.* AD 1850. Dry years were more frequent than wet years in the Kalahari and Eastern Cape records in the 1830s, but not in Lesotho. The 1840s, by contrast, were wet in the Eastern Cape, but generally dry in the Kalahari and Lesotho. A slight recovery in precipitation occurred in the proxy records at *c.* AD 1850, though this was brief, with a return to drier conditions observed until *c.* AD 1880. This is in sharp contrast to the Baobab record, which shows the opposite pattern. Although the 1850s were generally wet in the Eastern Cape, the other two documentary records, particularly the Kalahari reconstruction, show drier conditions dominating until the mid-1880s. Thereafter, wet conditions prevail until the early-1890s, followed by a return to generally drier conditions, while the multi-proxy reconstruction shows sustained wetter conditions after 1870, which form the wettest part of this record.

The other available annually-resolved nineteenth century records are the Nicholson et al. (2012) wetness indices for 90 African regions. Chronologies for six of these regions are shown in Figure 3.7, including the Eastern Cape, Lesotho, KwaZulu-Natal, southern Zimbabwe, south-central Mozambique, and northern Zimbabwe. These records each show relatively similar trends between 1800-1850, with dry conditions dominating the first two decades in each region. Generally dry conditions continue through to 1835 except for in the Eastern Cape, while wet years are observed from 1837-1842 in most regions, and conditions remained wet for most of the rest of the century in the Eastern Cape, with more variable conditions in Lesotho and southern Zimbabwe. However, in south-central Mozambique and northern Zimbabwe, drier conditions dominate until 1900.

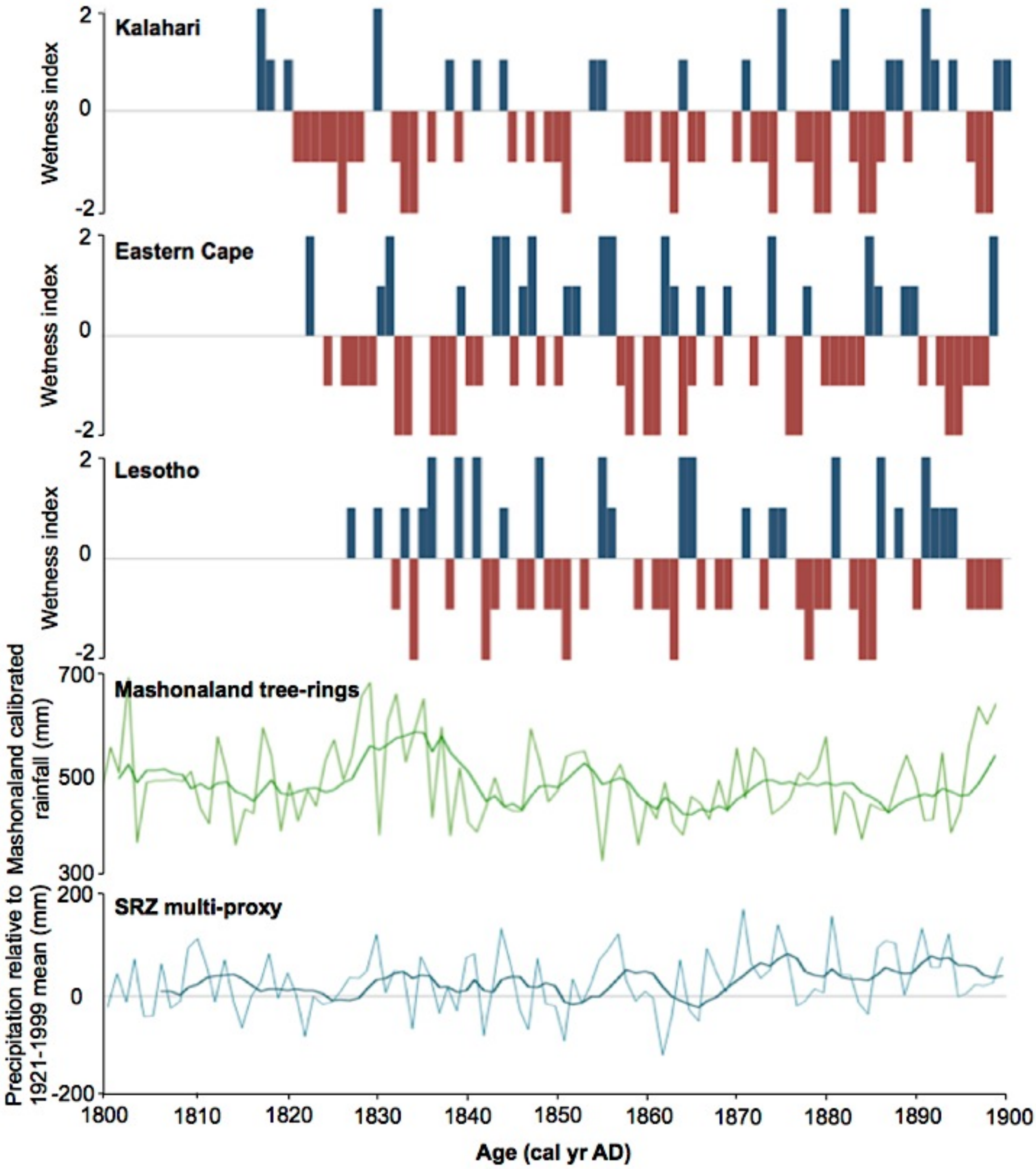

FIGURE 3.6 Summer Rainfall Zone documentary wetness indices: Index values: +2 very wet, +1 relatively wet, 0 normal, -1 relatively dry, -2 very dry, Mashonaland tree-ring record (Therrell et al. 2006), and multi-proxy reconstruction (Neukom et al. 2014).

Although a degree of correspondence is present between the Nicholson et al. (2012) datasets and the other proxy-documentary records in the latter half of the nineteenth century, clear and widespread discrepancies are present in the first two decades. These years are uniformly classified as dry for all southern African regions in the Nicholson et al. (2012) reconstructions, which bear little resemblance to the corresponding years in the proxy records. Notwithstanding the lack of data for this period in the Nicholson et al. database, the wider range of proxy sources suggest that this period was not uniformly dry. This early-nineteenth century period, key for societal investigations in Chapter 6, constitutes an area for further investigation for the ships' logbook precipitation reconstructions in Chapter 4.

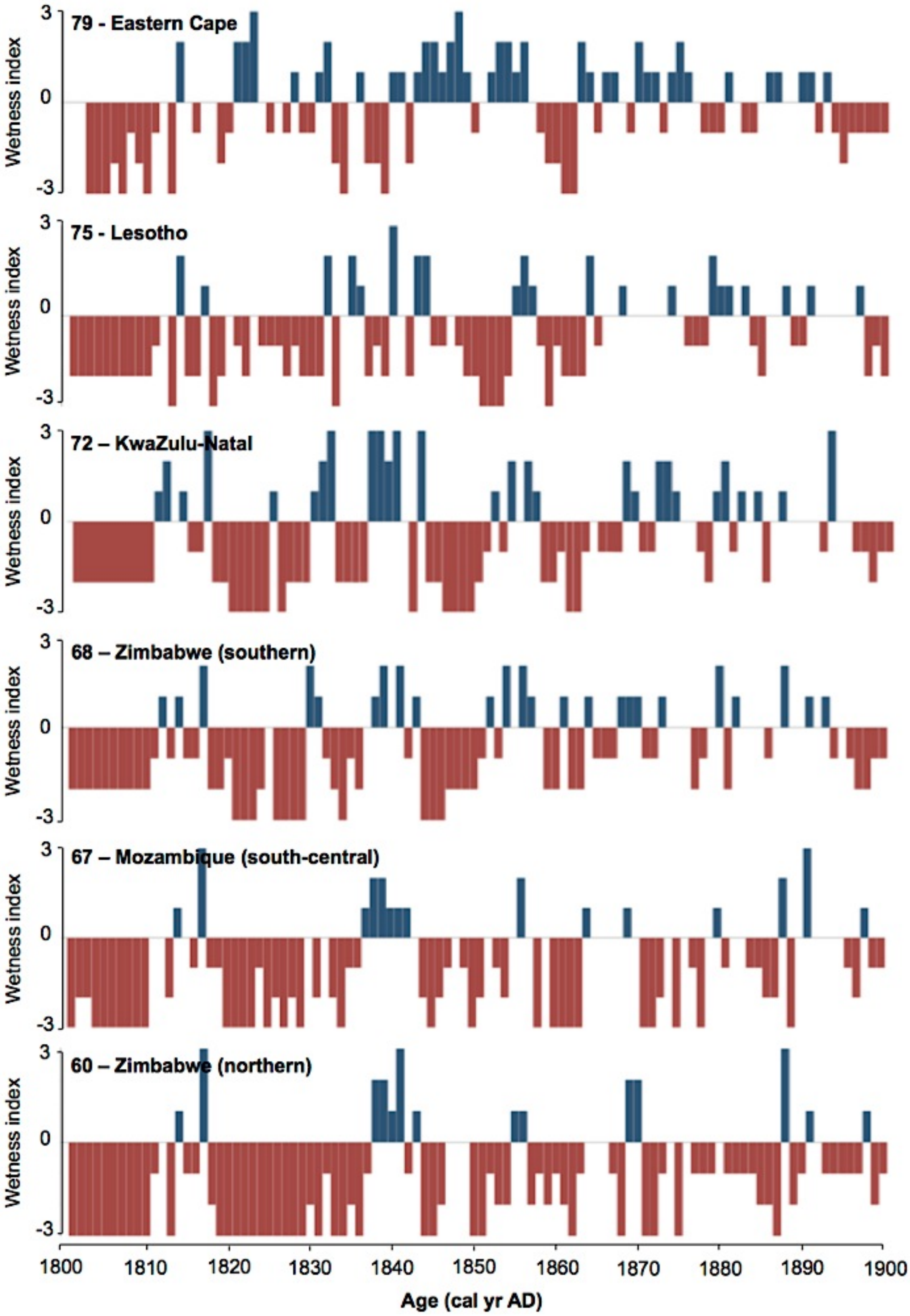

FIGURE 3.7 Wetness indices for six southern African regions from the Nicholson et al. (2012) nineteenth century Africa-wide precipitation dataset.

Towards the end of the 1200-year analysis period, $\delta^{13}C$ in both of the Cold Air Cave stalagmites remains below the 1036-1890 means for nearly all of the period up to

AD 1996 (Figure 3.5). The grey scale record makes a recovery at AD 1950, but stays relatively dry compared to the mean. T7 and T8 $\delta^{18}O$ declines to AD 1950, though increases rapidly through to the end of the record at AD 1996, possibly reflective of global temperature change. The Baobab shows a progressive decline in precipitation from AD 1880 to 2000, with only nine of these individual years exceeding the mean annual rainfall of the record. The tree-rings from northern Zimbabwe indicate above average rainfall for the first three decades of the twentieth century, followed by three decades of below average rainfall, and after AD 1960, conditions are normal to relatively wet. Both of the Mozambique lakes suggest that wetter conditions prevailed from *c.* AD 1700-2000.

This assessment of proxy-inferred SRZ precipitation variability has revealed periods of coherence and disagreement in wet and dry conditions. These include:

- General regional agreement of warm-wet conditions between *c.* AD 800-970
- Variable agreement in inferred precipitation between *c.* AD 970-1200
- Generally wetter conditions in the thirteenth century
- Variable agreement in fourteenth century inferred precipitation
- Drier conditions between *c.* AD 1420-1450, followed by an abrupt transition to wetter conditions
- Further abrupt shifts in precipitation variability in the sixteenth century, first towards drier conditions and then wetter conditions in the last three decades
- Generally drier conditions in the early-seventeenth century
- Widespread dry conditions in the late-seventeenth to early-eighteenth century, suggestive of regional cool-dry LIA
- General trend towards wetter conditions in the late-eighteenth century
- Variable correspondence in precipitation between proxy records and Nicholson et al. (2012) datasets at the beginning of the nineteenth century, reinforcing the uncertainties in these two decades.

3.2.3 The Medieval Climate Anomaly and Little Ice Age

The above analysis has demonstrated that multi-decadal to centennial phases of predominantly warm-wet and cool-dry conditions were features of the last 1200-years in the SRZ. As outlined in Section 2.1.1, these periods are thought to be synonymous with a regional MCA and LIA, yet there exists disagreement over their timing and magnitude, as well as the variability within these periods. To further understanding of these uncertainties, Figure 3.8 presents an assessment of the extent to which the proxy precipitation inferences were anomalous in the context of the common mean period of 1036-1890. Panel (a) shows the proportion of years above and below the 1036-1890 means and ±1 or ±2 standard deviations in the 20-year smoothed Cold Air Cave T7 stalagmite $\delta^{13}C$, T7 grey-scale, Limpopo Baobab, Karkloof and Mashonaland tree-ring series. Using the method outlined in Section 3.1.3.1, panel (b) reveals the same criteria for both the annually and non-annually resolved records, which are the T7 stalagmite δ13C and grey-scale records, Lake Sibaya diatom conductivity and % planktonic taxa, T8 δ13C, the Karkloof and Mashonaland tree-ring records and Dante Cave δ13C.

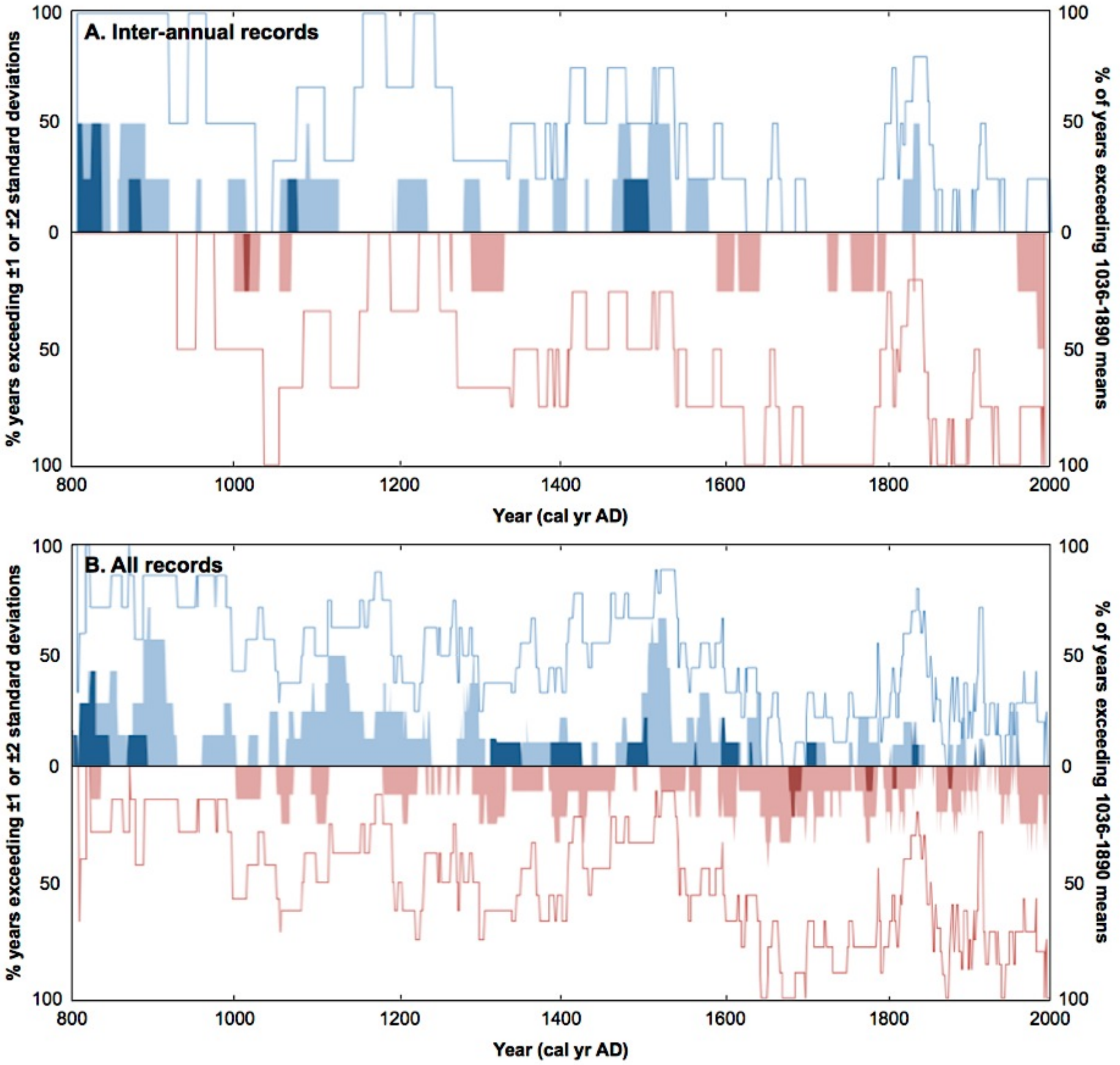

FIGURE 3.8 Proportion of years above or below the 1036-1890 record means (blue and red lines), and ±1 or ±2 standard deviations (blue and red bars) of: A. 20-year smoothed inter-annual proxy records and B. 20-year smoothed inter-annual records and non-annually resolved records. Blue lines: proportion of records above the 1036-1890 mean; red lines: proportion of records below the 1036-1890; light blue bars: +1 standard deviation; dark blue bars: +2 standard deviations; light red bars: -1 standard deviation; dark red bars: -2 standard deviations.

The inter-annual records plotted in panel (a) appear to capture the general evolution and variability of inferred precipitation from the wider range of proxies in panel (b). From both of the timeseries, it is clear that the period *c.* AD 800-1200, denotes a dominance, but not always a persistence, of wet conditions. The most extreme of these wet conditions (exceeding +2 standard deviations) were found in the ninth century. The eleventh century is less consistently wet, with occasional dry spells, while much of the twelfth century shows a dominance of wet conditions. The thirteenth century displays both wet and dry spells, and this variable picture continues into the fourteenth century, where in panel (b) a small number of records consistently display either very wet or very dry conditions. In the fifteenth century, conditions generally trend from dry to wet with an increased proportion of records exceeding the mean towards the latter part of the century. In the early-sixteenth century, a marked increase in the number of records suggesting wet conditions occurs, with a peak of 50% or more records exceeding +1 standard deviations. In the early- to mid-seventeenth century, this abruptly switches to a dominance of dry conditions, with the most extreme of these found in the late-seventeenth century in panel (b). These dry conditions persist until around 1780, and constitute the most persistent and severe dry conditions over the last 1200 years, which appear to represent the driest part of the LIA. With the exception of wet years in some records at the beginning of the nineteenth century, relatively dry conditions are persistent until the end of the twentieth century.

While it is not wise to define precise dates demarcating climatic episodes, these findings appear to suggest that wetter conditions associated with a regional MCA are relatively clearly defined between approximately AD 800-1200. Drier conditions associated with the broader extent of the LIA have a higher degree of ambiguity than the MCA, and are more difficult to clearly define. An increase in the presence of sustained drier periods appears to have begun around AD 1300, yet this is by no means permanent. The period between *c.* AD 1450-1550, for instance, shows wetter conditions prevailing, and is consistent with temperature and precipitation inferences from records not considered here such as the Wonderkrater pollen record and the Cango Cave speleothem (Scott 1982; Talma and Vogel 1992). Thereafter, until *c.* AD 1800, the analysis clearly indicates the dominance and persistence of drier periods congruent with those of suggested LIA cool-dry conditions (Holmgren et al. 1999; Stager et al. 2013; Sundqvist et al. 2013). Therefore, while it remains possible that generally drier conditions associated with the LIA were present in their broadest form from *c.* AD 1300, their severity across the SRZ was mostly felt from *c.* AD 1600.

Considering the timeframes inferred from this analysis in comparison to earlier work, it is clear that newer datasets such as the Lake Sibaya diatom and the Limpopo Baobab record refine and enhance understanding of precipitation variability in these periods. Tyson et al. (2000) suggested that generally warmer and wetter conditions MCA prevailed between AD 880-1320, while other studies have suggested AD 900-1300 as a timeframe (Tyson and Lindesay 1992). On more broader global or northern hemispheric scales, it has been suggested that the MCA is defined as spanning the period AD 950-1250 (Jones et al. 2001; Nicholson et al. 2013), or AD 950-1400 (Diaz et al. 2011). While this study is broadly in line with these timeframes, the analysis of numerous proxies provides clear evidence of wetter conditions back to at least AD 800.

In the southern African palaeoclimate literature, the LIA has been most often defined as either AD 1300-1850 (Tyson and Lindesay 1992; Holmgren et al. 1999; Huffman 2008) or AD 1500-1800 (Tyson et al. 2000; Holmgren et al. 2001), while globally, a general definition of AD 1300-1850 exists (Jones et al. 2001; Matthews and Briffa 2005). Considering precipitation signals alone, one could argue for both timeframes. What seems more likely, however, is that a 'weak' LIA was present from *c.* AD 1300-1500, which was punctuated by wetter conditions consistent with the warm-wet pulse suggested by Huffman (1996) and noted by others (Tyson and Lindesay 1992; Ekblom and Stabell 2008) between *c.* AD 1450-1550, and was followed by a 'strong' LIA between *c.* AD 1600-1800, with an abrupt termination (Figure 3.8). Recent re-analysis of the T7 oxygen isotope record (Sundqvist et al. 2013) suggests that cooling reached its greatest severity around 1690-1740, where temperatures were depressed by 0.9 °C on average relative to the 1961-1990 mean, with the coldest interval at 1720. This provides strong correspondence with the analysis of precipitation variability provided here, and is consistent with the warm-wet and cool-dry hypothesis (Tyson and Lindesay 1992). It should be borne in mind, however, that this analysis deals with precipitation alone, and temperature variability, while linked on multi-decadal to centennial scales, is not necessarily aligned with precipitation variability.

With the incorporation of more highly-resolved datasets into this analysis, it is also increasingly clear that these conveniently labelled periods were not uniform and contain within them considerable multi-decadal and centennial variability. On this latter point, Figure 3.9 shows the 30-year running mean standard deviations of the annually-resolved records, which displays the magnitude of precipitation variability.

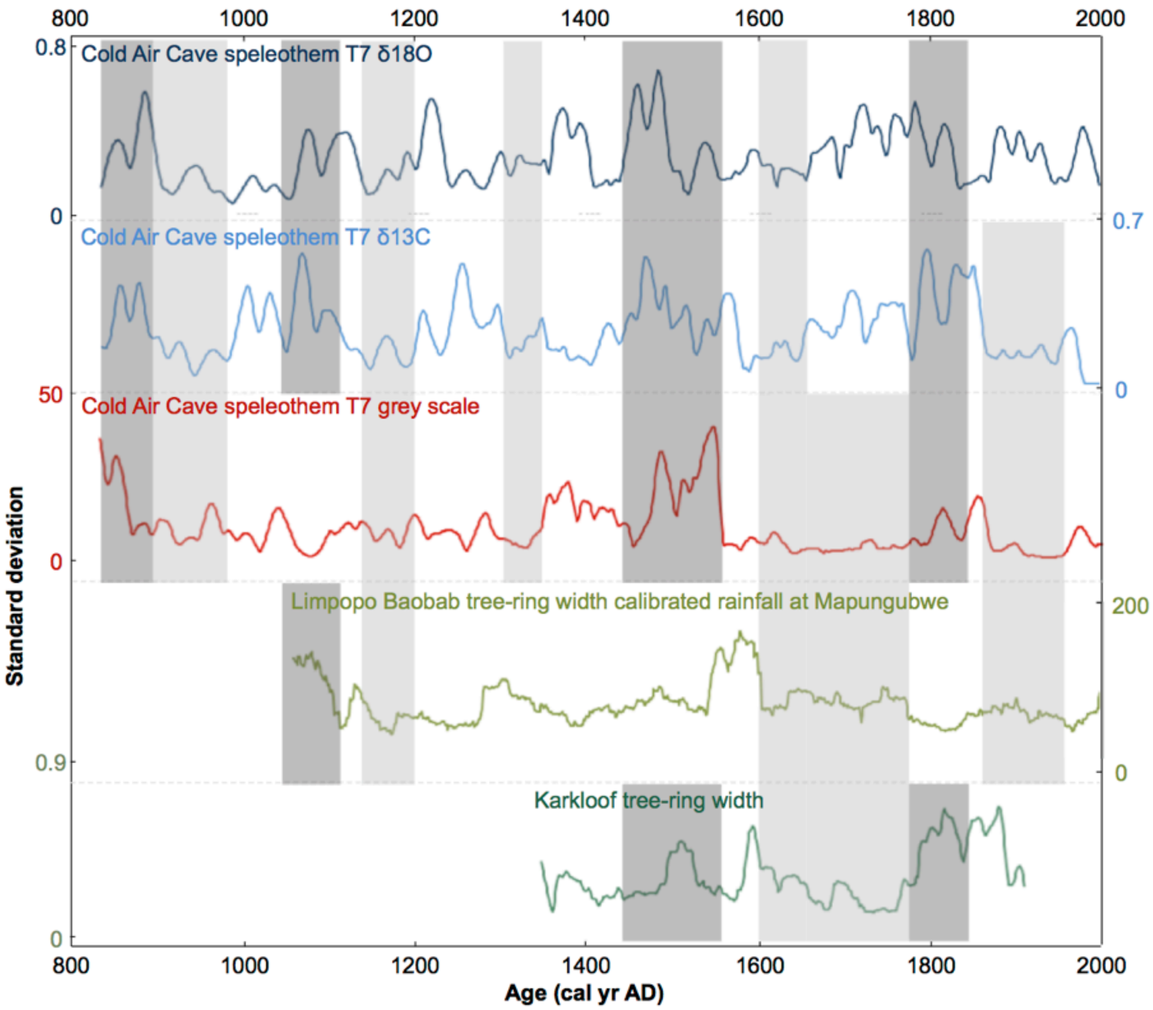

FIGURE 3.9 30-year running standard deviation of annually-resolved proxies. Dark grey bars indicate coherence of higher variability, light grey bars indicate coherence of lower variability.

Figure 3.9 reveals widespread periods of increased variability in most records from *c.* AD 820-890 and 1030-1100 in the MCA, and *c.* AD 1430-1570 and 1780-1830 covering parts of the LIA. Reduced variability is shown between *c.* AD 890-980, 1140-1200, 1310-1350, 1600-1780 and 1840-1960. This variability is reinforced by centennial comparisons of inferred precipitation in the T7 grey-scale, which show that three out of the four centuries in the MCA were significantly different to each other, including 800s and 900s, 900s and 1000s, and the 1100s and 1200s (students t-test, $p < 0.01$). Similarly, significant differences were observed between the 1200s and 1300s in the T7 grey-scale and Baobab records, as well as in these records and the Karkloof tree-ring in the 1400s and 1500s, and 1500s and 1600s. The 1600s and 1700s and 1700s and 1800s were also significantly different in the T7 grey scale and Karkloof records.

3.2.4 Independent comparison with written records

To supplement analysis of the proxy datasets, sixteenth to nineteenth century Portuguese written sources relating to the area between the Zambezi and Maputo (Delagoa) Bay were critically scrutinised for independent evidence of climate-related variables, or the possible impacts of weather events and climate variability. Building on earlier analysis by Ekblom (2004), Table 3.5 displays the most comprehensive list of this evidence yet. This is given in chronological order, with reference to the type of event described or inferred, the locations described (Figure 3.10), a confidence rating (Section 3.1.3.2), and the reference. A higher number of documented events from the eighteenth century onwards are taken from secondary literature, as the original documents reside in Lisbon, Maputo or Goa and are not yet available as translations. While these events are listed here for the purposes of cross-comparison with proxy data, the specific evidence and confidence assessments is fully analysed in Chapter 5 and Appendix A, as many of these events are derived from descriptions of famine rather than explicitly drought, which overlaps with the discussion on the societal significance of these climatic events. Indeed, these observations of possible climatic stress are key for the later chapters as they provide a direct link between data sources.

TABLE 3.5 Written records of weather events, drought, environmental disasters, scarcity and famine between the Zambezi River and Maputo Bay. Conf. – confidence intervals. Secondary references are italicised are not given confidence intervals. Modified after Ekblom (2004).

Year	Event (inferred)	Region	Conf.	Reference
1450-1480	Drought	Northern Zimbabwe	1	*Abraham 1962*
June-August 1506	Scarce provisions	Sofala	1	Coresma 1506
September 1511	Scarce provisions (shortage of sorghum)	Sofala	1	Perestrello 1511
1515	Scarce provisions (shortage of sorghum)	Sofala, adjacent interior region	2	Fernandes 1515
1516	Increased price of sorghum (drought?)	Sofala	2	Almada 1516

February 1516	Tropical cyclone damage	Sofala	3	Almada 1516
September 1518	Rotten provisions (wet year?)	Sofala	2	Almada 1518
1530s	Hunger	Manyika	1	Barros 1552
1554	Scarce provisions	Maputo bay	1	Perestrello 1554
1560	Heavy rain, flooding	Botonga	2	Fernandes 1560
1561	Drought, lack of food	Inhambane	2	Fernandes 1562
1561-3	Famine, drought, locusts	Zambezi; Mukaranga, Sena	2	Sousa 1697; Abraham 1962
1563-5	Floods	Zambezi; Mukaranga	1	Sousa 1697
1570s	Locusts	Sena, Zambezi valley	3	Monclaro 1573
1573	Lack of food	Manyika	3	Carneiro 1573
1589-1595	Famine, drought, locusts	Zambezi valley, Mozambique Island area	2	Santos 1609
1593	Scarce provisions	Tugela river basin (South of Maputo bay)	3	Lavanha 1593
1642-1647	Drought, locusts	Maputo Bay	2	Feyo 1647
1663	Drought	Tete	2	Mascarenhas 1663
1714	Drought	Zimbabwe interior	-	*Mudenge 1988*
1736-1745	Locusts	Lower Zambezi	3	Miranda 1766
1744-1745	Drought	Zumbo	-	*Nicholson 1996*
1758-1759	Famine, drought	Zambezi area, Tete, Maravi	2	Castro 1763
1759-1768	Drought, locusts	Middle Zambezi	-	*Newitt 1995*
1777	Famine? Drought	Maputo bay	-	*Nicholson 1996*
1790-1791	Famine, drought	Maputo bay and Inhambane	-	*Nicholson 1996*
1795-1801	Drought	Mozambique / southern Africa-wide	-	*Newitt 1995*
1820s	Famine, drought	Zambezi valley, Mozambique coast	-	*Newitt 1995*
Late-1820s	Dry conditions	KwaZulu-Natal	2	Isaacs 1836
1830	Locusts	KwaZulu-Natal coast	3	Isaacs 1836
1836	Drought	Zumbo	-	*Newitt 1995*
1858-1863	Famine? Drought	Sena, Tete, Quelimane	-	*Nicholson 1996,*
1861	Famine (drought?)	KwaZulu-Natal	2	Falaza 1898
1870s	Famine? Drought	Sena, Tete, Quelimane, Limpopo	-	*Nicholson 1996*
1875	Famine, drought	Maputo bay, Bazaruto Island	-	*Junod 1927*
1880	Famine, drought	Mozambique lowlands and Mpumalanga	-	*Ekblom 2004*
1895	Locusts	Harare area	-	*Beach 1977*
1896-1897	Drought	Maputo bay	-	*Nicholson 1996*

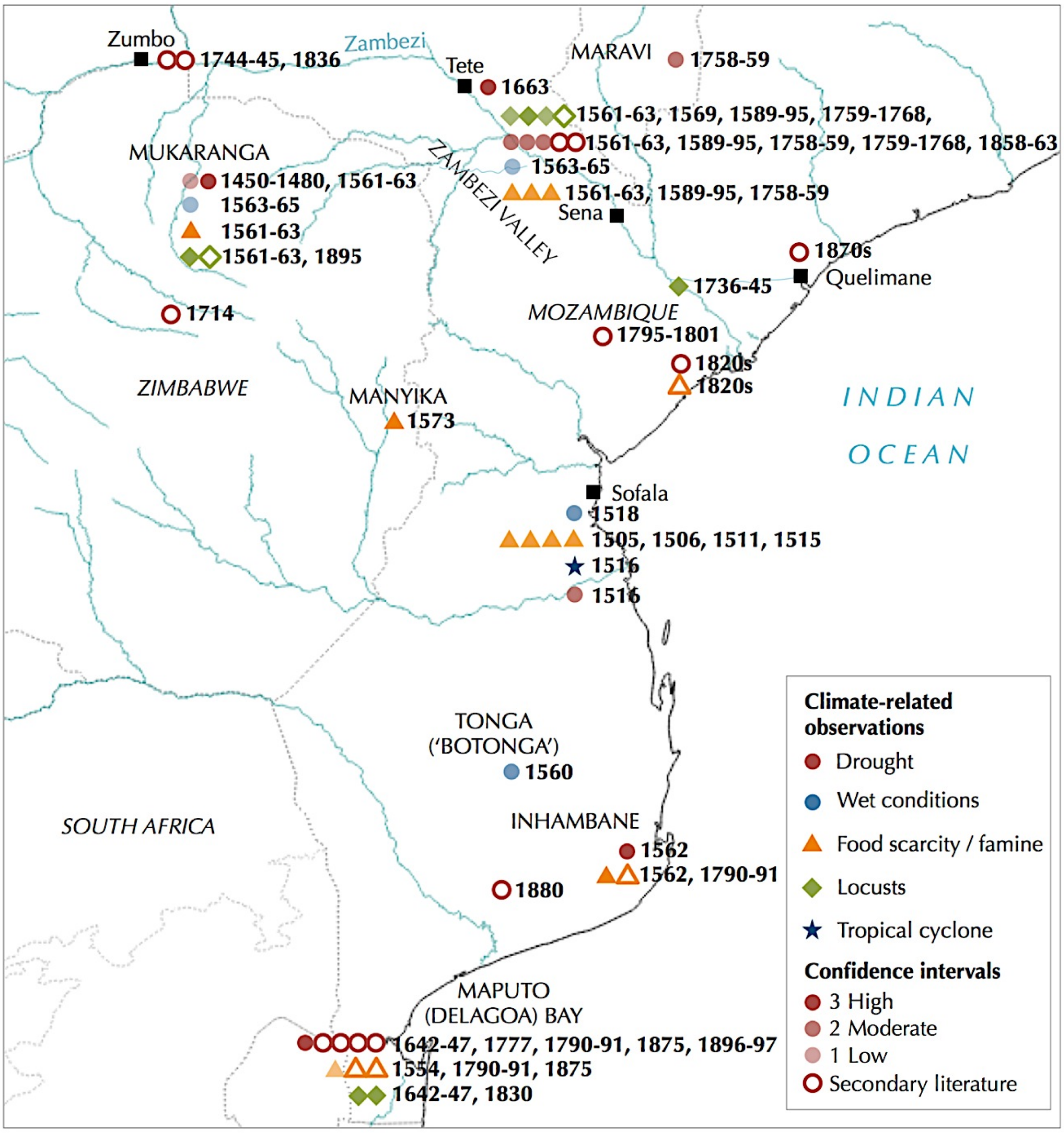

FIGURE 3.10 Map of documented events in Table 3.5.

3.2.4.1 Proxy-documentary correspondence

The compilation of observations in Table 3.5 shows that particularly high numbers of possible climate-related descriptions were made in the sixteenth century, while just two observations reveal evidence for possible climatic stress in the seventeenth century. A higher number of descriptions were found in eighteenth century documents and secondary literature, and many of these also refer to sustained periods of climatic stress. Aside from the varying significance of climate variability itself, this variable number of observations could relate to the changing sphere of Portuguese influence and observation. Yet as Figure 2.13 shows, this influence was at its height in the seventeenth century, where climate-related observations are at their minimum. One could also argue that the purpose for which these observations were recorded changed over time, though as references to climatic stress increase again in the eighteenth century, both of these explanations are problematic. This means that the nature and magnitude of climate variability itself and the vulnerability of societies must be considered as prime reasons for the variation in recorded frequency. To assess the former of these explanations, these possible references to climatic stress are compared to the proxy reconstructions. The brief durations of most recorded events and uncertainties in the dating of palaeoclimate records make close comparisons with proxy records difficult, nevertheless, it is possible to observe some correspondence. Figure 3.11 compares the recorded events from AD 1500-1900 with the Limpopo Baobab tree-ring, T7 grey-scale and T7 δ13C sequences.

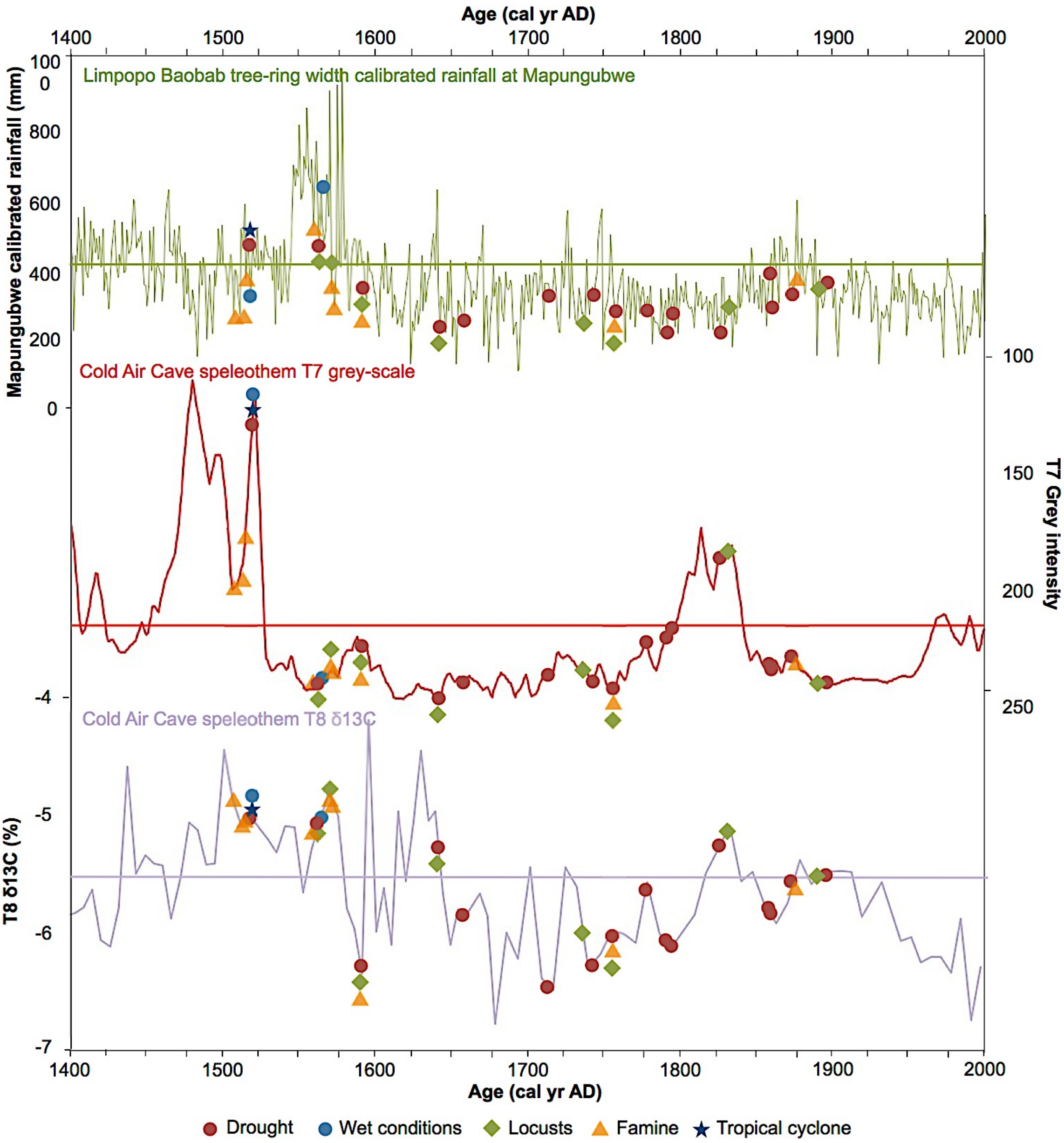

FIGURE 3.11 Comparison of documentary evidence for Summer Rainfall Zone climate variability and the Limpopo Baobab, T7 grey-scale and T8 δ13C records. Only confidence levels 2-3 shown.

Records of food scarcity in the early-sixteenth century show variable correspondence with proxy precipitation inferences, though as will be shown later, there exists doubt over whether these records are indicative of drought. It is, however, worth noting that the inferred tropical cyclone in 1516 closely matches with an extreme year of rainfall in the Baobab record in 1514. Woodborne (*pers. comm.*) relates these extreme rainfall events to tropical cyclones, with a dating precision of ±4 years. It is therefore possible that this extreme year reconstructed from the tree-rings represents the tropical cyclone described by Almada in 1516. The grey scale record also shows the tropical cyclone occurring at an abrupt decrease in grey intensity (note the inverted scale), suggestive of wetter conditions. Similarly, some of the later sixteenth century events display good correspondence with these records. Indeed, the cluster of drought events, famine and locust outbreaks from the 1560s to 1590s occur at a time of high rainfall variability in most records (Figure 3.9). Locust plagues, for instance, are predominantly determined by precipitation. This is manifest in that during periods of drought, locust predators are reduced, yet lack of rainfall also limits locust rates of increase (Walker 1991). Upon drought-breaking rains, however, the rates of increase in locusts rise rapidly, and thus high inter-annual variability can lead to more locust plagues (Ballard 1983; Walker 1991). This appears to have been the case in the late-sixteenth century, particularly in the Zambezi valley (Figure 3.10), when variability between wet and dry conditions was high in most records (Figures 3.9 and 3.11). The 1589-1595 episode of drought, famine and locusts also appears to have occurred within an abrupt drought period in the Baobab and T8 $\delta^{13}C$ series in Figure 3.11. The cluster of drought events in the eighteenth century also show good correspondence with drier years, while coherence between the proxy-documentary chronologies continues into the nineteenth century for the Baobab, and to an extent in the other two records.

While this analysis is relatively limited in scope due to the sparse nature of documentary records of climatic stress in this region and period, some findings are key for independent comparison of both the proxy and documentary data. In particular, it is clear from the previous section that the eighteenth century was the most severe part of the LIA, and is also the period in the written sources where incidence and extent of drought and famine is most pronounced. It is also possible to speculate that a greater number of impacts were recorded when climate variability was high, as well as severely dry in the mean. This may help explain why recorded events and impacts were greater in the sixteenth century, where overall conditions were wetter than the seventeenth century, but fewer recordings of climatic stress are found. This coherence, from radically different sources, is important when assessing the nature of past climate variability where debate over the reliability of proxy sources is profound.

3.3 Summarising proxy-documentary precipitation variability

From the above overview, it is possible to characterise the predominant multi-decadal signals of the widely separated records in most periods, allowing some conclusions to be drawn. A summary of general precipitation fluctuations from the records considered is shown in Table 3.6, along with a classification of the agreement across the SRZ. Strong agreement indicates that nearly all records agree, good infers that a majority show correspondence, variable suggests that some records agree but a majority do not, while weak refers to a lack of agreement between proxies. On present available evidence, this summary is considered likely to apply to most of the SRZ. However, these multi-decadal scale fluctuations mask considerable inter-annual variability, while intra-regional differences are also present. The overall agreement of this table with the most recent similar undertaking by Stager et al. (2013) (Table 2.1; Figure 2.15) is very good, despite the incorporation of several other widely dispersed datasets in this thesis.

TABLE 3.6 Multi-decadal SRZ proxy precipitation fluctuations over the last 1200 years.

Year AD	Precipitation	Agreement
800-830	Very wet	Strong
830-850	Relatively dry	Strong
850-970	Relatively wet, trending towards drier	Variable
970-1020	Relatively dry	Good
1020-1030	Variable, trending towards drier	Weak
1030-1070	Very dry	Good
1070-1110	Relatively dry, trending towards wetter	Good
1100-1140	Very wet	Variable
1140-1180	Relatively wet	Good
1180-1220	Relatively dry	Good
1220-1270	Relatively wet	Strong
1270-1330	Relatively dry	Variable
1330-1420	Variable, little agreement	Weak
1420-1450	Relatively dry	Variable
1450-1480	Relatively wet	Strong
1480-1500	Very wet	Good
1500-1520	Relatively wet, trending towards drier	Strong
1520-1570	Variable, mostly drier	Good
1570-1600	Variable, trending towards drier	Variable
1600-1640	Relatively dry	Strong
1640-1670	Variable, trending towards wetter	Strong
1670-1720	Very dry	Strong
1720-1770	Relatively dry	Strong
1770-1800	Variable, trending towards wetter	Good
1800-1820	Relatively wet	Good
1820-1880	Relatively dry	Good
1880-1900	Variable, trending towards wetter	Good
1900-2000	Variable, trending towards drier	Good

Analysis of this wide range of proxy sources has enhanced insight and understanding of precipitation variability over the last 1200-years, allowing greater confidence and reducing ambiguity for historical investigation. The general pattern of this variability is fairly clear, though it is also problematic to draw conclusions beyond a general level, particularly regarding spatial differences in SRZ palaeoprecipitation, as well as the precise (inter-annual) timing of variability. This is mainly a result of limitations in age models, complex interactions between local- and regional-scale climate patterns and processes, and uncertainties relating to the multiple processes that affect proxy data (Holmgren et al. 2012). With these constraints in mind, though, it is now possible to use this updated review of regional palaeoprecipitation in conjunction with analysis of societal development over the same timeframe in Chapters 5 and 6.

The major advancement and contribution of this chapter to the existing literature is the incorporation of all available high-resolution palaeoprecipitation datasets into a comparative analysis of precipitation variability over the last 1200 years, thus reducing reliance on individual proxies. A range of qualitative and quantitative analysis techniques, several of which have not been previously performed in this region over this timespan, have enabled this variability to be assessed in a comprehensive manner. Importantly, the general correspondence of this variability across the SRZ found in earlier work remains prominent, even with the inclusion of more widely separated datasets. Relatively clear evidence for a MCA between *c.* AD 800-1200 was found by assessing multiple proxies using certain thresholds as indicators of wet and dry periods. The same analysis also provided clear evidence for the driest part of the LIA occurring between *c.* AD 1600-1800, yet ambiguities remain over its onset. Questions over the nature of early-nineteenth century variability were raised, particularly regarding the accuracy of the Nicholson et al. (2012) dataset, and will be examined further in Chapter 4. Independent comparison from written sources showed some coherence with proxy data, but should be treated with caution due to caveats concerning the sparse and temporally variable nature of the written sources. Therefore, while problems remain in establishing precise detail over the timing and extent of climate variability, the use of a range of data and inclusion of independent written sources has reduced uncertainties in prescribing the timing and magnitude of cool-dry and warm-wet periods.

3.3.1 Palaeoclimate and society: towards scales of relevance

Societal investigations regarding the significance of climate variability can now be informed with greater confidence by the conclusions reached in this chapter. Key points will hereafter be summarised for the two main areas and timescales subject to investigation, with an added summary of how this research impacts upon previous climate-related hypotheses for state formation in the Shashe-Limpopo basin. These particularly concern the timing of precipitation variability and its *coincidence* with societal development, and how this impacts upon the investigations on the *interaction* between climate variability and societal change in the later chapters.

3.3.1.1 Shashe-Limpopo basin c. AD 900-1350

The Limpopo Baobab record suggests that the overall trend in the Shashe-Limpopo basin was towards drier conditions, and is reinforced in the analysis of faunal remains by Smith (2005). Caution must be applied when relating other palaeoclimate data to the Shashe-Limpopo basin, as local environmental factors, such as the rain shadow effect from the Soutspansberg range, play a strong role (Smith 2005). Nonetheless, that conditions were warmer and wetter when trajectories towards state formation began in the Shashe-Limpopo basin is a point of little contention. From the analysis in this chapter, it is clear that the climate was generally wetter through to *c*. AD 1200, with generally wetter conditions observed in some records up to the late thirteenth century. Despite the dominance of wet conditions, it is also apparent that a number of dry spells occurred in this area in the MCA. The most severe of these, picked up by the Limpopo Baobab tree-rings, lasted between *c*. AD 1030-1070, though the other local record of precipitation variability is not of a sufficient resolution to record this dry spell (Smith 2005). Smith also notes a dry spell sometime between *c*. AD 1200 and 1260, but this is not reflected in the Baobab, where conditions remained relatively wet.

A similar divergence occurs regarding the suggested drier conditions in the basin at *c*. AD 1300 (Huffman 2008). The Baobab record does show a decline at this time, but the isotope record of Smith (2005) suggests wetter conditions remained until at least *c*. AD 1415. Other records from further afield, including the Lake Sibaya conductivity record, the T7 and T8 $\delta^{13}C$ series, and the T7 grey scale records also indicate a dry spell at this point, and therefore Smith's relatively low resolution evidence alone is insufficient to rule out the link between the decline of Mapungubwe and a trend towards drier conditions in the basin. Whether this trend represents the onset of the regional LIA, though, is not of prime importance for societal investigation. The uncertainties associated with linking climate variability and societal change in this period are particularly high for reasons of data availability, and thus will not form a significant component of the later analysis.

3.3.1.2 Zambezi-Limpopo region c. AD *1400-1830*

Multi-centennial records from present-day Zimbabwe are unavailable prior to the late-eighteenth century, and thus inference from a wider range of proxies is required. The moisture inferences from the range of proxies suggest that it is too simplistic to assert that Great Zimbabwe was abandoned in a warm-wet period, and therefore that climate could not have played any role in state dynamics in the period running up to its decline. For instance, the early-fifteenth century was relatively dry in numerous records (Figure 3.5), and although conditions trended towards wetter from around AD 1450, this argument only allows for an abrupt collapse explanation, and rules out the possibility of persistent drier conditions eroding the resilience of the state.

Although the early-sixteenth century was generally wetter, there are a number of possible written references to climatic stress from the Mozambique coast, and these will be further investigated in Chapter 5. There are also a high number of written references to climatic stress in the Zambezi valley and Mutapa area in the mid- to late-sixteenth century, where agreement between proxies mostly suggests a trend towards drier conditions. Importantly, this period was characterised by high variability in precipitation (Figure 3.9), which may have been equally as significant for society as consistently drier conditions. The seventeenth century marked the beginning of the LIA and was generally dry, yet there are fewer references to climatic stress in the Zambezi-Limpopo area. In the eighteenth century, however, written references increase markedly in the Zambezi valley, Mutapa state and Mozambique coast. Although spatial differences in palaeoprecipitation were present in the LIA, it appears that the LIA imposed a general signal on patterns of local variability across the SRZ, thus providing a relatively consistent picture of climate variability. This either suggests that the severity of eighteenth century dry conditions translated into greater societal impacts, or that the differential vulnerability of societies over time was more important. These questions constitute key lines of investigation for Chapters 5 and 7.

3.3.1.3 KwaZulu-Natal area c. AD 1750-1830

The late-eighteenth century has been linked with the end of the regional LIA. Figure 3.8 does not suggest that this is the case, with only marginally improved conditions evident in the latter half of this century. The KwaZulu-Natal proxy records from Lake Sibaya and Karkloof, however, indicate that an earlier recovery of precipitation began from at least *c*. AD 1770, which does not rule out hypotheses suggesting that this facilitated higher crop yields. Both of these records also infer an extended dry spell in the 1790s, which may relate to the *mahlatule* famine. That the early-nineteenth century was a period of highly variability precipitation is relatively clear, and as previously suggested, this may well be as important as the severity of dry or wet conditions. Yet further investigation is needed into the early part of the nineteenth century, where there exists considerable disagreement between proxy sources and the precipitation dataset of Nicholson et al. (2012). Indeed, it is critical to establish the climatic conditions in the early-nineteenth century if the significance of climate variability is to be understood alongside conflict and political centralisation. This will be investigated using ships' logbooks in the next chapter.

Chapter 4. Early-nineteenth century precipitation reconstructions from ships' logbooks

The previous two chapters have drawn attention to the limited knowledge of inter-annual rainfall variability in the southern African SRZ before 1850, and particularly before 1820, where sparse written reference to and oral testimonies of drought currently remain the only utilised sources alongside palaeoclimate proxy data. Despite oral knowledge of the apparently drought-induced *mahlatule* famine at the turn of the nineteenth century, there exists almost no documentary coverage of climate variability in KwaZulu-Natal prior to the arrival of European traders in 1824, whose descriptions and observations on climate were generally thin. In addition to the caution expressed over the use of the Nicholson et al. (2012) precipitation indices, this lack of data means that new sources must be sought. One such source of historical climate data with an extensive spatial coverage (Figure 4.1) and high temporal resolution are the meteorological observations held within the ships' logbooks of the European former colonial powers, which have received growing attention in recent years.

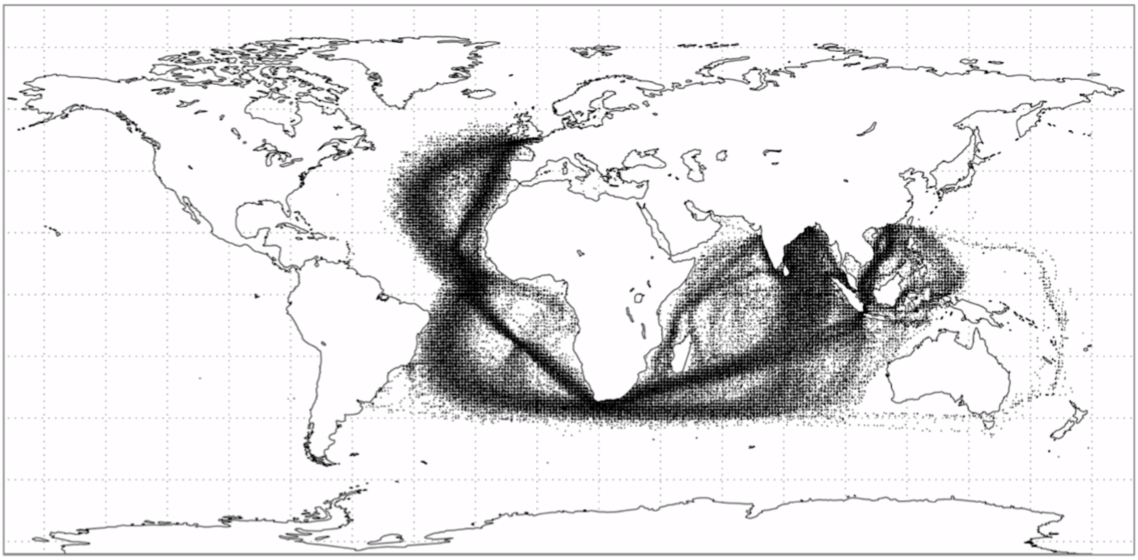

FIGURE 4.1 Distribution of digitised English East India Company logbook observations (1789-1834). Each black dot represents one observation.

Since the release of CLIWOC, these marine data have been used to reconstruct a range of climatological phenomena. Specifically, wind observations have been used in reconstructions of the North Atlantic Oscillation (Jones and Salmon 2005), North Atlantic sea-level pressure fields (Küttel et al. 2010), and atmospheric circulation in the English Channel (Wheeler et al. 2010). In the Southern Hemisphere, Neukom et al. (2014) used gridded CLIWOC-ICOADS (International Comprehensive Ocean-Atmosphere Dataset) wind data (Küttel et al. 2010) from 1834 onwards to provide an independent verification for their 200-year SRZ and WRZ multi-proxy precipitation reconstructions. This chapter will incorporate wind observations from the EEIC (Brohan et al. 2012) and CLIWOC datasets in order to statistically reconstruct seasonal station precipitation in southern Africa from 1796-1854.

Section 2.1.1.1 explained how wetter or drier seasonal conditions in both the SRZ and WRZ are strongly influenced by changes in the frequency, intensity and persistence of rainfall-producing weather systems (Mason and Jury 1997; Todd et al. 2004; Williams et al. 2007). As regional rainfall-producing systems are in turn related to changes in atmospheric circulation around southern Africa, the marine observational data held within ships' logbooks provide a unique means of statistically reconstructing past precipitation variability. By providing direct measurements, logbooks possess a significant advantage over proxy-based sources. They also differ from other documentary sources as they recorded information on airflow and circulation variations over a wide spatial area, factors important in any explanation of changes in past precipitation patterns (Wheeler et al. 2010). As there is no overlap of the early-nineteenth century logbook data with the instrumental station measurements, however, this investigation will first use reanalysis data to determine the statistical relationship between wind and precipitation in the area.

4.1 Data and methods

4.1.1 Reanalysis data

The wind data that will be used to assess the relationships between wind and precipitation are taken from the NCEP-DOE Reanalysis 2 dataset (Kanamitsu et al. 2002). The reanalysis assimilates available observations, including pressure, temperature, and humidity using model forecasts, providing a physical picture of the climate at consistent time-steps from 1979 onwards. The climatological variables used from the reanalysis are the u- (west-east) and v- (south-north) components of the wind. These are selected as the most common weather observations in the logbooks are wind direction and force. The u- and v-wind components are first re-gridded to an 8° x 8° latitude-longitude grid in accordance with previous studies (Gallego et al. 2005; Jones and Salmon 2005; Küttel et al. 2010), as this resolution gives a balance between incorporating as high a data density as possible in the corresponding logbook data, without obscuring or oversimplifying the spatial relationships between marine wind and continental rainfall. Both a 2° x 2° and 5° x 5° resolution were also tested in a sensitivity study (not shown), and while the spatial extent of significantly correlated grid boxes was slightly wider, the coverage of the logbook data in each grid box was inadequate to produce seasonal aggregations. As well as the relationships between wind and precipitation, the spatial domain will also be determined by the availability of digitised logbook data in the historical period, which is discussed in Section 4.1.3.

4.1.2 Station data

The station precipitation records were obtained from both the South African Weather Service and the Global Historical Climatology Network, though only stations which have complete precipitation records for the period 1979-2008 are used (Figure 4.2;

Table 4.1). This period is chosen as many station records have significant gaps in the preceding decades. This applies to much of KwaZulu-Natal and the portion of the Eastern Cape that falls within the SRZ, areas which are particularly sensitive to variability in atmospheric circulation over the oceans (Mason and Jury 1997; Tyson and Preston-Whyte 2000). Additionally, given that this recent period marks the beginning of satellite data entering the reanalysis, and a higher input of observational data, it is likely that the data are of a superior quality to those prior to this period. To select the stations where marine wind influences are significant, the 8° x 8° seasonally resolved NCEP-DOE wind vectors within the study domain are correlated with the station data. Both datasets are detrended before correlation. Of the total 19 stations with significant correlations at $p < 0.05$ (Figure 4.2), 15 are located within the South African portion of the SRZ, with two stations in the WRZ. This gives a relatively wide spatial coverage of areas most influenced by tropical-temperate systems and the westerly storm tracks, with several stations located in most of the South African provinces.

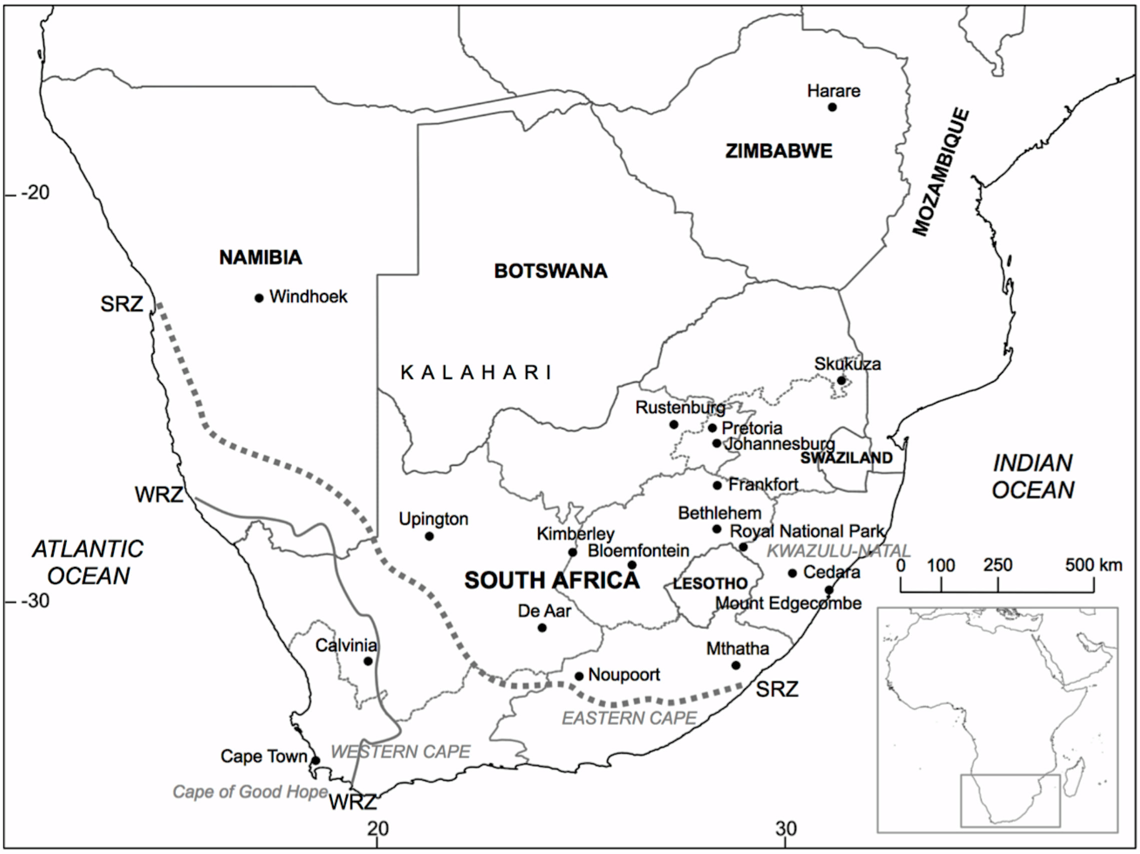

FIGURE 4.2 Map of southern African station precipitation records used in the study.

4.1.3 Ships' logbook wind data

The keeping of logbooks by ship officers was an important duty. All matters relating to the navigation of the ship were recorded at daily or sub-daily intervals, helping to ensure that the ships could transport goods as quickly and safely as possible (Ward and Wheeler 2012). Few such matters were more critical than the wind, weather and state of the sea, which played a large part in determining the speed and direction of the ship. Recently, digitisation of this climatic information in the thousands of logbooks held in archives in the UK, Spain, Netherlands and France resulted in the development of the CLIWOC project (García-Herrera et al. 2005a; Können and Koek, 2005). The current version 2.1 of this database holds 281,920 records between 1662-1855, with 99.6% of available data falling between 1750-1855. In addition to CLIWOC, the later digitisation of 891 EEIC logbooks provided a further 273,000 records of a similar spatial extent between the years 1789-1834.

TABLE 4.1 Reconstruction statistics for each station significantly correlated with NCEP-DOE u-wind (1979-2008).

Station	Mean annual precipitation (mm)	Grid boxes	Explained variance	r (first PC)	RE	r (validation time series)
Bethlehem	698.43	4	85, 12, 2, 1	-0.5108	0.27	0.5262
Bloemfontein	551.94	3	36, 33, 30, 0	0.5791	0.22	0.4852
Calvinia	201.99	2	90, 10, 0, 0	0.5370	0.21	0.4872
Cape Town	541.61	5	53, 32, 9, 5	0.6703	0.40	0.6338
Cedara	839.23	4	73, 18, 7, 2	-0.5473	0.22	0.4802
De Aar	332.05	2	95, 5, 0, 0	-0.4481	0.12	0.3624
Frankfort	664.27	5	70, 21, 6, 0.2	-0.6279	0.2	0.4725
Harare	690.01	3	64, 33, 0.2, 0	-0.4627	0.08	0.3177
Johannesburg	745.78	2	64, 36, 0, 0	-0.4902	0.13	0.3853
Kimberley	412.81	1	100, 0, 0, 0	-0.3685	0.09	0.3117
Mount Edgecombe	962.84	5	78, 17, 4, 1	-0.5824	0.26	0.5107
Mthatha	657.01	5	73, 15, 1, 0	-0.8125	0.61	0.7801
Noupoort	380.65	2	95, 5, 0, 0	-0.5440	0.23	0.4807
Pretoria	657.87	4	68, 18, 10, 4	-0.5501	0.1	0.3588
Royal National Park	1223.11	4	85, 12, 2, 1	-0.6763	0.43	0.6556
Rustenburg	575.84	2	72, 28, 0, 0	0.5177	0.22	0.4744
Skukuza	586.55	1	100, 0, 0, 0	-0.3813	0.05	0.2772
Upington		3	66, 19, 13, 2	-0.4690	0.1	0.3502
Windhoek	342.79	1	100, 0, 0, 0	-0.3910	-0.04	0.1661

Similarly to the distribution of modern marine data, observations from these digitisation projects cluster predominantly along established strategic routes, leaving certain areas, such as the Atlantic and Indian Oceans densely covered with data points, and others, like the Pacific, data deficient. One route covered in both datasets was the voyage from England to India and China, which generally took around two years. Before the opening of the Suez Canal in 1869, sailing ships travelling between England and the Indies had to follow a route constrained by the global wind fields. This meant sailing southwest through to the Southern Hemisphere westerlies, rounding the Cape of Good Hope, and then using either the Mozambique Channel or the westerly winds between 35-40°S before sailing north to India or China (Figure 4.3). The return voyage was a direct route round the Cape using the easterly trades, north west into the mid-Atlantic and then to England with the westerlies (Brohan et al. 2012). The oceans surrounding South Africa are consequently among the global areas with the highest data density, while the fact that the routes necessarily followed circulation systems makes the data suitable for reconstructing circulation-related variables, offering a previously unprecedented insight into the weather and climate of the late-eighteenth and early-nineteenth century.

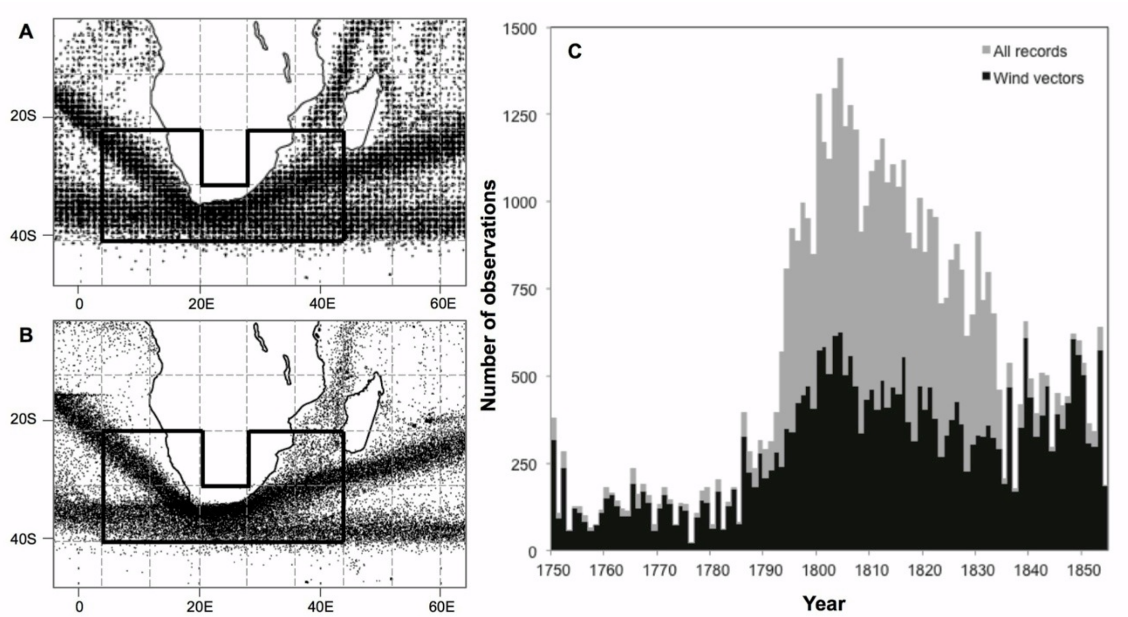

FIGURE 4.3 A. Distribution of English East India Company observations (1789-1834). B. Distribution of CLIWOC observations (1750-1854), the solid line indicates the gridded 8° x 8° domain of the study and C. Annual frequency of logbook observations within the domain, showing all records (grey) and records with complete wind vector information (black).

The spatial domain is partially determined by the availability of logbook observations. Following the methodology of Gallego et al. (2005), Jones and Salmon (2005), Küttel et al. (2010), and Neukom et al. (2014) the logbook observations are averaged and aggregated to seasonally resolved 8° x 8° grid boxes to ensure that meaningful wind information of a high enough density are present, and are thereafter transformed into the u- and v-components of the wind. The domain thus covers the oceanic areas between 25-41°S and 4-52°E. A total of 56,042 records were obtained in this area between 1750-1854 from the combined datasets. Only records with complete information on date, coordinates, wind direction and wind speed were used, lessening the total to 31,367. This high number of missing wind direction and/or speed records (Figure 4.3) is only present in the EEIC data, where budget constraints meant that digitisation priority was given to the pressure and temperature data in the logbooks (Brohan et al. 2012). Nevertheless, the wind vector data incorporated from the EEIC collection provides a significant amount of data for the early-nineteenth century where data density was previously insufficient (Neukom et al. 2014).

The observations recorded in logbooks were generally taken at the local noon. Three categories common to all observations are wind direction, wind speed and general descriptions of the state of the weather, the first two of which are of particular interest. These records were converted to the International Marine Meteorological

Archive format (Woodruff 2007), requiring several corrections which were made prior to release of the data.

Each of the observations are spatially and temporally referenced by date and coordinates. Longitudes, typically determined by dead-reckoning, were corrected to present-day coordinates. Wind direction was usually recorded on a 32-point magnetic compass, using expressions such as north-west-by-west. As instrumental data these contain little ambiguity, but were converted from the magnetic north to the true north (see Brohan et al. 2012; Wheeler et al. 2010). Wind speed observations are prone to a higher degree of subjectivity in their recording as they were estimated by reference to the state of the sea. Standardised vocabulary for assessing wind force was not in place until the adoption of the Beaufort Scale in the 1830s, yet even prior to this sailors were consistent in their description of the winds (Ward and Wheeler, 2013; Wheeler, 2005). This meant that wind force terms could be quantitatively re-expressed in modern Beaufort force equivalents using the multilingual CLIWOC wind force dictionary, and then to 10-m winds in ms^{-1} (see Wheeler 2005; Wheeler and Wilkinson, 2005). Of the descriptive wind speed terms in the CLIWOC database, 99% could be converted to Beaufort Scale equivalents, while this figure was around 80% for the EEIC data. Statistical investigation into the quality of these data by comparing observations from vessels sailing in convoy was performed by Wheeler (2005), the data were found to be highly reliable. For further details on wind direction and speed measurements and their corrections and conversions, the reader is referred to García-Herrera et al. (2005b); Wheeler and Wilkinson (2005) and Brohan et al. (2012). The digitised data from the EEIC do also provide some instrumental records, including thermometer and barometer observations. These data will not be considered here, however, as the pressure data, which may be used to infer precipitation, are generally too sparse to be used in a reconstruction.

4.1.4 Logbook data pre-processing

As previously stated, the oceans adjacent to southern Africa are relatively well-covered with logbook observations in comparison to oceanic areas surrounding most other landmasses. Nevertheless, using spatially and temporally variable data requires careful data pre-processing. Figure 4.3 displays the inter-annual variability in the number of CLIWOC-EEIC records. From 1796 onwards the available wind vector records in the study domain mostly exceed 300 annual observations, with peaks of well over 500 records around the turn of the nineteenth century and in the late 1840s. Minimum availability is observed in the 1830s, though most of this is accounted for by less austral winter voyages, meaning observations in the austral summer months remain generally consistent throughout the period. Intra-annual availability of observations is also variable. October has consistently low numbers of records, and is therefore omitted from the SRZ reconstructions, which consist of the austral summer months of November-March. This does not significantly alter summer rainfall totals as there is generally less rainfall in October than all other months in the SRZ rainy season. Six months (April-September) were used for the WRZ.

Given the inter-annual variability in the quantity of observations, it is important that a compromise is reached between maximising the number of seasonally-resolved grid boxes, and increasing the signal-to-noise ratio of the wind data (Küttel et al. 2010). This means that the true wind conditions are assumed to be well-captured by the available records at a specific grid box during a particular year. To reduce the noise component due to undersampling, Küttel et al. (2010) and Neukom et al. (2014) used a threshold where only seasons with at least three records in each 8° x 8° grid box were used. In this case, owing to the increased data coverage with the additional EEIC data (Figure 4.4), grid boxes are only included where an absolute minimum of one-tenth of seasonal days have observations. Where this was not the case, grid boxes are longitudinally interpolated from adjacent grid boxes exceeding this threshold based on the difference between their corresponding 1979-2008 mean in the NCEP-DOE reanalysis data. Higher thresholds were tested, but these did not improve the resolved variance in the reconstructions (not shown).

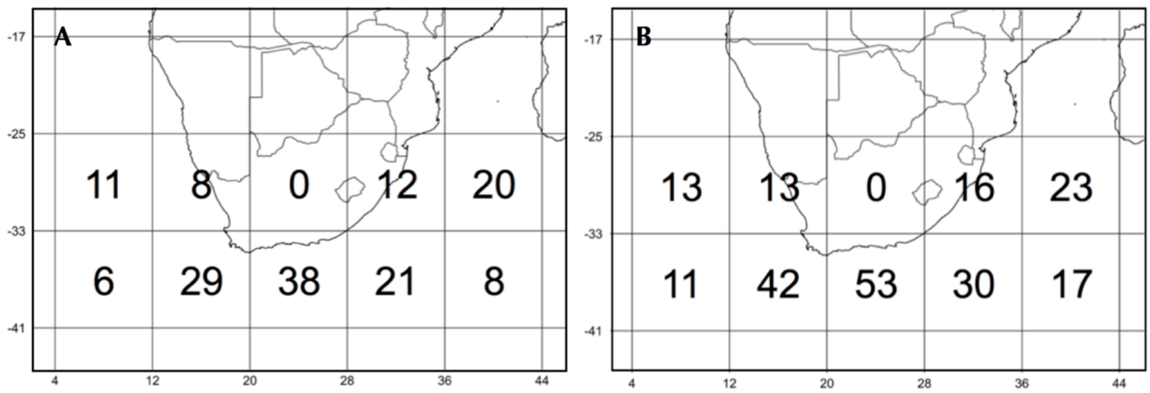

FIGURE 4.4 A. Average number of NDJFM records in each 8° x 8° grid box between 1796-1854 and B. average number of AMJJAS records in each 8° x 8° grid box.

4.1.5 Reconstructing precipitation

To establish regression models between wind and precipitation at various southern African stations, reanalysis wind data are used. The wind data are tested for suitability as precipitation predictors by correlating the gridded NCEP-DOE wind vectors against each of the station records obtained (Figure 4.2) over the period 1979-2008. Both of these datasets are first detrended to avoid potential spurious correlations due to timeseries having unrelated trends. The four stations with the highest r values from the correlation for u-wind are shown in Figure 4.5, while v-wind gave less significant results for the majority of stations and was consequently omitted (not shown). The plots are consistent with the discussion in the first section, and show that strengthened easterliness (lower u-wind) in the southwest Indian and southeast Atlantic Oceans is correlated with increased precipitation in the 'rain-year' months of November-March at SRZ stations. By contrast, strengthened westerliness (higher u-wind) in the southeast Atlantic is significantly correlated with higher precipitation in the WRZ rainy season months of April-September. These results show an influence of large-scale atmospheric circulation on precipitation in these regions, and link to wind speed and direction over adjacent oceanic areas. Importantly, these grid cells correspond with those in the path of the major shipping routes, and are thus suitable predictor variables to allow for statistical reconstructions.

For each station, the grid boxes significantly correlated at $p < 0.05$ were selected for the reconstructions. Principal Component (PC) analysis is performed over these areas, meaning the variables are reduced to a dataset containing fewer variables which separated the dominant patterns of spatial variability from unnecessary noise, and importantly are not correlated. Non-detrended seasonal mean u-wind data are used to perform the PC analysis in the domain, as the statistical relationships derived here are later applied to the seasonally aggregated logbook wind data. The first PC explains most of the variance in the significantly correlated areas of the u-wind data for each station record at 73% for Mthatha, 85% for Royal National Park, 78% for Mount Edgecombe, and 53% for Cape Town (Table 4.1). It also gives the highest correlation values with station precipitation. Principal Component Regression (PCR) is then used to reconstruct precipitation (see Luterbacher et al. 2002 for a full outline of this technique). The calibration with the predictand is performed over the period 1979-2008, where the greatest number of stations with complete records is available. For independent verification of the reconstruction, cross-validation is used (Wilks 2005), as the 30-year period would be inadequate if a substantial portion of it is reserved for a validation sample. This technique repeatedly divides the data into calibration and short validation data subsets, meaning the PCR is performed 30 times, each time estimating a different year not included in the calibration data. Two years on either side of the validation year are left out, meaning that the reconstructed time step is uncorrelated with all time steps used for model calibration. The final model for the reconstructions is therefore calibrated using data for each of the 30 years, which are then concatenated to produce a validation record. The performance of the statistical reconstruction is first assessed by calculating Reduction of Error (RE) skill scores (Cook et al. 1994) (Table 4.1; Figure 4.6). RE scores range from $-\infty$ to $+1$, where 1 indicates perfect agreement with the predictand, the station data, 0 means that the reconstruction is as good as the climatology, and negative RE scores indicate that the reconstruction contains no meaningful information. Second, the reconstructed timeseries from the wind data are correlated with the observed precipitation.

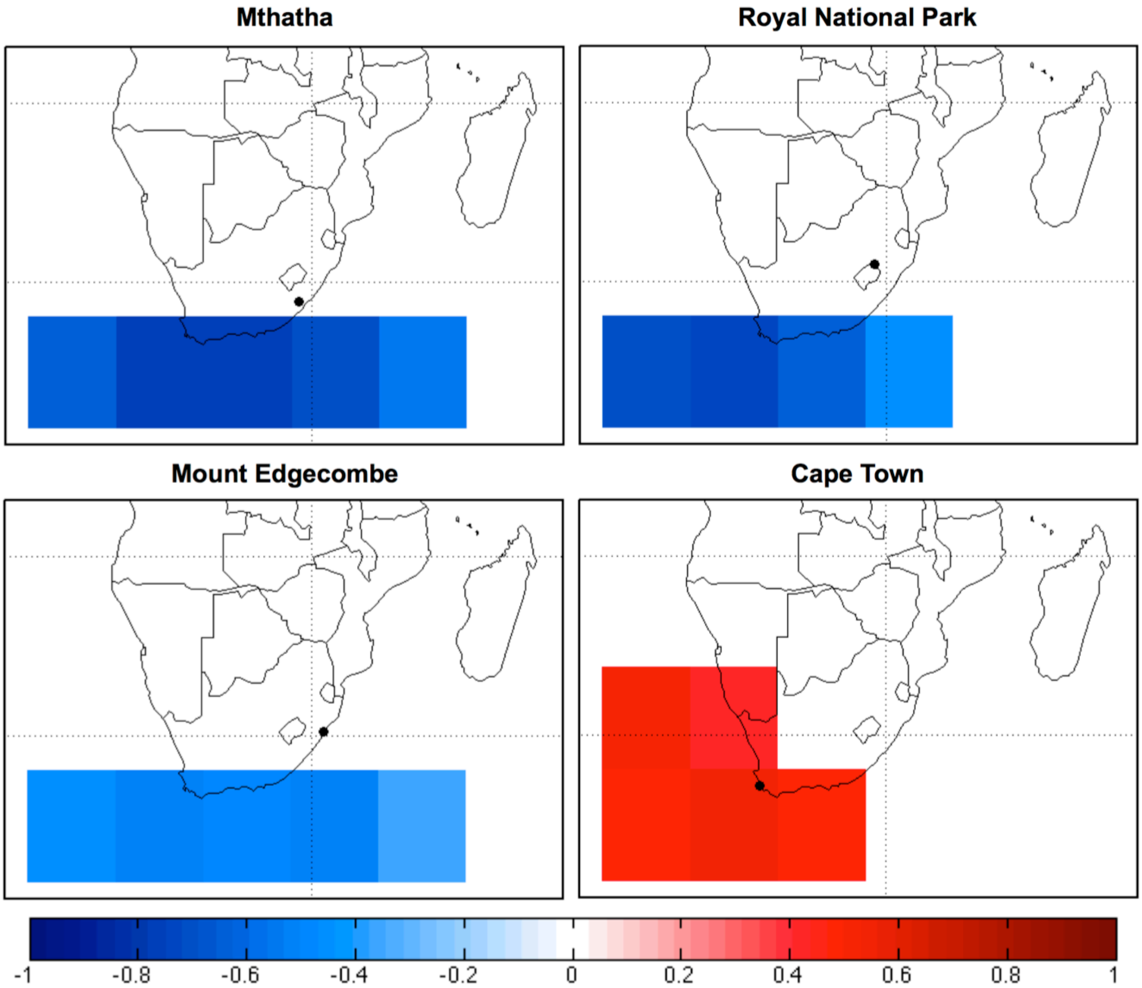

FIGURE 4.5 Correlation of the detrended NCEP-DOE Reanalysis 8° x 8° u-wind and detrended station precipitation 1979-2008. Only squares with statistically significant correlations ($p < 0.05$) are shown. Note that Cape Town uses winter rainfall months (AMJJAS).

4.2 Results

4.2.1 Reconstruction skill

The reconstruction skill of u-wind is spatially variable. The highest RE scores are observed for those stations with the greatest number of significantly correlated grid boxes included as predictors, with Cape Town and Royal National Park each having values ≥0.4, and Mthatha >0.6 (Figures 4.6 and 4.7). While Royal National Park is considerably further inland than Cape Town or Mthatha, the data recorded in the logbooks capture not only maritime climate, but the regional atmospheric circulation which is important for precipitation at this station (Mason and Jury 1997; Reason and Jagadeesha 2005). Weaker, though positive RE values are observed further inland, with only Windhoek displaying no reconstruction skill. This is most likely due to the greater influence of the strength of the southeasterly trades in the eastern South Atlantic on precipitation at Windhoek, an area which was excluded from the analysis domain. Reduced reconstruction skill is likely to be a consequence of other forcing mechanisms and local effects explaining precipitation variability which the PCs do not capture, while most of the inland stations are much drier than those in the coastal and southeast areas of South Africa. Similarly to the RE, the highest correlation coefficients are observed at Mthatha (r = 0.78), Cape Town (r = 0.63) and Royal National Park (r = 0.67). These stations were chosen to be reconstructed, but nine other stations also have significantly correlated timeseries' at $p < 0.05$ (Table S1).

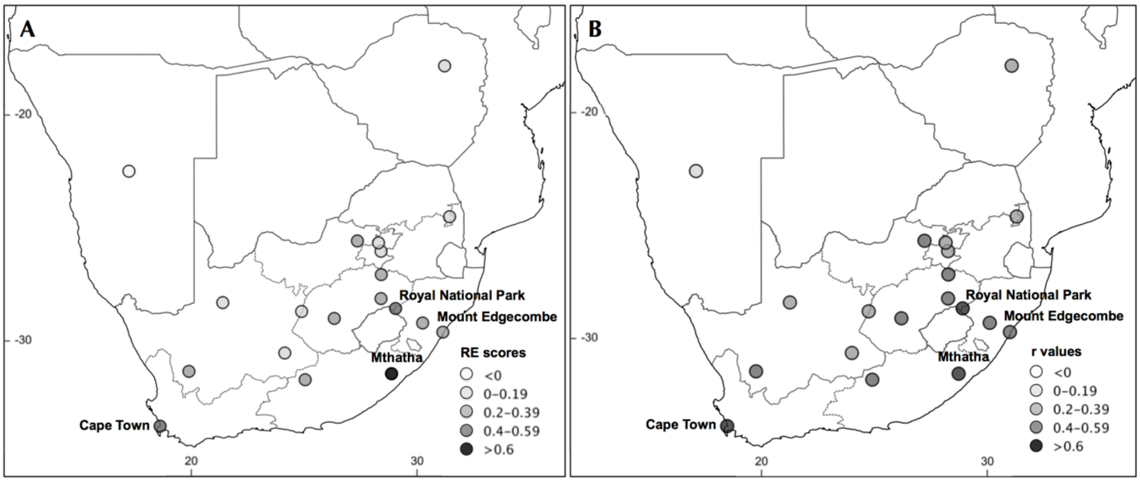

FIGURE 4.6 A. Calibration period-derived Reduction of Error skill scores and B. correlation coefficients for selected stations across the Summer and Winter Rainfall Zones.

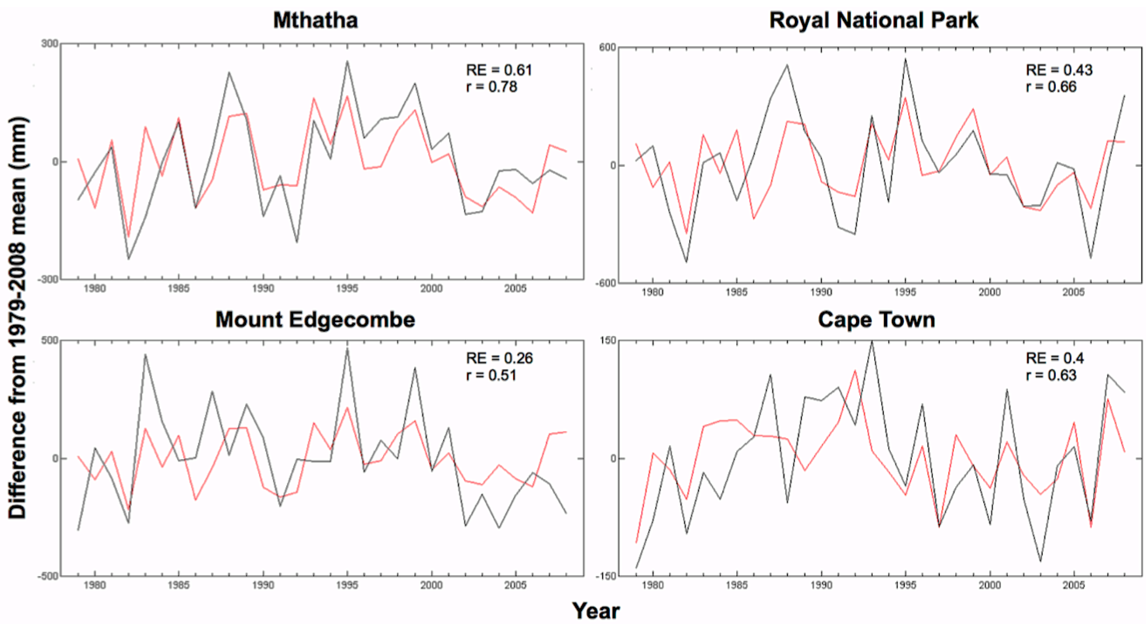

FIGURE 4.7 Reconstructed (red line) and observed precipitation (black line) from NCEP-DOE u-wind 1979-2008 at four stations with the highest RE values.

4.2.2 Precipitation reconstructions

The summer season precipitation reconstructions for Mthatha and Royal National Park, derived from applying the statistical relationships established in the calibration period to the logbook data, are shown in Figure 4.8. The axis years are dated by the November and December months but refer to the entire SRZ 'rain-year'. The thin black line shows the inter-annual values, while the thicker black line is the 7-year running mean. The grey error bars are confidence intervals, which cover the true value with a probability of 95%. They are defined as ±1.96 standard deviations of the residuals from the model calibration as during the calibration period about 95% of the true precipitation values lay inside an interval of this size. As just one 8° x 8° grid box was the difference between the predictor networks for the two SRZ stations in Figure 4.8, the reconstructed inter-annual values are very similar, while the reconstruction for Mount Edgecombe displayed an identical curve to Mthatha as the predictor network was the same and is therefore not shown.

Although all decadal anomalies for the SRZ stations are within the error bars relative to the 1979-2008 mean (±147.6 mm), t-tests are conducted to test whether the difference in mean decadal conditions is significant. For the SRZ stations, the decades beginning in 1810 and 1820 are statistically significantly different ($p < 0.02$), with the 1810s being wetter than the 1820s, while no significant difference is observed between the other decades. The most severe dry conditions of the reconstructions (exceeding -1 standard deviations from the 1979-2008 mean) are 1796-97, 1805-06, 1820-21, 1826-28, 1829-30, 1831-32 and 1841-42. The wettest years (exceeding +1 standard deviations from the 1979-2008 mean) were 1812-13, 1818-20, 1830-31, 1835-36, and 1845-46.

At Cape Town (Figure 4.8), in the WRZ, conducting t-tests on the decadal differences reveals that the 1820s and 1830s are significantly different ($p < 0.025$); the 1820s being wetter than the 1830s, although three years in the 1830s had too few wind observations to reconstruct precipitation. No significant difference is found between the other decades in the period. Pronounced dry conditions (below -1 standard deviations from the calibration period mean) are reconstructed in the WRZ rain season in 1806, 1808, 1812, 1818, 1820, 1832, 1836, 1840 and 1847. Wetter conditions (exceeding +1 standard deviations from the calibration period mean) are observed in 1801, 1804, 1813, 1824, 1827, and 1849 and 1850.

Examination of the changing variability in the reconstruction period is conducted by calculating the 7-year running standard deviation. For the Mthatha reconstruction (Figure 4.9), f-tests revealed 1820-21 to 1836-37 as a period with consistently high rainfall variability, being significantly different at $p < 0.01$ from periods between 1803-04 to 1819-20 and 1837-38 to 1853-54, where reduced rainfall variability is observed. For Cape Town, variability is fairly constant throughout the reconstruction period (Figure 4.10).

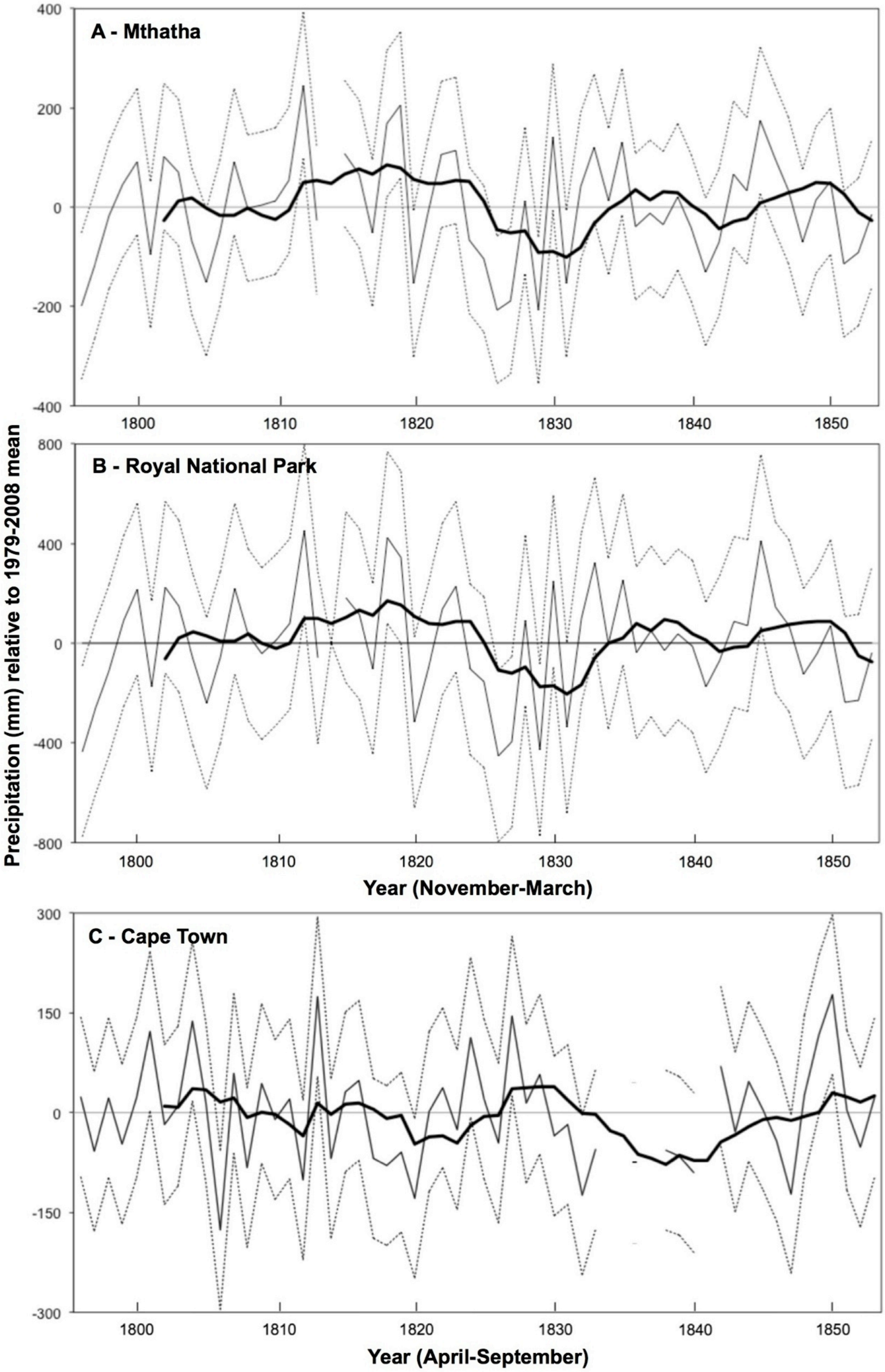

FIGURE 4.8 Reconstructed 1796-1853 November-March precipitation for A. Mthatha, B. Royal National Park and C. reconstructed April-September precipitation for Cape Town. The thin black line indicates the inter-annual precipitation given as the difference from the 1979-2008 mean (note the difference between the three y axes). The thicker black line is the 7-year running mean. The thin grey lines show the 95% confidence intervals. The SRZ station years are dated by the Nov/Dec.

4.2.3 Atmospheric circulation

In order to further examine the wind patterns associated with the reconstructed precipitation variability, summer and winter indices of atmospheric circulation are produced (Figures 4.9 and 4.10). These are calculated by aggregating the wind direction observations to the four cardinal compass points, as demonstrated by Wheeler and Suarez-Dominguez (2006), which combine to produce measures of the proportional frequency of days with winds blowing from the east and west, giving further insight into the circulation dynamics influencing precipitation. This technique also yields some extra wind information from the EEIC data, as some of those data with only wind direction *or* wind speed records could be utilised where this was not possible in the reconstructions.

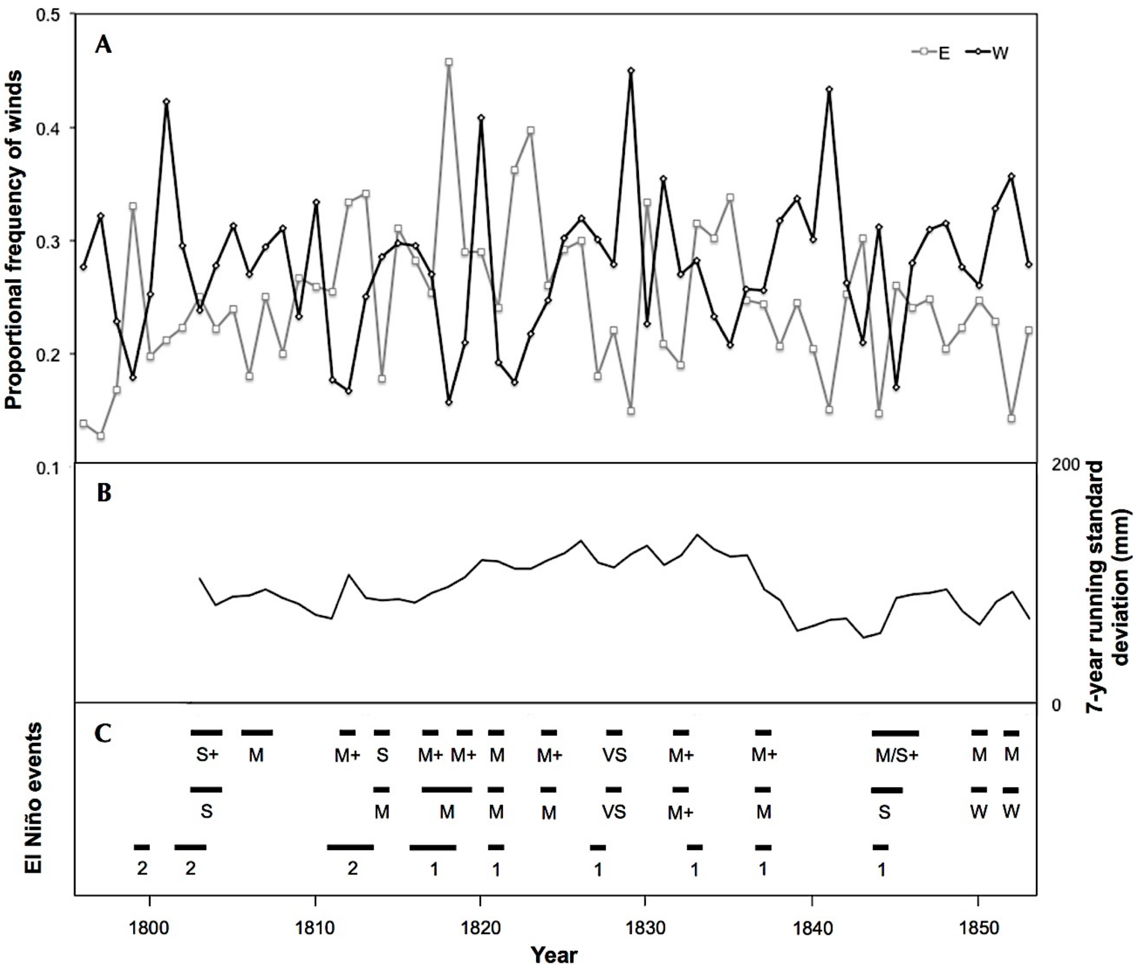

FIGURE 4.9 A. Proportional frequency of November-March zonal winds in the leading Principal Component for the Mthatha grid boxes, B. 7-year running standard deviation for precipitation at Mthatha (middle panel), and C. El Niño events identified by Quinn and Neal (1995) (top) and Ortlieb (2000): M – moderate, S – strong, VS – very strong; and Garcia-Herrera (2008): 1 – probably El Niño, 2 – possible El Niño (lower panel).

Figure 4.9 reveals the proportional frequency of winds from the east and west in the area of the leading PC for Mthatha (shown in Figure 4.5). As previously outlined, when the easterly component of the wind is stronger, precipitation at Mthatha is higher, while increased westerliness is associated with reduced precipitation. From the beginning of the reconstruction period to 1810-11, westerliness exceeds easterliness in all except three years. This situation reverses in the period 1810-11 to 1824-25, where 10 out of 15 years are characterised by a higher proportion of winds from the east. Following this, easterliness exceeds westerliness in only six of the years to 1853-54. The period of increased reconstructed precipitation variability between 1818-19 to 1836-37, identified in the running standard deviation, can therefore be linked to highly variable shifts in the zonal wind. In comparison, the winter season wind direction index (Figure 4.10) shows a relatively consistent proportional frequency of westerly and easterly winds throughout the period. These findings are now discussed in comparison with other regional rainfall reconstructions and possible ENSO forcing.

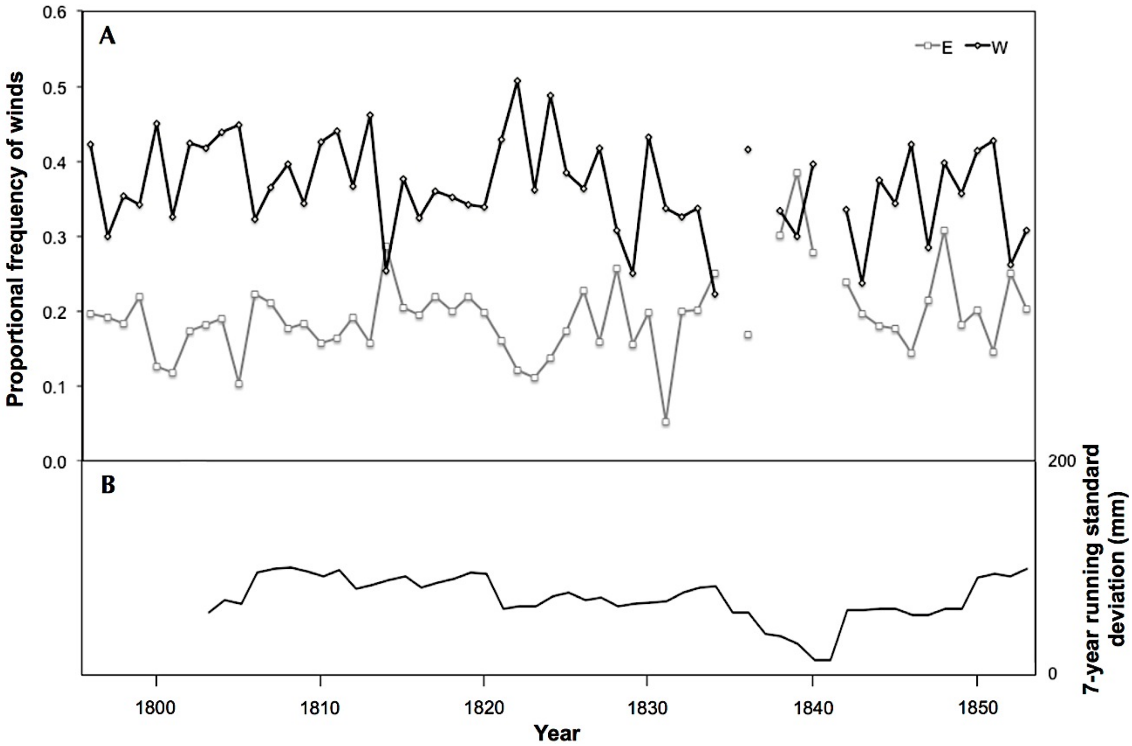

FIGURE 4.10 A. Proportional frequency of April-September zonal winds in the leading Principal Component for the Cape Town grid boxes and B. 7-year running standard deviation for precipitation at Cape Town.

4.3 Assessing early-nineteenth century precipitation variability

4.3.1 Comparison with other regional records

The precipitation reconstructions can be directly compared with other southern African records of early-nineteenth century rainfall variability with inter-annual resolution. The records selected for comparison are the multi-proxy records for the SRZ and WRZ (Neukom et al. 2014), which are made up of various documentary, instrumental and natural proxy records, the semi-quantitative documentary-derived rainfall records for Lesotho (Nash and Grab, 2010), the Eastern and Southern Cape (Vogel, 1989), and the Western Cape proxy-documentary wetness index produced by Nicholson et al. (2012). Those for the SRZ are compared with the Mthatha reconstruction in Figure 4.11.

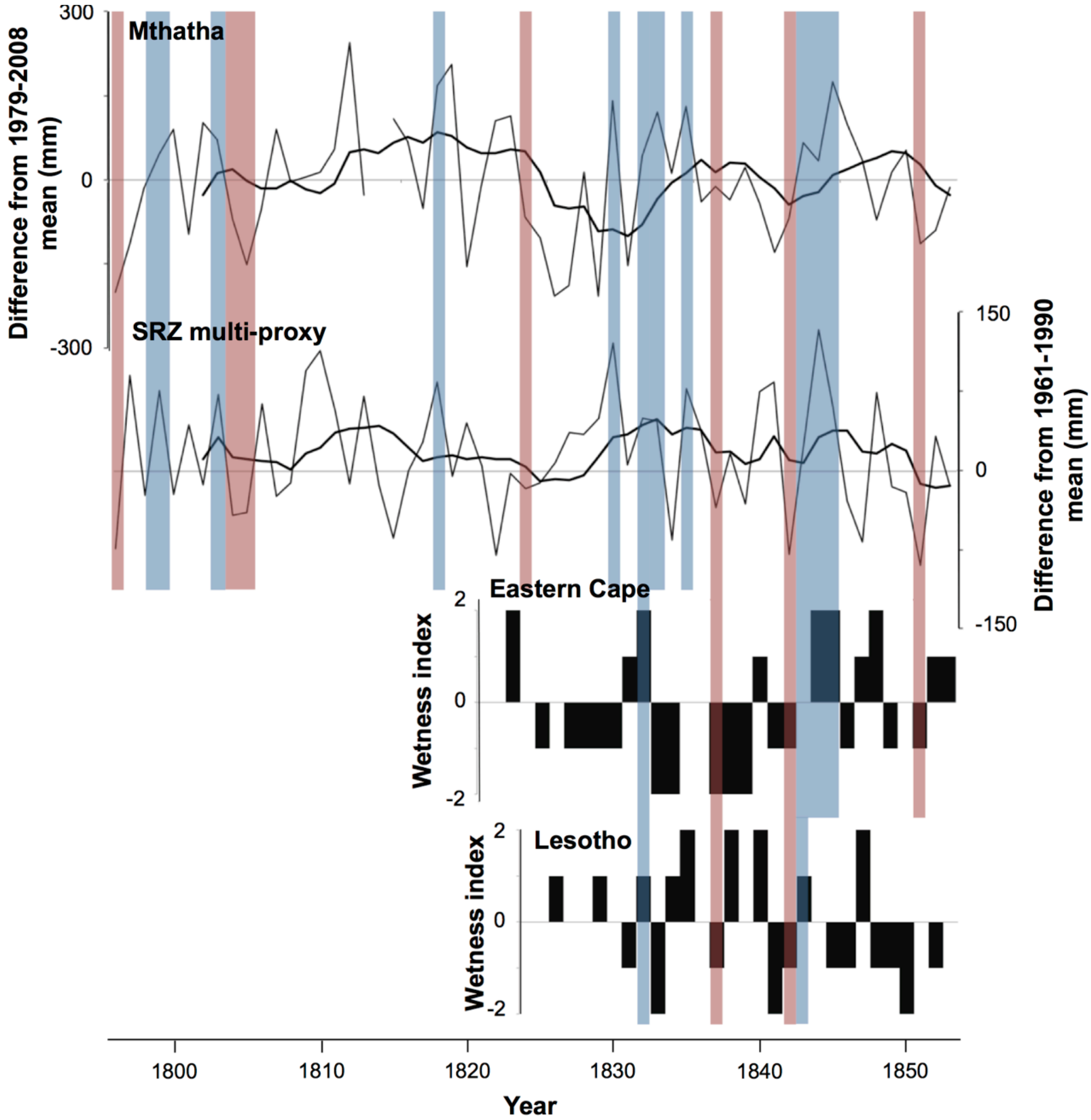

FIGURE 4.11 Comparison of the Mthatha reconstruction and other Summer Rainfall Zone reconstructions. The Summer Rainfall Zone multi-proxy is from Neukom et al. (2014), the Eastern Cape and Lesotho records are reconstructed from documentary evidence by Vogel (1989) and Nash and Grab (2010) respectively. The scale of the documentary reconstructions ranges from 2 (wet) to -2 (dry). The darker shaded bars extending across the plots indicate inter-annual correspondence of wetter conditions in the records, and the lighter bars correspondence of drier conditions. Note the difference in reference mean periods of the logbook and multi-proxy reconstructions.

Though correlation between SRZ records is statistically insignificant, the comparison of records reveals some correspondence on both inter-annual and decadal scales. The period to 1810 had two major dry spells, the summers of 1796-97 and 1805-06, which are picked up by both records. The generally drier years at the end of the eighteenth century may correspond to the *mahlatule* famine, while the latter drought is also noted by Eldredge (1992). Although wetter conditions are observed in both the logbook and multi-proxy records between 1810-20, little inter-annual correspondence is present excluding the normal conditions in 1811-12 and the wet summer of 1818-19. The 1820s was the driest decade in the period in both the logbook reconstruction and the SRZ multi-proxy record, although the latter still received slightly above average precipitation. The drier years in the Mthatha record are towards the late 1820s, which agrees with the Eastern Cape record (Vogel 1989), as well as references to drought in Mozambique (Newitt 1988) and the reference to drier conditions in KwaZulu-Natal by Isaacs (1836), which are assessed in Chapters 5 and 6. The drier years in the multi-proxy reconstruction, however, are shown to be at the beginning of the 1820s, while very little correspondence is observed with the Lesotho chronology beginning in 1824. Improved coherence between records is observed in the 1830s, particularly with the multi-proxy and Lesotho records. The summer of 1830-31 was wet at Mthatha and in the multi-proxy reconstruction, while wet summers were observed in these records in 1832-34 and 1835-36. In the late 1830s, normal to relatively dry conditions prevailed at Mthatha and in the multi-proxy record. Agreement with the Lesotho record is shown in the relatively dry summer of 1837-38, while the documentary Eastern Cape chronology gives very dry conditions for these years. The 1840s showed reasonable correspondence between records, with the drier summer of 1842-43 reflected in all four records being followed by three wetter summers (1842-46), each of which are picked up by the multi-proxy record, two by the Eastern Cape record, though only one by the Lesotho chronology. Relatively drier conditions are registered in each record except for the Eastern Cape at the beginning of the 1850s. In addition, two of the three southern Africa-wide droughts identified by Kelso and Vogel (2007) in this period were reflected in the SRZ logbook reconstructions, those in 1820-21 and 1825-27.

The regional comparison of records for the WRZ is shown in Figure 4.12. Again, a statistically insignificant correlation is present between the Cape Town and multi-proxy record, which for the overlapping period is comprised of the Die Bos tree-ring record (Dunwiddie and LaMarche 1980) and two documentary datasets (Kelso and Vogel 2007; Vogel 1989). Lower frequency variability indicated by the 7-year running mean shows slightly better correspondence, with both records showing a decrease in precipitation in the 1830s, and increasing precipitation towards the end of the record. The longest other contemporaneous inter-annual record from the WRZ is the proxy-documentary record marked as region 84 in the wetness index by Nicholson et al. (2012). Correlating the wetness values with the logbook reconstructed precipitation record gives a weakly significant value of $r = 0.23$ ($p < 0.10$).

Relatively normal precipitation relative to the 1979-2008 mean prevailed at Cape Town until 1812, with two anomalously wet years (1801 and 1804) and one very dry winter (1806), two of which are picked up by the Western Cape proxy-documentary record (Nicholson et al. 2012). Relatively dry conditions were present until 1821, with notably drier conditions occurring in the available WRZ records at this time shown in Figure 4.12 in the winters of 1819 and 1820. Conditions were relatively wet until 1824, with coherence between the Cape Town and multi-proxy records observed in 1822 and 1824. The multi-proxy and documentary reconstructions then show a three-year dry period, in which two of these years are not reflected in the logbook reconstruction. Little agreement is present between records from 1829-1832, however, the mid- and late-1830s show the greatest correspondence between records, with very dry conditions occurring in most years. Unfortunately, some winters were unable to be reconstructed from the logbook data as the data density was poor, though those that were reconstructed were consistently lower than the 1979-2008 mean. Conditions were relatively variable towards the end of the reconstruction, with some dry years, notably 1846, reflected across each of the records. 1850, a very wet year in the WRZ, was also reflected across each of the four records shown.

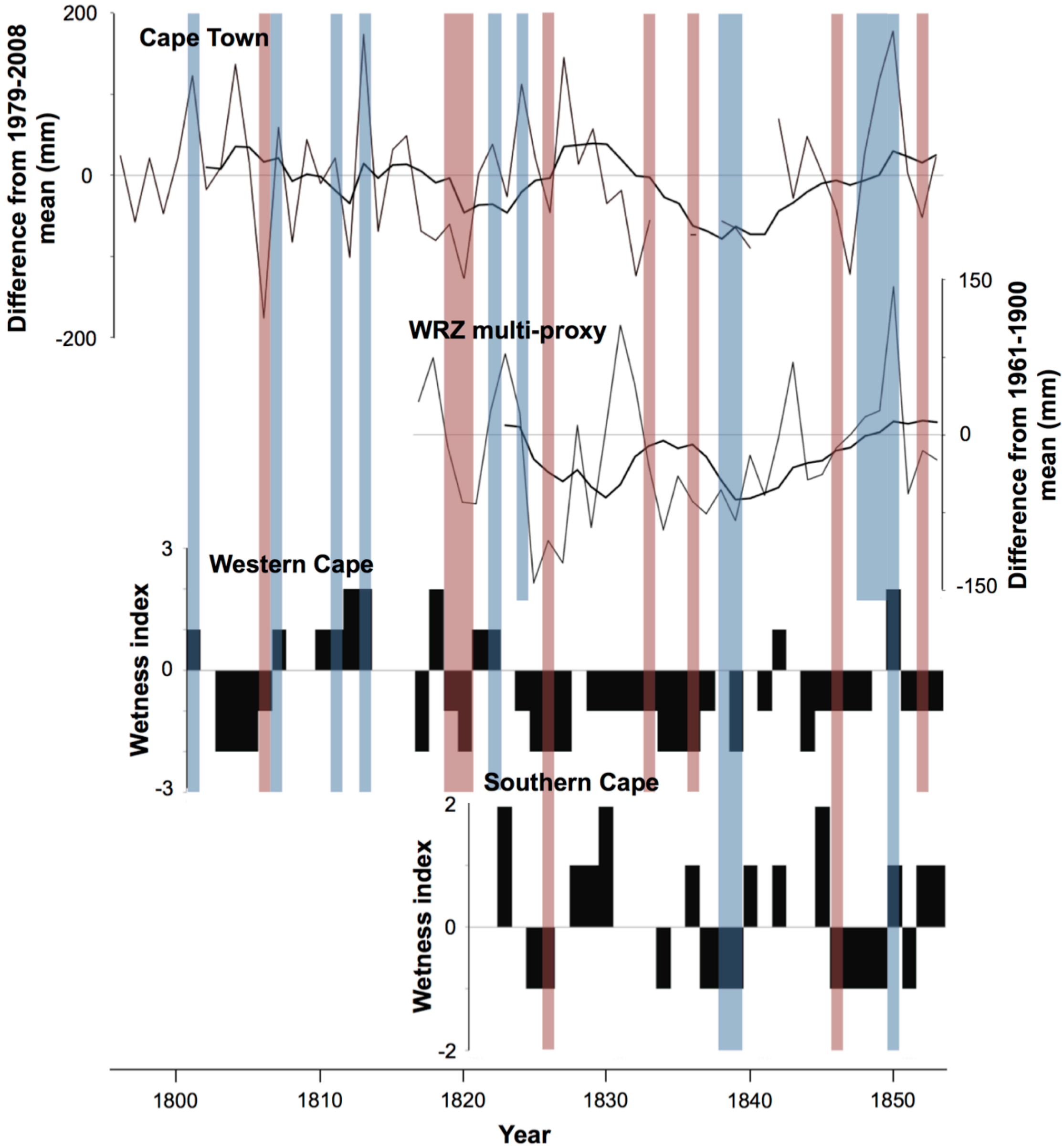

FIGURE 4.12 Comparison of the Cape Town reconstruction and other Winter Rainfall Zone reconstructions. The Winter Rainfall Zone multi-proxy is from Neukom et al. (2014), the Western Cape and Southern Cape records are reconstructed from documentary evidence by Nicholson et al. (2012) and Vogel (1989) respectively. Note that the scale of the documentary reconstruction for the Nicholson et al. (2012) reconstruction ranges from 3 (very wet) to -3 (very dry), while that of Vogel (1989) ranges from 2 (wet) to -2 (dry). The darker shaded bars indicate inter-annual correspondence of wetter conditions in the records, and the lighter bars drier conditions. Note the difference in reference mean periods of the logbook and multi-proxy reconstructions.

Although some correspondence is found between the records, inter-annual variability often differs, with occasional notable differences between certain reconstructions. A major reason for this may be that the multi-proxy data are composed of very different sources influenced by various forcing mechanisms across a wide spatial area, each of which may have a local bias. For instance, in the SRZ, the tree-ring chronology from Zimbabwe by Therrell et al. (2006), representative of ITCZ-forced precipitation levels, and the Ifaty Reef Indian Ocean coral record by Zinke et al. (2004), sensitive to changes in sea-surface temperatures, were combined with documentary records from Lesotho, the Eastern Cape, and the Kalahari. Although a general coherence of summer rainfall totals across the SRZ exists, inter-annual variability between areas is present. While the WRZ is considerably smaller than the SRZ, inter-annual variability between documentary records still exists. Despite the relatively high RE values and correlation coefficients in the calibration period, a limitation of this approach is that there may also be other mechanisms of precipitation variability reflected in the other records that are not captured by the regression relationships with the wind data, such as intensified anticyclonic circulation over southern Africa (Mason and Jury 1997). Moreover, the logbook reconstruction itself is based upon spatially and temporally variable data incorporated according to pre-processing criteria, it is therefore also possible that changes in wind speed may be more rapid than that captured by the sample, although by using seasonal means it is hoped that this may be minimised. Certainly, the potential to increase the data density by incorporating the yet to be digitised EEIC logbook observations would further improve the reconstructions.

4.3.2 Droughts and ENSO events in the Summer Rainfall Zone

ENSO warm events, or El Niño events, are associated with drought over areas of southern Africa, with a strong response in the southeast (Rocha and Simmonds 1997; Nash and Grab, 2010). This is particularly evident in the summer immediately after an El Niño event, with the greatest rainfall reductions occurring between January and March (Nicholson 2000). According to Mason and Jury (1997) and Tyson and Preston-Whyte (2000), El Niño events are followed by a northward shift of the westerlies in the southern African sector, leading to a diminution of moisture convergence and a dominance of dry conditions.

Relating patterns in summer atmospheric circulation to the semi-quantitative documentary reconstructions of ENSO warm events by Quinn and Neal (1995) and Ortlieb (2000) (Figure 4.9), some potentially noteworthy patterns emerge. Although not attempting to over-attribute cause, 14 of the 18 El Niño years identified by Quinn and Neal (1995) in the period of the logbook reconstruction coincided with an increase in or above average westerliness the following summer, while this number is 11 out of 15 for the revised chronology by Ortlieb (2000). Furthermore, the only El Niño event in the time period identified as ‘very strong’ in both records, in 1828, coincides with the highest proportional frequency of westerliness and the second driest year in the record. Given the high concentration of El Niño events reported in both documentary records between 1814 and 1832, it may also be possible that this is linked to the increased inter-annual rainfall variability calculated in the 7-year running standard deviation (Figure 4.19), and also the high variability in this period shown in Figure 3.9. Despite this association with the two chronologies listed above, less correspondence is observed with El Niño events reconstructed in the most recent documentary chronology by García-Herrera et al. (2008), with only four out of 14 summers following El Niño events having increased or above average westerliness. As inferred by the difference in correspondence, discrepancies exist between El Niño events in the records, including a suggested overestimation of events by Quinn and Neal (1995) due to both inappropriate interpretation of documents and the inclusion of reports from areas where ENSO teleconnections are uncertain (García-Herrera et al. 2008). The level of correspondence between El Niño events and summer westerliness, therefore, is dependent on the record used for comparison.

In addition to discrepancies between records, it is important to note that while most El Niño events recorded in Quinn and Neal (1995) and Ortlieb (2000) appear to coincide with increased westerliness, they do not always result in reduced rainfall at Mthatha or Royal National Park. A total of 11 out of the 18 years following El Niño events in the Quinn and Neal (1995) record are marked by a decrease in precipitation, while this figure is eight out of 15 for the years identified by Ortlieb (2000). Furthermore, in both records, only three out of the seven severely dry years noted in the results section - 1805-06, 1820-21, and 1829-30 - are in years following El Niño events in both records. That two out of these three events, however, are rated as 'strong' and 'very strong' perhaps suggests that the incidence of stronger ENSO warm events is more likely to result in such severe decreases in precipitation in southeast southern Africa, while a weaker atmospheric response and consequently weaker precipitation anomaly is generally present in events of a moderate strength. This also suggests that whilst El Niño events appear to have an important influence on atmospheric circulation according to two of the chronologies, the precise nature of the relationship is more complex, and that they are not the only cause of drier conditions in southern Africa (Nicholson 2000; Nash and Grab 2010). Furthermore, as the Southern Hemisphere westerlies shift poleward in La Niña events (L'Heureux and Thompson 2006; Seager et al. 2007), it is possible that the consequences of La Niña conditions are captured in the wind data in years with increased easterliness (Figure 4.9). However, the resultant wetter conditions may be under-recorded in the documentary records, which is a common issue in reconstructions from written sources (Kelso and Vogel 2007; Nash and Grab 2010), as is reaffirmed by those compiled in Table 3.5.

4.4 Summary

By establishing statistical relationships between wind and precipitation using reanalysis data, this chapter has presented precipitation reconstructions at selected southern African weather stations for the period 1796-1854. Results for the SRZ stations showed that the 1810s was the wettest decade of the period, while the 1820s was the driest. At Cape Town in the WRZ, the reconstruction revealed the 1820s to be the wettest decade, while the 1830s, although having some missing years, was shown to be the driest decade of the time period. A degree of correspondence was registered between the logbook reconstruction and other records, although frequent differences in inter-annual observations were registered. Moreover, potentially important correspondence was observed between the dry years in the late-1820s in the SRZ reconstructions and the more sparse written reference to drought shown in Table 3.5. Discrepancies in correspondence may be due to the spatial extent of certain records, or their sensitivity to alternative or local forcing factors. Nevertheless, the SRZ reconstruction did pick up two of the three southern Africa-wide drought episodes identified by Kelso and Vogel (2007) in 1820-21 and 1825-27.

Identification of causation in past rainfall variability should be treated with caution. However, comparison of the El Niño records by Quinn and Neal (1995) and Ortlieb (2000) revealed that in all but four of the El Niño years identified by each record respectively, westerliness in the following summer increased or was above average for the period. Despite this, the strength of atmospheric response following El Niño events differed, and not all events were followed by markedly dry summers. Reduced correspondence was present with the independent chronology of García-Herrera et al. (2008). This therefore cautions against strong causal linkages with documentary-reconstructed El Niño events in this period without further investigation.

By providing highly-resolved and reliable observations for the oceans surrounding southern Africa, the logbooks have offered new and independent insight into the past atmospheric circulation and precipitation patterns in the region. That the logbook data are not proxy-based but are the result of direct observations, recorded to a common standard, is a significant advantage, the value of which has been demonstrated in this study. Importantly for this thesis, the SRZ records can now be used for consideration of climate-society interaction in Chapters 5 and 6, where inter-annual knowledge of precipitation variability prior to 1820 was previously sparse.

Chapter 5. Vulnerability and response to climate variability in the Zambezi-Limpopo region (*c.* AD 1450-1830)

The impacts of climate variability have been suggested as an important contributory factor in historical societal development in the Zambezi-Limpopo area (Newitt 1995; Tyson et al. 2002; Pikirayi 2003; Holmgren and Öberg 2006; Huffman 2008), yet there remains a lack of detailed consideration of the interaction between climate and society in this region, particularly after written sources become available in the early-sixteenth century. The nature and uncertainties of climate variability over this period have, to an extent, been clarified in Chapter 3. The mediating human context upon which this impacted, however, is poorly understood, with high vulnerability and the 'dislocation' of society in times of climatic stress often assumed as a matter of course. This chapter will investigate the dynamics of interaction between climate variability and society and its significance in societal change in southeast Africa between *c.* 1450-1830. This begins with the decline of Great Zimbabwe, spans the growth and diminution of the Mutapa state and the Manyika and Teve polities, as well Portuguese influence, and ends with the arrival of Nguni-speaking communities in the 1820s and 1830s.

As this thesis has already recognised, in reality climate variability takes its place with other stressors, meaning a wider range of economic, social and political factors must be assessed in relation to the contextual vulnerability of societies. This premise, and the limited direct information on climate-society interaction, necessitates a much wider scope of analysis than the nature of climatic change and its recorded impacts alone. Consequently, in addition to qualitative consideration of a broader range of factors, this chapter develops a new, semi-quantitative methodology to assess the vulnerability context of polities and populations to climate variability at certain points in time from written sources. Along with geographical differences such as resource abundance outlined in Section 2.2.1, this means that particular focus will be lent to the identification of temporal differences in factors which influenced the livelihood base, political stability, health, and effectiveness of social networks in communities across the region. These range from relatively short-term conditions like conflict, epidemic disease and commodity prices to more gradual changes such as the working out of gold deposits, protracted civil war, and external political influence. It is the changes in these factors that influenced vulnerability and efficacy of response to the precipitation variability documented in Chapter 3, and consequently its human significance.

5.1 Sources and methods

In 1552, João de Barros told his audience of *Da Asia* that the inhabitants of southern Africa:

> "Can neither read nor write, have no books, and all ancient history and other things which they know they learn by tradition from their ancestors" (Barros 1552, 201).

The main source of data for this investigation is thus written information from the hundreds of documents recorded by Portuguese officials, traders and missionaries since Pero d'Anhaia established a fort at Sofala in 1505, and to a limited extent, oral traditions. This reliance on a history told by the Portuguese brings with it numerous caveats, but, as the next section will show, certain advantages for the task in hand. This is because the Portuguese were primarily interested in the exploitation of the region's resources, which occasioned an economic and livelihood-related focus in the documents. The next sections will overview the recording, content, and coverage of the documents, before discussing how an evaluation of vulnerability will be undertaken.

5.1.1 Written sources

In contrast to much of the Sub-Saharan African interior in the pre-colonial period, the area falling within the borders of present-day Zimbabwe, Mozambique and southern Malawi offers a comparatively vast range of written source material relating to African society (Axelson 1960; Beach 1980). This began in earnest with Portuguese contact on the Mozambique coast at the end of the fifteenth century, and spanned four centuries to the imposition of colonial rule at the close of the nineteenth century. It is therefore possible to read either first- or good second-hand accounts of most aspects of human activity in the region, supplemented by descriptions of the environment, climate, vegetation and fauna (Beach 1987). The principal factor that accounts for this relatively high availability of information inland was the gold of the Zimbabwe plateau, which meant that while this area received attention from an early date, the interior between the Shire River and Ethiopia, and the Save River and the Cape was largely ignored.

The accumulation of these documents was a product of the administration of the Portuguese state, church and mercantile capital across its *Estado da Índia*. The bulk of the documents examined here are held within three translated source compilations (Table 5.1): the nine-volume *Records of South-Eastern Africa* (*RSEA*) (Theal 1898-1903), the nine-volume *Documents on the Portuguese in Mozambique and Central Africa 1497-1840* (*DPMCA*) (da Silva Rego and Baxter 1962-1975), and the two-volume *The Shona and the Portuguese* (Beach and Noronha 1980). The primary sources within each of these source compilations (see bibliography for details of individual sources) were consulted and related evidence was recorded verbatim.

TABLE 5.1 Source compilations consulted. Beach and Noronha (1980) documents kindly provided electronically by T. N. Huffman and W. V. Work.

Source	Location	Timeframe	Information
Theal (1898-1903) (9 vols.) (*RSEA*)	British Library, London	1497-1890	Translated Portuguese documents, book extracts in English
da Silva Rego and Baxter (1962-1975) (9 vols.) (*DPMCA*)	British Library, London	1497-1890	Translated Portuguese documents and administrative records
Beach and Noronha (1980) (2 vols.)	University of Harare, Zimbabwe	1585-1890	73 translated Portuguese documents not in *RSEA* or *DPMCA*
Freeman-Grenville (1962)	British Library, London	900-1890	Translated Portuguese and Arabic documents

In addition to Portuguese documents, some Arabic texts exist which allude to the Zambezi-Limpopo region. However, Beach (1987) notes it is unlikely that any literate Arab or Swahili observed the plateau itself first-hand, as the documents show little knowledge of the region except excluding the presence and trade of gold and ivory with interior states (Burke 1962). The first non-Portuguese writers in the area only began in the 1830s relating to the Ndebele and Gaza states. Outside these two Nguni-speaking polities, though, the coverage of non-Portuguese source material was very uneven. Moreover, diarists described a narrow trail across the region, and were not in a position to obtain as much information as the Portuguese, who settled for long periods at their towns, *feiras* and *prazos* (Beach 1980). Beach (1987) adds that the Portuguese traders, priests and officials who wrote these documents had to submit them to a bureaucratic chain that led to Lisbon or the Vatican, while other observers wrote with the purpose to reinforce their memories or to collect material for a book. Therefore, though useful supplements, diaries will not be used extensively.

5.1.1.1 Recording and content of Portuguese documents

The documents consulted possess a high degree of homogeneity in both their manner of recording and content. Generally, written descriptions depict the situation in a certain area over a period of time, although in some cases the writer had not seen the things described. Yet this did not mean that the information was inaccurate, as most Portuguese resided at trading centres, to which African traders related first-hand information (Newitt 1995). This means that the Portuguese writer, often a speaker of Shona or Tonga, knew the situation in a distant territory over a number of years with a degree of accuracy. Beach (1980), however, cautions that some writers plagiarised the work of others, and so what may appear as an independent verification of an earlier statement could well be a copy. Indeed, the Portuguese had a tendency to repeat obsolete information (Phimister 1976). Beach (1987) classified documents into 'first-hand' and 'second-hand' (Figure 5.1), where first-hand documents refer to those where the writer had visited the region in question, whereas second-hand writers had not. While important, this is not a definitive assessment of their quality, and many second-hand documents provide reliable information (Beach 1987).

The Portuguese were mainly concerned with the wealth of the region, and this in turn influenced what was recorded and to whom it related (Pikirayi 2003). In the first two centuries, almost all descriptions of African society related in some way to the exploitation of the land, as well as to convince the crown that its money would be better spent in southeast Africa than in Brazil or Asia (Beach 1987; Newitt 1995). Exaggeration and bias is thus an issue that frequently creeps in. That a high proportion of the earlier documents were written from a strongly utilitarian standpoint, however, is not necessarily a limitation to their use in this thesis, as livelihood aspects such as mining, trade, hunting, crop cultivation and cattle are at the core of the examination of differential societal vulnerability to climate variability. Other factors, such as African religion, were also described but in usually disparaging terms, a major reason for this being that the Portuguese aimed to supplant it with Christianity. All of these factors mean that the documents must be read with a critical eye. Regardless of these caveats, the documents provide relatively homogenous and detailed information on mining, local trade, crops, religion, war, tribute, diplomacy and village life over a sustained time period, all of which are central to an examination of the research questions here.

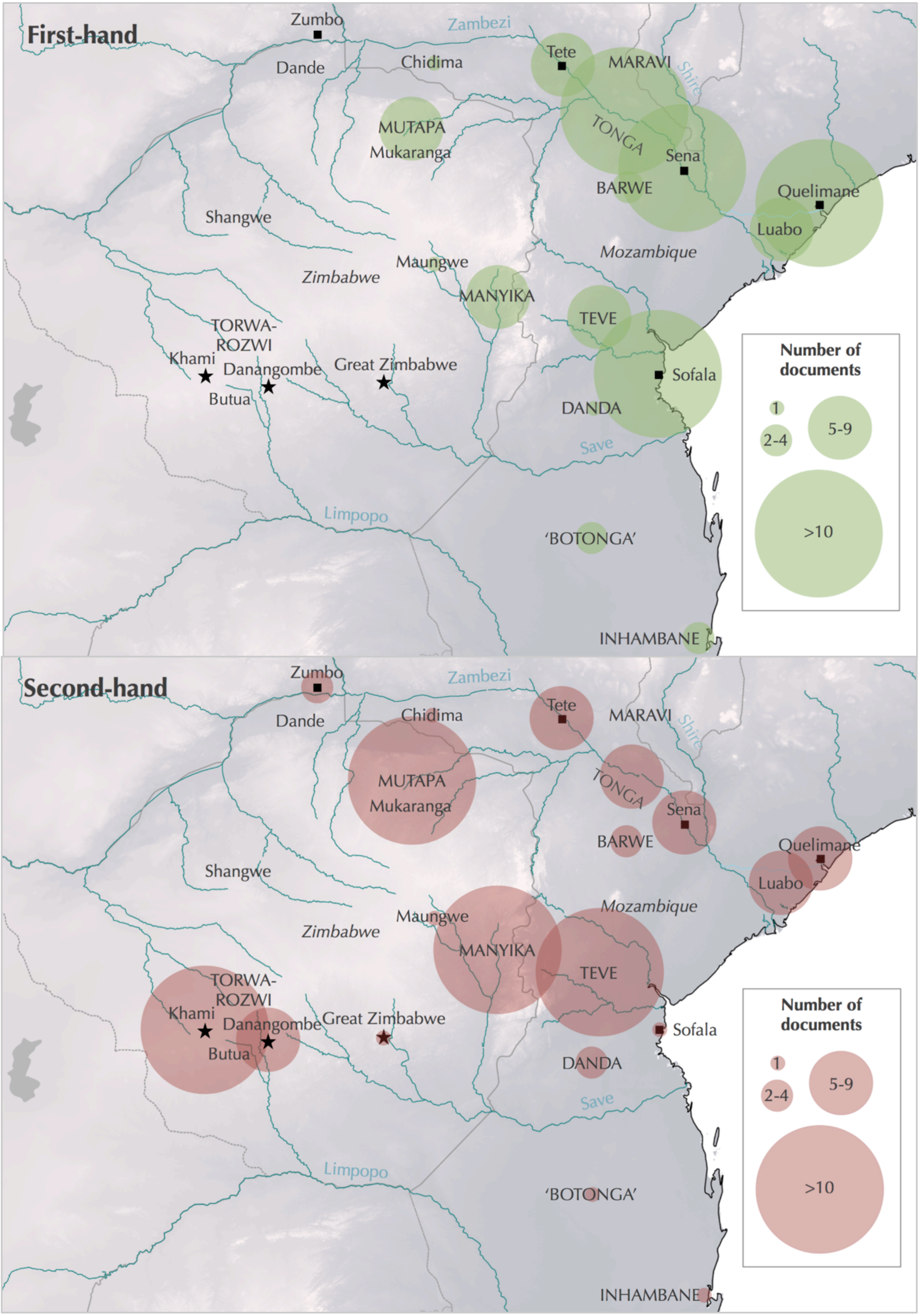

FIGURE 5.1 First- and second-hand Portuguese documents relating to African society in the Zambezi-Limpopo area, c. 1505-1830.

5.1.1.2 Spatial and temporal coverage

The earliest first-hand evidence in the interior plateau region is from 1512 in an account written by Gaspar Veloso, while documents were written in the same area from 1561. Generally at this time, however, the Portuguese relied upon second-hand evidence from the interior from African or Muslim traders, the quality of which varied (for example Barbosa 1518; Barros 1552). First-hand evidence from the Mutapa state commenced from 1560 (Silveira 1560), with further information gathered from the Zambezi Valley and Manyika in the attempted conquest in the decades that followed (Monclaro 1573; Homem 1576). The comprehensive account of Santos (1609) also gives detailed information on Teve in 1586-90 and 1594, and, according to Beach (1987), is perhaps the first document to move away from the utilitarian approach predominant in all accounts preceding it.

First-hand information increased in quantity and geographical extent in the early-seventeenth century due to the weakening of the Mutapa state (for instance Bocarro 1631-49; Rezende 1634; Gomes 1648). Knowledge on areas such as Manyika and Teve increased substantially after the conquests of 1628-32, yet knowledge was still very scanty in the Torwa area, and remained limited to second-hand accounts. While information on the north-central plateau was reduced after the Portuguese abandoned their *feiras* in 1693, this was not the case elsewhere (Beach 1987; Pikirayi 1993; Newitt 2009). Manyika, Teve and Barwe remained covered by first-hand observers, the Zambezi valley underwent an increase in knowledge, and the new *feira* of Zumbo resulted in second-hand information further west around the Dande area. Similarly, the Mozambique coast remained covered from the early-sixteenth century onwards, particularly in the areas around Sofala and Quelimane. In addition, the eighteenth and nineteenth centuries also saw an increase in interest in African society for its own sake (Beach 1987). The major decline in knowledge came with the significant weakening in Portuguese power in the region in the 1850s. The end of the permanent occupation of the Manyika *feiras* in 1835 reduced first-hand information from this area, although the Zambezi valley upstream of Tete remained an area which was well-observed.

5.1.2 Investigating differential vulnerability using written sources

The archival sources introduced above will be used to evaluate societal vulnerability and response to climate variability. Key to this assessment is identifying the sensitivities of the socio-ecological system associated with the enhancement or impediment of an effective response to climatic stress, and their differences over space and time. Qualitative critical analysis will form the backbone of the text, but in order to produce a comparative assessment of vulnerability across a wide spatial and temporal domain, an indicator-based approach is also adopted. This approach draws from the contemporary literature around future climate impacts, yet has recently been applied to the past in assessing the impacts of famine (Engler 2012; Engler et al. 2013).

A vulnerability indicator is "an operational representation of a characteristic or quality of a system able to provide information regarding the susceptibility, coping capacity and resilience of a system to an impact of a disaster" (Birkmann 2006, 57). These indicators are thus essentially a measure of possible harm, or a value judgement on the 'badness' of a state (Hinkel 2011), but are also strongly tied to adaptive capacity and resilience (Endfield 2012). This analytical framework is represented in the schematic in Figure 5.2, where climate variability is shown as the external stressor that impacts upon the socio-ecological vulnerability context. Crucially, this vulnerability context is the starting-point of the analysis, as it assesses the living conditions of an affected group or society before the potential 'driver' is considered (Bohle 2001; Turner II et al. 2003; Birkmann 2006; Füssel 2007). Past climate variability itself, including its magnitude, spatial range, duration, speed of onset and timing is not included as an indicator, as it is here considered as a potential driver (Figure 5.2).

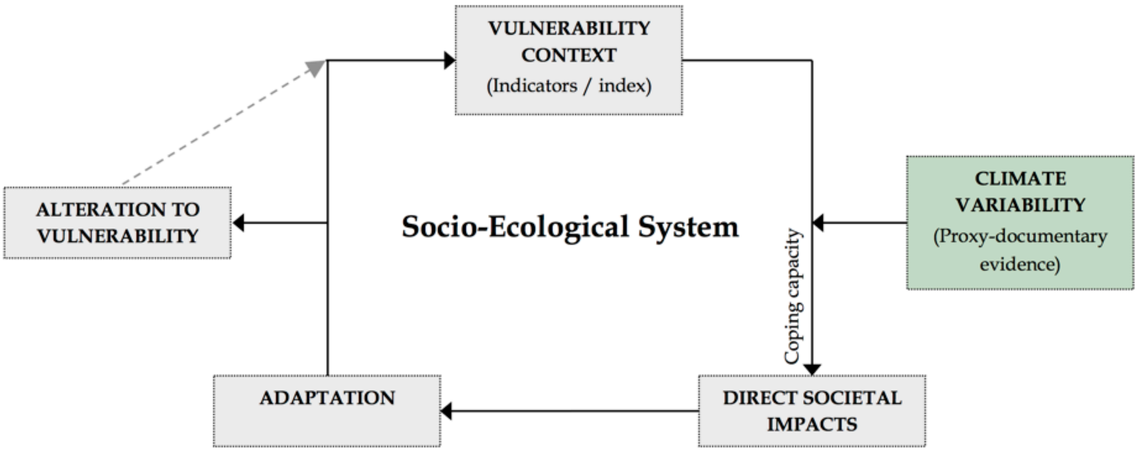

FIGURE 5.2 Vulnerability and climate impacts in the socio-ecological system.

The indicator-based approach basically involves selecting factors associated with vulnerability to climate variability, and assigning scores based upon the inferred situation in a given political unit or area at a particular point or period in time. In this case, a 'deductive' approach is partially followed, whereby a limited number of variables are adapted from those used in the literature in order to create an index supported by extant theory and examples (Yoon 2012; see Hahn et al. 2009; Gbetibouo et al. 2010 for examples). Assessing vulnerability using such a method, however, must give particular attention to the place- and time-specific context of pre-colonial southeast Africa. This means that the wider vulnerability literature is only of general assistance in selecting the precise variables used. In other words, the meaning of harm must be explicitly defined and reasoned for the context under consideration (Hinkel 2011). Similarly, it is also important to remember that vulnerability, and its constituents of exposure, sensitivity and adaptive capacity, are a dynamic phenomena, often in a continuous state of flux, and are scale-dependent (Adger 2006).

5.1.2.1 Assessing vulnerability indicators

Box 5.1 displays the 20 indicators selected for the analysis, which consist of food system, livelihoods and trade, socio-political and biophysical components. Although the indicators included here are based upon hypothesised links, the southeast African case context and the availability of information in the Portuguese documents mean that a number of subjective decisions and assumptions are unavoidably embodied in the methodology. As Adger and Vincent (2005) state, this uncertainty is a product of being unable to validate the effectiveness of indicators in representing determinants of vulnerability, as their objective is to capture intangible processes. Where possible, the literature was used to identify a common list of food system, livelihood, social and biophysical indicators (for example Yohe and Tol 2002; Füssel 2007; Engler et al. 2013), which were then adapted to the space-time context. Furthermore, indicators were chosen which are applicable to the multi-centennial analysis period.

Most of these variables simplify a number of important properties, and are based upon well-established links (Table 5.2). For example, it is commonly asserted that diversity in cultivated crops and livelihoods decreases vulnerability to climate impacts (Kandji et al. 2006). Similarly, it is well attested that political stability, robust social networks and functional relief structures improve adaptive capacity and therefore reduce vulnerability (Ford et al. 2006). Some indicators, however, are more subjective and open to interpretation, a prime case being control of gold resources and access to the inter-continental trade network. On the one hand, gold was an important resource to pre-colonial polities, and the imports traded via the Indian Ocean network in turn provided a source of wealth which aided the maintenance of political authority. On the other hand, possession of these resources subjected polities to the potentially destructive influence of mercantile capitalism, while the risks of the mining process itself presented another danger (Phimister 1976). In this case, the position adopted is that mining provided a source of livelihood diversification, the production from which could also be traded for grain in times of scarcity, and thus decreased vulnerability. In each of the four components in Box 5.1, a number of 'other determinants' also exist, which are either not conducive for quantification or the information is simply insufficient to do so. These determinants will be qualitatively assessed where possible.

Each of the 20 indicators in Box 5.1 are classified with a simple numerical index with equal weighting assigned to all sub-components (following Hahn et al. 2009). A value of '0' is assigned when the indicator is considered to have neither a positive nor negative influence, '-1' when it is thought to decrease vulnerability or has mitigating impacts, and '1' for when it is adjudged to increase it. Where evidence is too sparse to allow an unambiguous assessment of an indicator, the indicator is marked with the sign '-', and is not counted in the index evaluation. This process is also followed where indicators do not apply to the respective context of the population or period. Secondary data (for instance conflict data in Beach 1980; Mudenge 1988; Newitt 1995 and data on gold and ivory prices in Alpers 1975; Phimister 1976; Mudenge 1988) are used where primary data is limited (see Appendix B for full indicator assessment values and sources). The evaluation is further supplemented by illustrative quotes recorded verbatim from the written sources throughout the text. In spite of the equal weighting of the indicators in the assessment, particular attention in the text will be devoted to food systems, and their diversity, production and security. This is because these are both climate-sensitive livelihoods (Barnett and Adger 2007), and as Section 2.2.2.1 outlines, formed the economic basis of most southeast African communities.

BOX 5.1 Vulnerability indicators for assessment, other determinants, key sensitivities and source coverage of each indicator.

Food system	**Source coverage**
1. Crop diversity	High
2. Domestic animals	High
3. Animals hunted	High
4. Wild resources	Moderate
5. Cultivatable territory	High

Other determinants: labour, gender, cultivation techniques, storage, food distribution, traditional ecological knowledge
Key sensitivities: food resource dependence, food security, dietary diversity

Livelihoods and trade	
6. Quantity of minerals controlled and mined	Very high
7. Prices of and demand for minerals	Moderate
8. Quantity of ivory hunted	High
9. Prices of and demand for ivory	Moderate
10. Alternative livelihood options	Moderate
11. Access to and participation in inter-continental trade network	Very high
12. Access to local trade network	Moderate

Other determinants: labour, gender, goods traded, external political events
Key sensitivities: resource dependence, exposure to external shocks, terms of trade

Socio-political	
13. Leadership contention and stability	High
14. Sovereignty	High
15. Presence of local conflict or raiding	High
16. External conflict presence	Very high
17. Presence of slavery	Moderate

Other determinants: population, migration (voluntary or forced), urban-rural dynamics, social stratification, succession system, colonialism, religion, territorial control, worldview, perception of weather anomalies
Key sensitivities: political stability, exposure to conflict, nature of relations

Biophysical	
18. Inferred fertility of land	High
19. Hazard prevalence	Moderate
20. Occurrence of epidemic, disease, plague or pests	Moderate

Other determinants: vegetation, climate regime
Key sensitivities: hazard exposure, state of health

TABLE 5.2 Vulnerability indicators, criteria and rationale.

Indicator	High vulnerability (+1)	Neutral (0)	Low vulnerability (-1)
Food system			
1. Crop diversity	Dependence on one or two crops	Some crop diversity	Diverse cultivation strategy
Rationale: Crop diversification is widely recognised as an effective strategy for managing risk (O'Brien et al. 2004; Gbetibouo et al. 2010). Different crops also respond differently to climatic variables and have varying storage capabilities, thus greater diversity can decrease the vulnerability of the food system (Kandji et al. 2006; Reidsma and Ewert 2008).			
2. Domestic animals	Very few domestic animals	Some domestic animals	High quantity and range of domestic animals
Rationale: A high stock of domestic animals, such as cattle, sheep and goats, provide an important supplement to cultivated crops, and as they outlast the agricultural cycle they can act as a buffer in times of drought and poor harvests (Beach 1977; Pikirayi 2003).			
3. Animals hunted	Few to no animals hunted	Some animals hunted	Range of animals hunted
Rationale: Hunting provides an important source of food, particularly when other food resources are scarce (Beach 1994). The wider the diversity and higher the volume of hunting options, the lower the vulnerability of the population to climate variability.			
4. Wild resources	Little to no gathering	Gathering practised	Gathering practised extensively
Rationale: The availability and use of wild food resources, such as fish, fruit or roots provides another source of food in times of scarcity or poor harvests. Where gathering was reported as a component of the food system, vulnerability is scored as lower.			
5. Cultivatable territory	Small or marginal territory, food imports required	Territory not extensive but no imports required	Extensive cultivatable territory
Rationale: Polities or people-groups that controlled a higher area of cultivatable territory could draw upon this if land was lost in conflict, annexed by the Portuguese or affected by environmental degradation or disaster.			
Livelihoods and trade			
6. Quantity of minerals controlled and mined	Little to no mineral resources controlled and mined	Some mineral resource controlled and mined	Extensive mineral resources controlled and mined
Rationale: The availability and access to mineral resources, particularly gold for trade purposes, can result in a greater diversity of non-farming livelihood options that can spread risk (Paavola 2008). This means that societies can respond to decreasing or seasonally varying returns in agriculture by means of trade. This can, however, lead to lower economic returns for greater security, and a poverty trap because productivity gains from specialisation are not realised (Barrett and Swallow 2004). New vulnerabilities may also be raised here, such as increased attention from European powers, susceptibility to global economic fluctuations, and risk of injury or death from dangerous mining methods.			
7. Prices of and demand for minerals	Low prices and demand	Moderate prices and demand	High prices and demand
Rationale: Lower prices and demand for minerals amounts to a decrease in returns, including cloth, beads and occasionally food, for their export.			
8. Quantity of ivory hunted	No or minimal ivory	Some ivory	Plentiful ivory
Rationale: This scale follows the rationale of indicator 6.			

9. Prices of and demand for ivory	Low prices and demand	Moderate prices and demand	High prices and demand
Rationale: This scale follows the rationale of indicator 7.			
10. Alternative livelihoods	Few to no alternative livelihoods practised	Some alternative livelihoods practised	Range of alternative livelihoods practised
Rationale: This scale follows the rationale of indicator 6.			
11. Access to and participation in inter-continental trade network	Inaccessible, disrupted or very limited access	Accessible and practised	Accessible and widely practised
Rationale: Experiences of integration into the contemporary Indian Ocean or global trade network are inevitably diverse. It is possible to argue that this leads to the exploitation of particular sectors of the economy, and in turn reinforce existing inequalities in the society. This indicator, however, adopts the position that greater participation in the trade network created opportunities for economic diversification (Adger and Vincent 2005). Where 'trade' turned to extortion or forced labour, a rating of '1' is given.			
12. Access to and participation in local trade network	Inaccessible, disrupted or very limited access	Accessible and practised	Accessible and widely practised
Rationale: This scale follows the rationale of indicator 11, but integration into the local trade network in times of peace carries less risk of exploitation, as the trade was often focussed on food resources, acting as more of a social network which helped manage risk. This is also a proxy for isolation, where more isolated polities are viewed as vulnerable.			
Socio-political			
13. Leadership contention and stability	Power or leadership struggle and instability	Minor instability but no power struggle	Stable leadership
Rationale: Power or leadership struggles reduce political stability and governance effectiveness. This may disable the ability of social networks to respond to crises.			
14. Sovereignty	Under direct rule of another polity	Under distant rule of another polity	Sovereign polity
Rationale: Any loss of sovereignty can result in an accompanying loss in decision-making, which may reduce the likelihood of effective governance of the polity or people-group concerned.			
15. Presence of local conflict or raiding	Civil war or widespread conflict	Limited conflict or violence	No conflict or violence
Rationale: The presence of conflict and violent events in most cases creates new vulnerabilities to climate variability (Barnett 2006). An example is the paralysis of governments and social networks in post-conflict situations, reducing ability to address impacts of environmental change.			
16. Presence of external conflict	Widespread conflict and violence	Some conflict and violence	Little to no conflict and violence
Rationale: This scale follows the rationale of indicator 15.			
17. Presence of 'slavery'	Slavery operating	Slavery in vicinity but no evidence that polity subjected	Slavery not operating
Rationale: The operation of 'slavery' (whether the clientship described by Portuguese writers or the forced expropriation of people) was oriented towards short-term profit and weakened socio-political structures. The presence of slavery is also proxy for local stress, as is later evidenced in the reasons people sold themselves as slaves for protection.			

Biophysical			
18. Inferred fertility of land	Infertile	Fertile	Very fertile
Rationale: While perceptions of land fertility may be heavily influenced by Portuguese biases, these aspects are well-documented and provide a simple, if coarse, classification of the state of the landscape where detailed information on vegetation is not available.			
19. Environmental hazard exposure	Location in drought or hazard-prone area	Location in area where hazards can occur	Location in well-watered (less drought-prone) area
Rationale: The location of polities or populations in hazard-prone areas (to environmental hazards such as cyclones, drought, floods and wildfires) increases their vulnerability.			
20. Occurrence of epidemic disease, plague or pests	Incidence of epidemic, plague, disease or pests	No incidence	Land described as healthy
Rationale: The health status of a polity or population can influence or be influenced by climate variability. Infectious diseases, locust plagues or pests can also directly exacerbate risk of malnourishment, malnourished individuals (possibly as a result of drought and poor harvests) are more susceptible to diseases (Hammond and Dube 2012).			

Before considering the application of this approach to southeast Africa, it is important to further clarify its explanatory scope and the assumptions of its outcomes. As each indicator carries equal weight in the overall index, an unavoidable by-product is the assumption that a low value in one variable can be compensated by a high value in another, though clearly some components may have disproportionate impacts on the overall vulnerability context. In cases where this is judged to be obvious, such as the instance of 'total war' or the outbreak of a severe epidemic disease, the relevant constituent of vulnerability will be highlighted as a potential system-undermining determinant. It should be stressed, therefore, that the sum total from the index does not represent an exact quantification of vulnerability, but is designed to give an *approximate* measure. These results will take the form of 'vulnerability radars', which will provide a snapshot in time of a potential state that is dynamic and multidimensional. These diagrams are points of departure rather than end-states of analysis, and are useful to prompt further conversation and research. Indeed, as these indices simplify a complex reality and require narratives to interpret them, the findings will be more fully discussed in the text, which will provide a more nuanced representation of the situation rather than a rigid quantitative assessment. Despite these constraints, and by considering the nature of uncertainty, the method and interpretable outputs of the index offer considerable advantages over the previous approaches outlined in Section 2.2 for a comparative study of vulnerability to climate variability, and overall, the outcomes of this approach far outweigh their acknowledged risks.

5.1.2.2 Periodisation and attribution

The above section has outlined what will be assessed, but has not yet addressed in detail when, where, and for whom. Chapter 2 outlined critical perspectives on the existing focus on narrow space-time contexts for suggested climate-related socio-political change, such as the conceptualisation of the decline of Mapungubwe on only a decadal timescale. By contrast, this chapter will attempt to address multiple scales, including both the possible climate-related causal dynamics and implications of shorter-term developments, like the decline of Great Zimbabwe, and changes in the vulnerability of socio-ecological systems over the long-term. This approach and timespan partially stems from the limitations of the sources, particularly the limited inter-annual understanding of precipitation variability prior to 1800, but also has a number of advantages. Indeed, the real value of the long-term comparative scale of this chapter is the testing of the premise that in order to understand the underlying causes of and impacts of climate variability, one must also consider periods when climate did not appear to be a significant stressor and the reasons behind this.

Beginning with the decline of Great Zimbabwe, a number of periods are defined to enable the consideration of the significance of climate variability in key periods of socio-political change and over the long-term (Table 5.3). These periods are centred around events which adjusted the configuration of southeast African society, such as the decline of one state and the rise of others, the arrival of the Portuguese, the expansion of Portuguese jurisdiction over African populations, the expulsion of the Portuguese from the Zimbabwe plateau, and the migrations of Nguni-speaking communities north of the Limpopo. Variants of these periods have been used by other scholars of pre-colonial history in southeast Africa (Bhila 1982; Mudenge 1988; Pikirayi 2001, 2003), and are outlined in Table 5.3. Despite the delimitation of periods for the purposes of the vulnerability index, this does not mean that finer-scale socio-political events will be ignored. Rather, the background to these events in Section 2.2 and in other secondary sources will borne in mind throughout the analysis of historical vulnerability and climate-society interactions.

TABLE 5.3 Periods, key events and polities.

Years (AD)	Key events	Vulnerability index
1450-1504	Decline of Great Zimbabwe, shift in trade to the Zambezi, Mutapa-Torwa succession, civil wars	Not applicable - insufficient written records
1505-1560	Portuguese arrival and settlement at Sofala, Mutapa-Manyika-Danda civil war, early Mutapa-Portuguese contact, founding of Zambezi towns and Quelimane	Mutapa, Manyika, Sofala
1561-1624	Portuguese penetration of the Mutapa state and Manyika and Teve polities, establishment of *feiras* Maravi attacks south of the Zambezi	Mutapa, Manyika, Teve, Zambezi Tonga, Inhambane, Sofala, Sena, Quelimane
1625-1693	Mutapa, Manyika, Teve and Tonga under the Portuguese, establishment of Zambezi *prazos*	Mutapa, Manyika, Teve, Sofala, Sena, Quelimane
1694-1760	Rise of the Rozvi, expulsion of Portuguese from the interior, Mutapa shift to the Zambezi (Chidima), founding of Zumbo	Mutapa, Manyika, Teve, Sofala, Sena, Quelimane
1760-1830	Mutapa civil wars, Nguni migrations, African socio-political breakdown, decline of Sena	Mutapa, Manyika, Zambezi Tonga, Sena, Quelimane

Six of the seven periods outlined in Table 5.3 permit the construction of vulnerability indices for the polities and places shown. The first period, however, has insufficient written source material to undertake this exercise, yet as it was an important period precursor to all of the socio-political events that followed it, some consideration is desirable. Here, existing archaeological analysis will be combined with 'retrogressive' analysis from documents relating to later Zimbabwe culture society and political units, oral traditions and palaeoclimate data. Several authors have performed a similar kind of analysis in the region (Beach 1998; Murimbika 2006; Manyanga 2007) on the strict basis that later historical situations and practices provide pointers and clues to 'pre-historic' situations, rather than advocating the false assumption of a static landscape over long periods. In the rest of the periods in Table 5.3, vulnerability indices will be constructed for a number of polities and populations. The spatial extent and influence of these varied over time, but are outlined to a general extent in Figure 5.3, and include the Mutapa state, the Manyika and Teve kingdoms, the small-scale Tonga-speaking chiefdoms of the Zambezi valley, the Inhambane polity and the Afro-Portuguese towns and hinterlands of Sofala, Sena and Quelimane. By considering both African polities and populations under the influence or jurisdiction of the Portuguese, further comparative perspectives on historical vulnerability will also be gained. This chapter will now examine the changes in these factors that influenced societal vulnerability and response to climate variability.

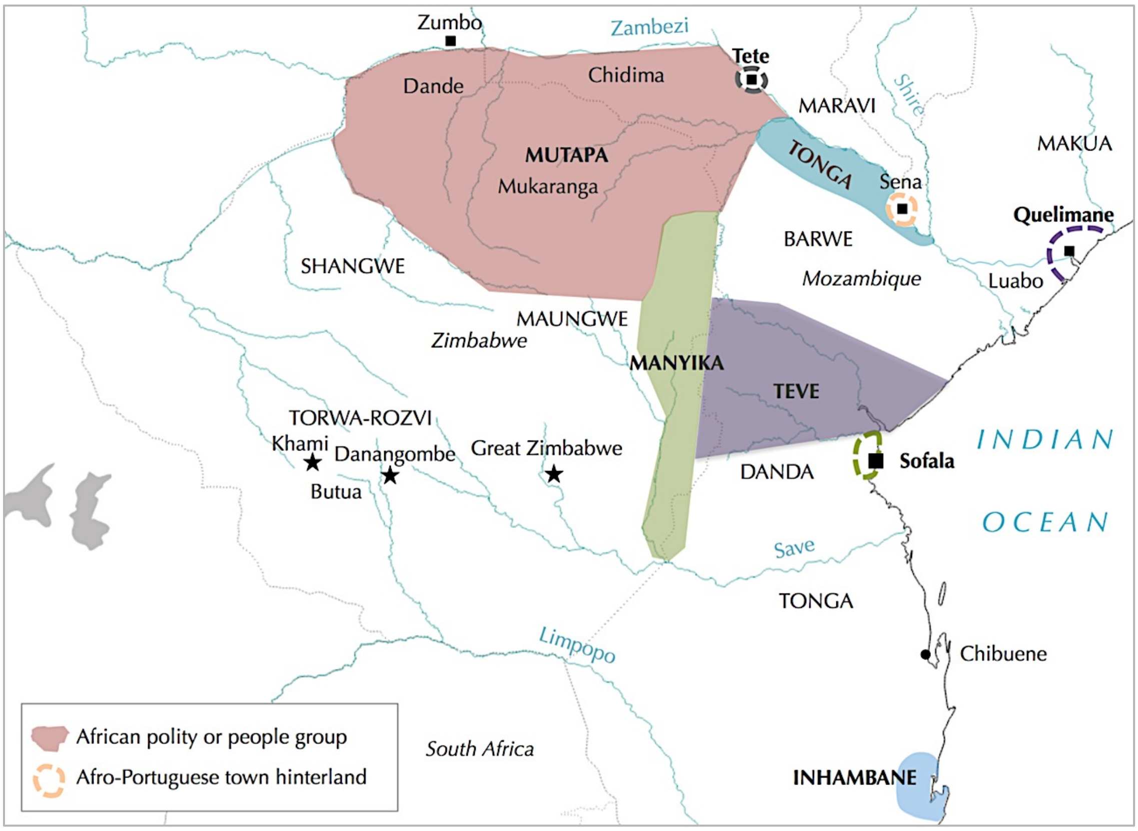

FIGURE 5.3 Approximate extent of polities and populations analysed in vulnerability indices.

5.2 Great Zimbabwe, successor states and civil wars (*c.* 1450-1504)

The first period of re-examination covers the decline of Great Zimbabwe, the rise of its successor states, and ends prior to Portuguese contact with the interior. Any attempt to analyse the first of these events is frustrated by lack of evidence, and this section will draw only tentative conclusions by critical analysis of primary written and oral sources, and expanding upon scenarios posited by archaeologists and historians.

5.2.1 Chronology: the process of state decline

The chronology of the decline of Great Zimbabwe and its surrounding state structure is critical to the interpretation of the causal factors that underlie it. Huffman and Vogel (1991) provide the most comprehensive chronology of the site through radiocarbon dating, and argue for its abandonment in the mid-fifteenth century. One unavoidable shortcoming of this dating was that early archaeological investigations (Bent 1896) significantly damaged the later top levels of the site, which has restricted dating of the terminal periods of the site (Pikirayi 2013a). In what Pikirayi terms the 'proto-historical' period, however, the very limited availability of written sources does permit some consideration of this when combined with archaeological data. Key here is a document compiled by Barros in the 1530s, probably making references to events three decades earlier (Pikirayi 2013a), which refers to continued occupation at the capital:

> "There are other mines in a district called Toroa [Torwa], which by another name is known as the kingdom of Butua, which is ruled by a prince called Burrom, a vassal of Benomotapa [Mutapa], which land adjoins the aforesaid consisting of vast plains, and these mines are the most ancient in the country, and they are all in the plain, in the midst of which there is a square fortress of masonry, built of stones of marvellous size, and there appears to be no mortar adjoining them… This edifice is almost surrounded by hills, upon which are others resembling it in the fashioning of the stone and the absence of mortar, and one of them is a tower more than twelve fathoms high.
>
> The natives of the country call these edifices Symbaoe [*zimbabwe*], which according to their language signifies court… It is guarded by a nobleman, who has charge of it after the manner of a chief alcaide, and they call this officer Symbacáyo, as we should say keeper of the Symbaoe, and there are always some of Benomotapa's wives therein, of whom Symbacáyo takes care. When, and by whom, these edifices were raised, as the people of the land are ignorant of the art of writing, there is no record, but they say they are the work of the devil… In the opinion of the Moors who saw it, it is very ancient, and was built there to keep possession of the mines, which are very old, and no gold has been extracted from them for years, because of the wars. Considering the facts of the matter, it would seem that some prince who had possession of the mines ordered it to be built as a sign thereof, which he afterwards lost in course of time, and through being so remote from his kingdom" (Barros 1552, 267).

Huffman (2007) plays down the significance of this document, stating that "By the mid-fifteenth century, Great Zimbabwe had lost its power, and most people had moved away… a few people stayed or returned for another 50 years or so, but the capital never regained its former importance" (Huffman 2007, 421). Huffman is indeed correct that the combined historical-archaeological evidence indicates that Great

Zimbabwe was not the important centre it once was, but as Pikirayi (2005, 2013a) asserts, this viewpoint fails to account for the protracted process of leaving Great Zimbabwe. This is a particularly important point as the "few people" referred to in the document appear to be Zimbabwe elites, or one of the sons or vassals of the Mutapa ruler (Pikirayi and Chirikure 2011). Furthermore, although this account was heavily derived from Muslim traders, the precise descriptions of the buildings and ancient inscriptions clearly show that the site was still known in some depth at this time. These points considered, Barros's account certainly raises the possibility of a longer occupation than the *c*. 1300-1450 timeframe professed by Huffman and Vogel. Crucially, this draws the end of Great Zimbabwe considerably further into the picture of the rising and competing Torwa and Mutapa polities, and in light of this important difference in interpretation, a number of hypotheses require further re-examination.

5.2.2 Gold, trade and successor states

One of the main explanations relating to the decline of the Zimbabwe state, the rise of its successors and the outbreak of Mutapa-Torwa conflict stems from a loss of control over the gold resources distant from the site (Figure 5.4). It is here important to remember that the generally accepted viewpoint of trade supporting the wealth and complexity of Great Zimbabwe and its elite is not the same as the heavily criticised idea of the 'trade stimulus', where external factors are viewed as sole actants in the development and transformation of state structures. Accepting this premise, it is clear that several contemporary factors were against the Zimbabwe state in its hold over gold mining and trade, and consequently the maintenance and stability of its rulers.

The first of these was the geographical location of the capital. Although ideally situated to partake in trade with the Indian Ocean coast, it is reasonable to assume that over a minimum 150-year timeframe of state growth, the highly limited quantity of gold in the hinterland of the site would have been worked out (Phimister 1976), a factor which may have contributed to the decrease in production hypothesised in Figure 5.5. This would undoubtedly have meant that the leadership had to rely upon gold resources considerably further away from the core of the state (Figure 5.4). As it is known that the Mutapa and Torwa states were expanding during the late-fifteenth century or earlier, this would have provoked competition with Great Zimbabwe, which although still occupied, would have increasingly had to go to great lengths to control its wider resource base. Khami and the Torwa state are particularly key here, as the most important gold resources lay in this area (Huffman 2007). While the origins of Khami are still relatively unknown, there exists a real possibility that the growth of this state, aided by the control of abundant local gold deposits, increased the economic and political vulnerability of the Zimbabwe state, and was of high importance in its decline.

This overlap between the three polities is similarly suggestive of competition when shifting trade routes are considered. Paucity of evidence limits examination of the suggestion that the Save River fell out of use as a trade route due to climate change

(Summers 1960), yet it is clear that sometime before the decline of the Zimbabwe state, the northern Zambezi route to Angoche superseded the central route linking the interior to Sofala (Huffman 2007) (Figure 5.4). Furthermore, archaeological data have been interpreted to suggest that Khami may have either continued or reinstated the southern route, as Khami ceramics dominate at Manyikeni, a Zimbabwe culture site near Chibuene (Huffman 2007). This may have meant that Khami bypassed Great Zimbabwe and the central route to access whatever trade remained at this part of the coast, and thus undermined the supporting role of the gold trade in political status.

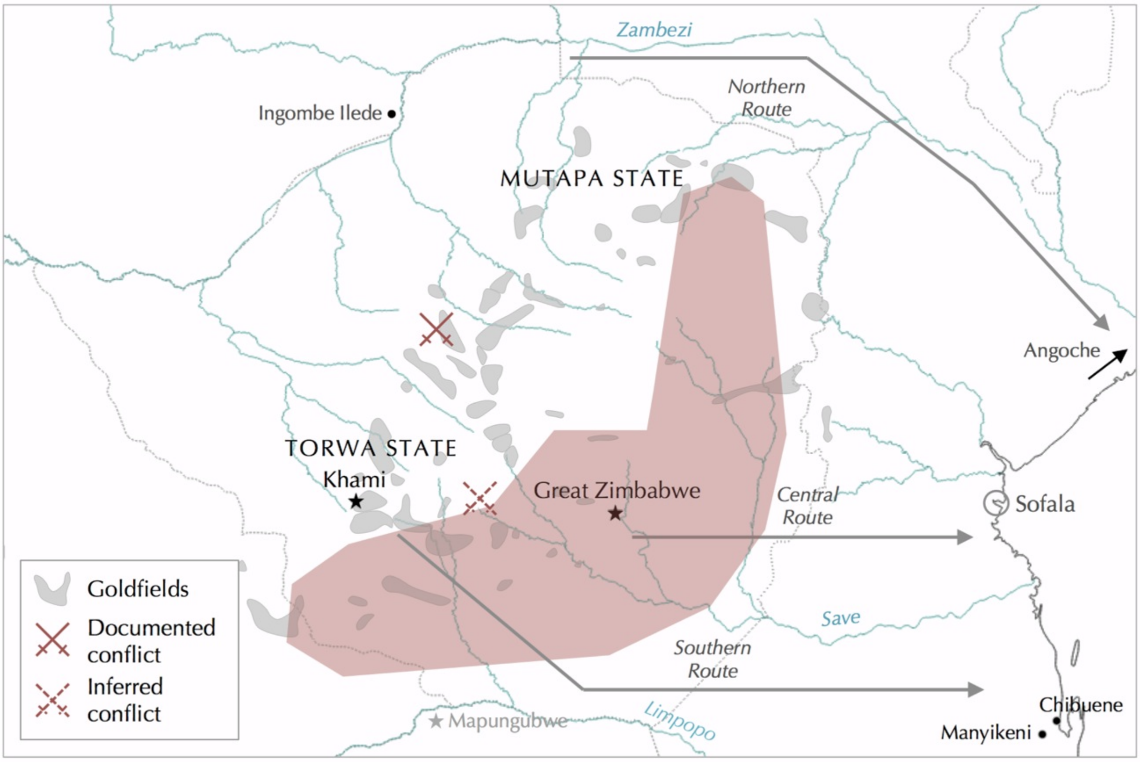

FIGURE 5.4 The maximum extent of the Zimbabwe state (after Huffman 2007), gold-producing areas, successor states, trade dynamics and conflict.

The Mutapa state, situated amongst the northern goldfields, was well-placed for access to the prime northern trade route. Economic factors are widely credited to have played some role in the growth of the state following its formation, perhaps by a Great Zimbabwe dynasty, but it is not certain whether gold was a major factor. Pikirayi (2013a) is of the opinion that gold provides a strong explanation for the northward expansion of the Zimbabwe culture, stating that "Karanga expansion northwards must have been triggered by the discovery of more lucrative goldfields… [which] may have affected Great Zimbabwe in terms of population depletion" (Pikirayi 2013a, 32). Yet a problem with this interpretation is that its evidence is based upon oral traditions which bizarrely mention salt but not gold (Abraham 1962). On the contrary, Phimister (1976) argues that gold was a comparatively minor factor in the state's economy, as early to mid sixteenth century documents attest to the increasingly unfavourable 'terms of trade' stemming from declining gold prices and the arrival of the Portuguese. While this may be true of the sixteenth century onwards, cause must precede effect, and these factors do not rule out the possibility that the growth of the Mutapa state may have been aided by its leaders exerting control over the northern goldfields. Whatever the reasons for the rise of the Mutapa and Torwa states, though, it seems clear that these polities were undercutting Great Zimbabwe's economic dominance of commercial links with the coast. Indeed, by the time of Portuguese arrival in 1505, the Mutapa state in particular was integrated into the global trade network, and the site of Great Zimbabwe was concluding its gradual process of decline.

While it is known from early Portuguese documents that late-fifteenth century civil wars in the Mutapa state were a result of a succession dispute (Alcáçova 1506; Section 2.2.3.3), it is appropriate to consider the combination of these factors in respect of the dynamics of ongoing Mutapa-Torwa conflict at this time. One possibility is that conflict erupted over disputed gold deposits between the expanding Mutapa and Torwa states and control of the northern trade route. Certainly, two new polities emerging within ±30 years of each other, and found to be at war upon the first written observations from the interior, suggests that such a scenario is possible.

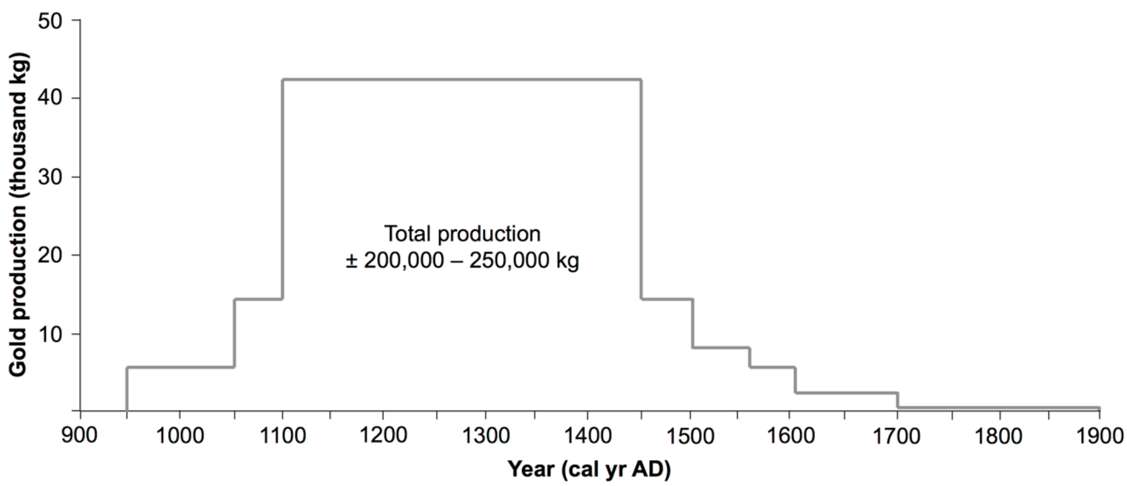

FIGURE 5.5 Revised distribution of Summers (1960) hypothetical distribution of pre-colonial gold production (after Phimister 1976).

5.2.3 Environment, climate and urban food security

Although gold mining, trade and elite control over these activities have been dealt with above, the later documents reveal that subsistence agriculture and pastoralism were the most important livelihood activities for the majority of the population. Accordingly, the other main hypothesis for the decline of Great Zimbabwe is environmental degradation in the locality of the site, coupled with problems such as overcrowding and sanitation, contributing to the emigration of people from the core of the state. Again, evidence relating to this potential pathway is almost non-existent, with one perhaps notable exception being the absence of *Brachystegia speciformis*, an important source of fuel, from the site's immediate surroundings (Pikirayi 2013b). This means that one can only hypothesise about the *response* to potential environmental problems from what is known of later Zimbabwe culture polities. If it is accepted that

150 years of fairly intensive land-use by a sizeable population at the site degraded the biophysical sustainability of local food systems, that is, cultivatable land, pastureland and hunting grounds, then the key factor to consider is the range of coping strategies and adaptation options to maintain normal functioning of the capital and state. One such option was tribute and centralised food and social security. It is known from later Zimbabwe culture polities that the system of tribute and service meant that in theory, elites could draw upon the support of the hinterland for grain supplies, and Huffman (2007) has used this evidence to insist that environmental degradation was of limited significance in the decline of Great Zimbabwe. Yet uncritical and universal acceptance of this adaptive mechanism in theory overlooks its potential problems in practice, particularly where large settlements are concerned. Re-examining later primary evidence, Barros (1552) claimed that the interior political units:

> "Have a system of service instead of tribute, which is that all the officers and servants of his court, and the captains of the soldiers, each with his men, must serve him in the cultivation of his fields or other work seven days in every thirty. And the lords to whom he gives land receive the same service for them" (Barros 1552, 271).

And on a wider scale, referring to the Teve area, Santos (1609) stated that:

> "The Kaffirs, vassals of Quiteve, also pay him tribute in the following manner: In all the villages and kraals in the kingdom of Quiteve there is a large crop of millet for the king, and all the inhabitants of the place are obliged to work upon it certain days in the year, which are fixed upon. In this way the Kaffirs each kraal weed, dig, sow, and gather this crop reserved in their village for the king, which the king orders to be collected by his agents appointed in each village for the purpose" (Santos 1609, 222).

Considering these two statements, Barros's account seems only to relate to local land in the capital hinterland, which presumably would have been most affected by intensive land use in the environmental degradation scenario at Great Zimbabwe. Santos's account, however, alludes to this practice occurring across the entire territory of the polity. Clearly, this would strengthen the resilience of the capital population as it could draw upon a vast area for its supplies. While such a scenario may have been possible in a smaller polity like Teve, it is hard to imagine that this system could have operated across the Zimbabwe state, as its sheer size would have meant serious problems in the transportation of grain. True, cattle could be utilised to carry grain, but no evidence exists to suggest that this practice took place in later centuries. The only alternative to this was for women to carry the grain, which was both slow and could move only small quantities, while this would have removed women and their labour from villages, having a knock-on effect on the agricultural cycle (Beach 1980). A later account on the tribute system gives more detail on the extent of land cultivated to support the Mutapa rulers. Conceição (1696, 207) related that:

> "All of them sow their fields and the king also has one cultivated by his Kaffirs which stretches where the eyes cannot see. He eventually collects so much food that usually he and his wives live in plenty and even in luxury"

But referring to the wider state territory, he follows on to stress that:

> "He also has the contributions sent to him by the chiefs and other important Kaffirs to whom he has given some parts his empire. They pay the tribute to him according to what the land produces but it is always very little" (Conceição 1696, 207).

Here, it is again told that the immediate hinterland was extensively utilised for tribute cultivation, however, supply problems emerged when considering the tribute from lands further away. The assertion that the tribute was always rather little could strictly refer to contemporary food shortages, or simply to changes over space and time, but perhaps relates to the aforesaid difficulties of supply networks over the wider landscape. Whatever grain was available, however, could then be re-distributed to commoners in times of scarcity (Beach 1980; Mudenge 1988). Available evidence allows for little speculation on a wider range of adaptive mechanisms, particularly in the Zimbabwe state, but it is likely that the inflow of food to the capital constituted a major buffer to the impacts of local environmental problems. In assessing this, clear differences begin to appear in the adaptive capacity of states in theory and practice.

As a further and related critique to this explanation, Huffman (2007) also notes that as Great Zimbabwe lay in a high rainfall district, agriculture would have been viable most of the time, and that if environmental degradation was a factor, the site would probably have been abandoned much earlier. Yet perhaps considering environmental problems as the chief cause of its abandonment is misleading, as this was one of several factors amongst a complex interplay of population dynamics, terms of trade, conflict and other events, of which very little is known about how these changed over the minimum 150-year occupation of the site. Indeed, the population may have reached 18,000 at its height, but this must have fluctuated. Similarly, civil wars like those in the late-fifteenth century Mutapa state were significant, but left little archaeological trace (Beach 1998), and so any conclusions are confined to speculation.

One point, however, is that a drought, or a series of droughts at a point when the population of the site reached a high level may have severely impacted upon the ability of the local area to support it (Beach 1980). From this suggestion it is possible to speculate how the limitations in adaptive capacity relating to food supply difficulties may have affected several levels of society. For instance, if rulers could not provide grain to distribute to the general population in times of climatic stress, it may have encouraged emigration and the weakening of the political structure. Both Huffman (2007) and Pikirayi (2013b) dismiss such a scenario, however, as they interpret palaeoclimate data in this period to infer wetter conditions. Re-examining precipitation signals from SRZ palaeoclimate data either ITCZ-sensitive or relatively proximate to the Zimbabwe plateau area at this time, that is the T7 grey scale, T7/T8 $\delta^{13}C$, Lake Sibaya conductivity and Limpopo Baobab tree-rings, this does not seem to be completely reflective of available data (Figure 3.5). Although it is true that conditions were trending towards wetter in three of the four records, precipitation conditions only appear to have reached a level greater than the 1036-1890 mean *after c.* 1450. Rejecting an abrupt 'collapse' scenario, then, more attention should be placed on climatic conditions leading up to the earliest abandonment date of *c.* 1450. In this period, the T7 grey scale and Lake Sibaya conductivity records clearly show an extended period of below average precipitation from at least *c*. 1420, while two clusters of consecutive drought years are observed in the Limpopo Baobab record between 1422-1426, and 1448-1450 (Figure 5.6), which are atypical of precipitation conditions over the span of Great Zimbabwe's fluorescence. Tentative though it may be, this high-resolution evidence means that a scenario involving climate can no longer be dismissed on the grounds that available datasets all show warmer and wetter conditions. Oral traditions also make note of a 30-year drought between 1450-1480 (Abraham 1962) (Table 3.5), yet the reliability of these traditions have been put into question by Beach (1994), while it is improbable that a drought event could last three decades, particularly in the relatively unambiguously wet period of the late-fifteenth century (Figure 5.6; Table 3.6).

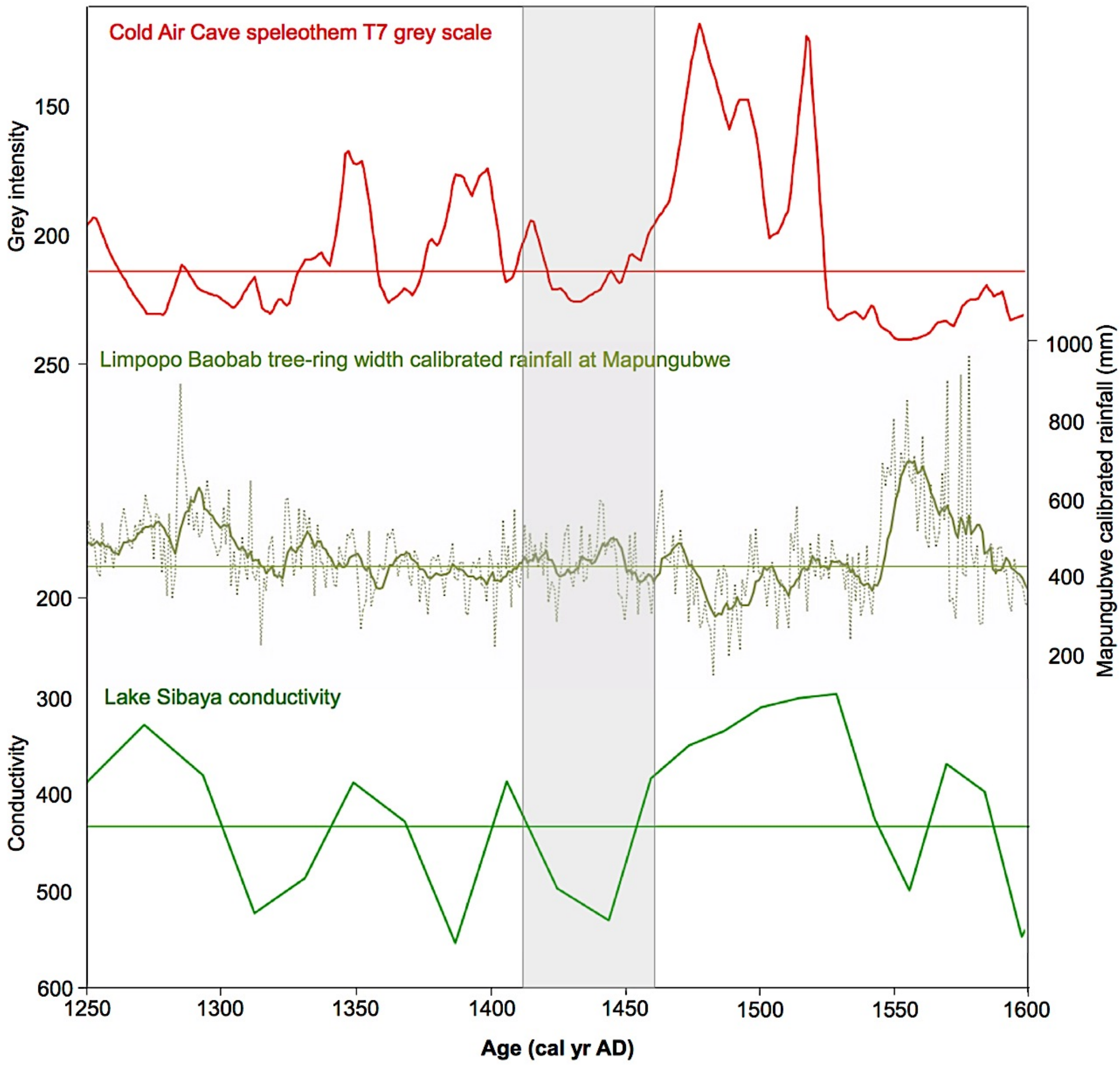

FIGURE 5.6 Precipitation inferred from the T7 grey scale record, Limpopo Baobab tree-ring record and Lake Sibaya diatom conductivity record 1250-1600.

A re-examination of primary evidence and existing hypotheses leaves open the reasons for Great Zimbabwe's decline. The major problem, as with most cases of state transformation prior to the period of the written record, is that minimal 'ground-truth' information is available to corroborate any possible inferences from data such as precipitation proxies. Therefore, while remaining a possible scenario, any firmer link between climate and the decline of the state certainly goes some way beyond available evidence. Gold exports were of importance to the prestige, maintenance and stability of the leadership, and multiple factors elsewhere on the plateau show emerging competition for the state's supremacy. Yet these factors do not account for why the state, powerful as it was, could not assert its authority over its rivals, and probably suggest that internal factors restricted its ability to do so. It is here that there is merit in imagining Great Zimbabwe as a living, urban environment (Manyanga et al. 2011), and more pertinently the view that the site itself was an 'experiment' (Beach 1994), atypical in scale and structure to any other previous or contemporaneous settlement in the region. Problems such as sanitation and resource depletion probably had some impact on the internal workings of the capital, but placing too much weight on this theory does not leave much room for human agency and adaptation options.

Perhaps, however, the reasons for the decline of the site and state rest on a combination of the factors discussed above. Considering these together, a multi-causal scenario would first involve the gradual exhaustion of local gold resources, meaning that state expansion and the control of resources further away from the site was necessary to maintain its hold over trade. The growth of polities elsewhere and the shift in trade routes presented challenges to this, while internal problems at Great Zimbabwe itself were on the rise, and restricted the ability of an effective response to growing competition. Inferred years of successive drought in the early-mid fifteenth century could have meant that the food system at the capital became more reliant upon supplies from its hinterland, which put further strain on the leadership. This reliance gradually eroded the resilience of the state and contributed to the periodic emigration of commoners, whether voluntarily or through expulsion, from the site and state core. As Beach (1998, 60) hypothesises, this final process may have been 'implosive', meaning the city became smaller and smaller until the last inhabitant "expired next to the grave of the second-last inhabitant", or 'explosive', with the eventual leaving of the main dynasty following repeated emigrations. Ultimately, however, paucity of evidence means that this remains the subject of informed guesswork.

5.3 Food systems, trade and Portuguese contact (1505-1560)

The socio-political situation when the first written sources become available had changed considerably since the decline of Great Zimbabwe. The Mutapa civil war had drawn to a close, while the three breakaway polities of Manyika, Teve and Danda were already virtually independent from the Mutapa state (Figure 5.3). The availability of written sources from 1505 enables a deeper consideration of societal vulnerability contexts, although only for the Mutapa state, the Manyika polity and the hinterland of Sofala (Figure 5.7). Nevertheless, this provides sufficient scope for a comparative assessment of vulnerability in these areas where key events took place, including the arrival and settlement of the Portuguese, and the Mutapa-Danda civil war. This section investigates knowledge of contemporary food systems, livelihood changes, conflict and the possible impacts of climate variability in this period.

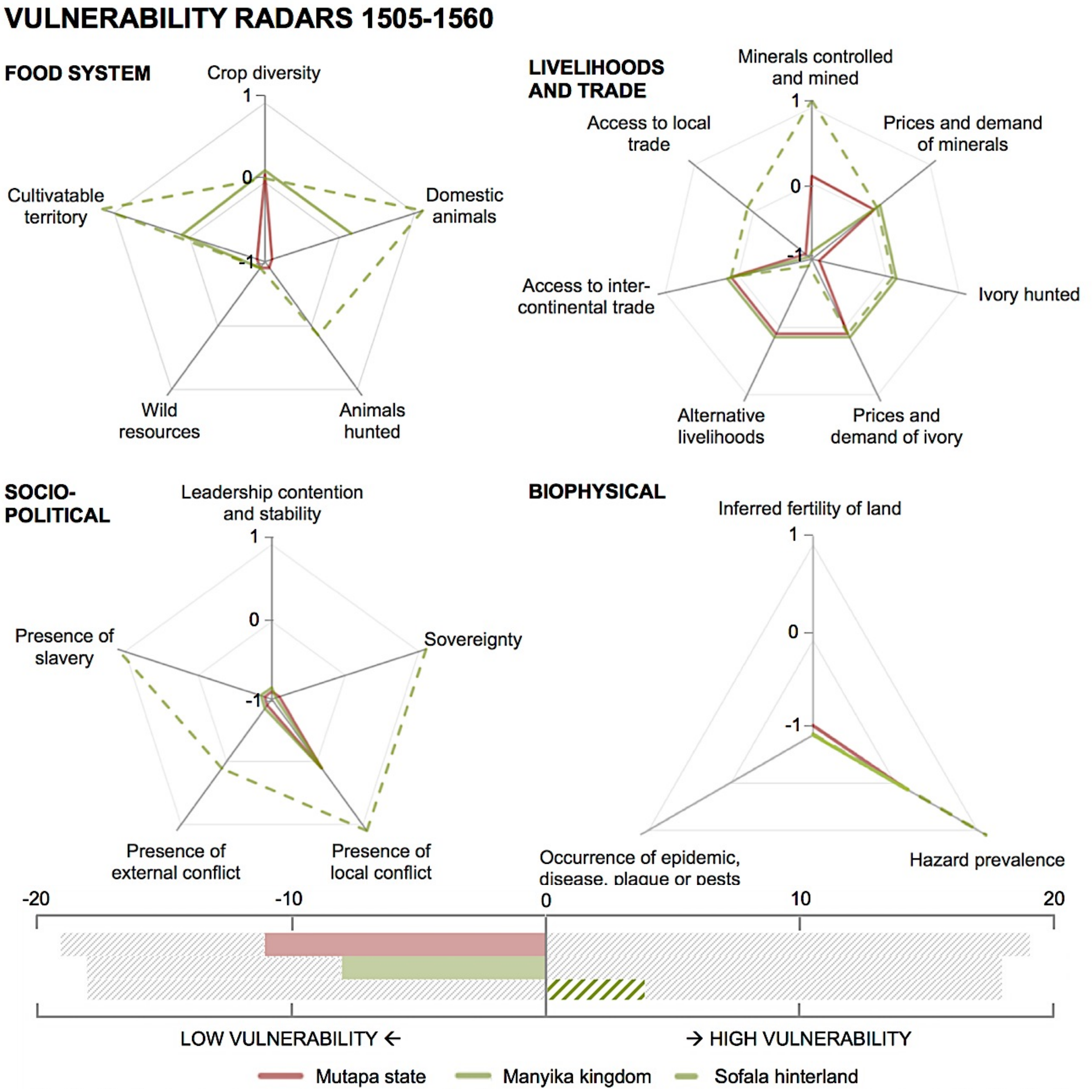

FIGURE 5.7 Vulnerability radars for the Mutapa state, Manyika polity and the Sofala hinterland 1505-1560. Incomplete polygons indicate where data are insufficient to categorise the indicator.

5.3.1 Food system vulnerability in the early- to mid-sixteenth century

Only basic information is provided on the food system of the three areas in Figure 5.7 at the beginning of this period, primarily because Portuguese interest lay firmly in the potential of the region's gold resources. Barbosa (1518), however, notes that in addition to the 'traditional' grains of sorghum and the two millets, rice was grown, though was cultivated to a greater extent around Sofala. At first glance, the translated records in *DPMCA* also suggest that maize (the English translation of *milho*) was cultivated widely around Sofala and was the prime grain that supplied the Portuguese garrison (Figueroa 1511; Fernandes 1515; Almada 1516). Nevertheless, careful reanalyses have cast doubt on whether maize was introduced to southeast Africa at this early date, as '*milho*' only came to mean maize after its widespread introduction in Portugal (Hair 1977). Thus it is generally accepted that the *milho* in the early documents was actually sorghum, which was the principal staple at this time in the Sofala area (Tavares 1965; Hair 1977; Newitt 1995). This is reflected in Figueroa's statement, which noted that Sofala yielded a lot of rice and *milho* but that there was an absence of 'corn' (Figueroa 1511). Similarly, '*meixoeira*' in the early-sixteenth century Portuguese documents was incorrectly translated to 'Kafir corn', which usually refers to sorghum. In this case, *meixoeira* represents pearl millet, as it did later in the century and remains so today.

Towards the middle of the century, more detailed accounts point to the high fertility of the region excluding the Mozambique coastal plains (Barros 1552; Fernandes 1560). In the Mutapa state, Goes wrote sometime in this period that there was an abundance of all food sources in Mukaranga, suggesting low vulnerability (Figure 5.7):

> "All this kingdom of Benomotapa [Mutapa] is most abundant in provisions, fruits, and cattle and there are such great herds of wild elephants there that not a year passes in which the number killed does not amount to four or five thousand, by which means a large quantity of ivory is sent to India" (Goes, unknown year, 129).

This richness in foodstuffs apparently supported a large population in the area, as both Barros (1552, 266) and Frois (1561, 34) reported with considerable exaggeration:

> "The other part of the country, along the river Cuama [Zambezi]… is mostly mountainous, covered with trees, watered by rivers, and pleasantly situated, and is therefore more thickly populated; and Benomotapa generally resides there. As it is so thickly populated, the elephants avoid it and seek the other part where there are the plains aforesaid, where they go about in droves almost like a herd of cows."

> "There are so many people that it is said that within the compass of eight days the king, whenever he wishes, can bring on the field three hundred thousand warriors."

Little evidence of comparable quality is available on the Manyika polity other than the cultivation of the traditional mix of grains and the ownership of cattle. One key statement, however, suggests that gold was bartered for food in times of hunger:

> "If the people were covetous a great quantity [of gold] would be obtained, but they are so lazy in seeking it, or rather covet it so little, that one of these negroes must be very hungry before he will dig for it" (Barros 1552, 267).

The precise implications of this statement are open to interpretation, but it is likely that in times of food scarcity, a coping strategy at the household level was to intensify mining of gold to exchange for cloth and beads with Muslim traders at their *bazaars*, and then to barter this merchandise for grain with a neighbouring area such as Barwe, as is later evidenced in Section 5.4. As Barros's account was derived from information collected by Vicente de Pegado in the 1530s (Beach 1987), it is possible that food shortages were felt in Manyika around this time, but low confidence is ascribed to the possibility that this statement infers contemporary drought (Table 3.5). Indeed, although precipitation conditions in this period were trending towards drier (Table 3.6), it is difficult to assess whether climatic stress was the cause of hunger due to the limited knowledge of the Manyika polity prior to the 1560s. Still, this interpretation of Barros's statement suggests that local trade and inter-polity social networks were present over a relatively wide area, and could be employed to buffer climatic stress.

Written evidence on domestic animals at this time is similarly patchy, though it is widely acknowledged that the Mutapa were owners of many cattle from the early growth of the state (Beach 1980, 1994; Ogot 1999; Pikirayi 2001). This is reinforced by one of the earliest documents dealing with the Mutapa area, which avers that 4000 hornless cows were offered to the Mutapa ruler as a bribe (Alcáçova 1506). Allowing for exaggeration in this report, and drawing on the report of Goes, it is probable that the state was rich in cattle at this time, and that this provided both an important socio-cultural 'resource' and a buffer to crop failure (Figure 5.7). Around Sofala, Figueroa (1511) wrote of sheep, and Barbosa (1518, 375) described the presence of "sea-horses" (hippopotamuses), lions, deer and many other wild beasts, as well as fish, which offered numerous hunting and gathering options. In the Mutapa area, the quotes provided on the previous page also suggest that hunting and gathering options were plentiful. In particular, the high figures attributed to elephant hunting quoted by Goes imply that this was practised to a great extent, and later accounts suggest that elephant meat was a prime constituent of hunting-based food sources (Santos 1609).

With the exception of rice cultivation, which appears to have been relatively small-scale, this sketch of the Mutapa and Manyika food systems is fairly consistent with the basic outline provided in Section 2.2.2.1, and more than likely that of the Zimbabwe state. Thus, while the limited evidence of food system stress in the Mutapa area is perhaps due to the limited Portuguese coverage prior to the 1560s, it is possible to speculate that the Mutapa food system was relatively resilient at this stage, as suggested by the continued use of a small but drought-resistant mix of crops, ownership of high numbers of cattle, and the exploitation of wild food resources. The key shift in food system vulnerability in southeast Africa at this time occurred at Sofala with the growing presence of Portuguese, both those garrisoned at the fort and from the crews of increasing merchant traffic, with ships harboured there for weeks or even months at a time. This meant that grain rations had to be provided for both the quasi-permanent garrison, the slave population and the more temporary inhabitants from ships' crews, and these rations are accordingly well-documented for the first decade of Portuguese occupation. The extent of this new demand for foodstuffs was reflected in evidence that Sofala purchased 287,000 litres of sorghum during 1513-14 (Newitt 1995; Ekblom 2004), some of which was bought locally, but much was also imported from further up the coast or inland (Barbosa 1518). If this new demand for food provided opportunities for local populations to trade surpluses, it also put strain on local food systems to supply Sofala's fluctuating but increased population, and shortages of sorghum were recorded in 1505, 1506, 1511, 1515 and 1516. The latter of these shortages has been speculatively linked to drought, the impacts of which have in turn been linked with the outbreak of the Mutapa-Danda civil war in 1516 (Bhila 1982). It is therefore important to scrutinise this link and investigate the impact of climate variability on the changing nature of food systems in the Sofala area.

5.3.1.1 Drought, food scarcity and conflict in Mozambique

References to food shortages at Sofala begin soon after Portuguese settlement. In 1506, Quaresma wrote that the fort was "laid waste", leaving "Pero d'Anhaia [the governor] and seventy-six men without supplies" (Quaresma 1506, 55). Shortages of sorghum were then reported in September 1511 by Perestrello, who noted the use of 'Kafir corn' (in this case pearl millet) and rice as supplements. In 1515, Antonio Fernandes provided further information on the nature of food scarcity, and revealed that sorghum was "brought inland and far away", though that the sale was controlled by African chiefs, "there being little of it in the land and not wanting to sell it" (Fernandes 1515, 187). This difficulty in obtaining grain was corroborated the following year by Almada (1516), who reported that the price of a bag of *milho* doubled from one to two *meticals*.

The possible causes behind these food shortages are numerous. Population-consumption dynamics offer a direct association with shortages of provisions, and were explicitly linked by Almada (1516, 275) who described how food scarcity was often a result of ships docked at Sofala for extended periods of time "wasting the supplies the fortress have for their maintenance, especially at a time when the *alqueire* is worth two *miticals*". This situation probably also applied to the early years of settlement at Sofala, when the organisation of local food supply may not yet have been capable of providing sufficient foodstuffs for a sudden increase in demand associated with the frequent or extended visits of Portuguese ships. Nevertheless, that higher sorghum prices were present in 1516 and that there was a reluctance of chiefs to sell it, regardless of fluctuating demand at Sofala, indicates that stressors on the production side were also significant, one of which may have been climate. Notwithstanding the difficulties of close comparison between the seasonally dated food shortages with the proxy records in Figure 3.11, this may be corroborated as each of these palaeoclimate records suggest a short-term decline in precipitation after several very wet years at the beginning of the sixteenth century, which is reflective of a more general period of high variability in precipitation (Figure 3.9). The potential impact of environmental stress was reinforced by the exposure of Sofala to hazards (Figure 5.7). In particular, Almada (1516) described what appears to represent the impacts of a high magnitude tropical cyclone, which may have been equally responsible for the increase in grain prices:

> "The last day of February, 1516, a Friday, the morning dawned with a storm so strong from the south that it seemed to me that it would carry away the castle, and it lasted some four or five hours during which it threw down forthwith the wooden hut of the fortress… And it belaboured the palm groves so that a Moor who had five hundred palm trees was left with no more than thirty and twenty and the same happened to the other houses which were nearly all razed by the palm trees; in this way they suffered great loss, whilst we lost what we got from the palm groves, the oil and the coconuts and the vinegar, so that we now have a shortage of everything… in the factory there was not a tile left on the roof, and there were heavy rains that damaged all the merchandise… And we have here some eighty or ninety cows, some Your Highness's and some mine, and the wind brought such confusion among them that thirty-nine of them were flung into the river and drowned" (Almada 1516, 279).

What is most clear from the evidence of food scarcity is that the arrival of the Portuguese imposed new vulnerabilities on the local population, which were mirrored by the dependence of the Portuguese garrison on imports and its resultant high exposure to shocks. It is therefore possible to view the role of climate and population interactively, so that when dry years or extreme events coalesced with a swelling of the population, it exposed Sofala's fragile food security and created shortages.

Frequent food scarcity combined with other factors to undermine the viability of Sofala as the chief Portuguese settlement in southeast Africa. One of these was meddling in African politics, which was a new vulnerability that would reach chronic proportions the coming centuries. The decision by some Portuguese to supply chief Nyamunda of the Danda polity with gunpowder in about 1516 had profound consequences for the settlement, imposing a blockade on trade, and to an extent, food imports, as the local population could only draw upon a small cultivatable territory and wild resources such as fish in the immediate hinterland of the fort (Figure 5.7). Bhila (1982) suggests that drought-induced food shortages across the wider area of east-central Mozambique could have enforced Nyamunda to extract more tribute out of the Portuguese, yet there is no evidence of a clear link between climatic and food system stress on a wider scale and civil war between the Danda polity and the Mutapa state, which rather appears to have been the result of a dispute over the control of new trade opportunities (Mudenge 1988; Newitt 1995). The disruption to the trade caused by this, as well as the success of Muslim traders at Angoche and in the interior at outmanoeuvring Portuguese economic activity, compounded earlier problems at Sofala. Moreover, while dry conditions appear to have ameliorated after 1515, Almada (1518, 593) reported that in September of that year, the *milho*, chick-peas and pearl millet "was like mud" as it had rotted in the storage bins, and had to be thrown out to sea, possibly inferring very wet conditions, and certainly loss of food. This coalescence of environmental and economic vulnerabilities degraded the viability of Sofala as a commercial centre, contributing to the Portuguese shift in policy towards the Zambezi.

The limited evidence that exists on the nature of the aforementioned conflict between these distant polities may well suggest that it was relatively limited, and after 1528, a period of relative peace began. The reduction of Nyamunda's power gave way to the growth of the Teve polity, and by 1531, the Portuguese had settled at Quelimane, the main entry point to the Zambezi, and Sena and Tete along the river itself (Figure 5.3). This marked the beginning of over 400 years of continuous Portuguese occupation of the triangle of territory between Sena, Sofala and the Zambezi delta, and cemented the decline in the strategic importance of Sofala (Newitt 1995). However, few first-hand accounts are available from these areas until the 1560s, and thus unlike Sofala it is only possible to speculate on the impact of the Portuguese on local food systems and security. The Mutapa state experienced a period of political stability at this time, with Neshangwe Munembire on the throne for two decades (Figure 5.7), and although there remained a protracted conflict between the Mutapa and Teve polities, Mudenge (1988) points out that the disruption and mortality from this distant conflict, which lasted until around 1542, was highly limited. Further conflict was noted near Sofala in 1573, while a revolt of Tonga-speaking communities in the Zambezi valley began against the Mutapa state in about 1550 (Beach 1994), yet relative to other periods, the early- to mid-sixteenth century was a time of comparative peace, interrupted only by relatively sporadic and small-scale conflict (Figure 5.7).

5.3.2 Livelihoods and trade

Unlike food systems in the centralised African polities, changes in livelihood strategies do appear to have taken place in the early part of the century. In particular, gold production further declined at this time (Alcáçova 1506; Phimister 1976). This appears to have been influenced by wider economic changes, such as the declining profit margins in the international trade in precious metals (Phimister 1976), which reduced the exchange potential of mining-based livelihoods. Indeed, the fact that markets or fairs existed in the interior perhaps reflected a situation where it was no longer worth the while of African traders to bring their small quantities of gold to the coast. These unfavourable 'terms of trade' may well account for the strict policy over the mining of gold deposits in the Mutapa area, where Alcáçova (1506, 63-64) reported that "no man can take it [gold] without leave from the king, under penalty of death". Phimister (1976) made the plausible suggestion that such a policy may have been implemented in the hope that a deliberate restriction of gold mining output would increase the price and profit margins of the trade. This therefore implies that while gold could no longer provide the export power it once had, the inflow of material wealth into centralised polities still held disproportionate importance in the maintenance of state leadership. The decline in the profitability of gold was further impacted by the arrival of the Portuguese, who paid little attention to the market, and sought to extract high profits from European cloth which was not in demand (Newitt 1995). Moreover, conflict at Angoche in 1512 and the civil wars between the Mutapa and Danda polities further disrupted the trade (Figure 5.7). For the wider population of the Mutapa state, these instabilities, combined with internal policy, must have led to a decline in the degree of concentration on trade-based livelihoods, and accordingly a loss of a coping strategy in times of climatic stress. Thus, agricultural and pastoral pursuits continued to represent the most crucial livelihoods for the majority of people, perhaps with less distraction than was the case previously.

Although gold exports declined in the Mutapa state, evidence suggests that the 1530s and 1540s was a time of prosperity for trade-based livelihoods elsewhere. This mostly stemmed from strength of the ivory trade, which appears to have been restored by the captains of Mozambique and Sofala to form the principal trade in southeast Africa at the time. The increasing importance of ivory is evidenced in export figures from the factories, where in 1545, 26,000 kg of ivory was exported from Sofala, up from a figure of 8,820 kg in 1519 (Newitt 1995). Much of the ivory that reached Sofala was obtained from the Teve polity, where later evidence suggests that tusks were initially a by-product of extensive hunting rather than a separate livelihood (Santos 1609). This extensive trade with Sofala at this time must have increased the material wealth of the Teve leadership, which may well have increased its capability to both advance its level of socio-political organisation and support a defence force to assert its independence in the face of external threats. Towards the late-1540s, however, the ivory trade began to decline markedly, which was in part due to the self-interest of some Portuguese traders exchanging cloth at cheap prices to increase their personal wealth (Velho 1547). In the early-1550s, Botelho (1552, 274) lamented that "already no ivory comes from Sofala or Mozambique, when there was wont to come one hundred and twenty to one hundred and fifty *bahars*. This year there came only twenty *bahars*". Still, given later suggestions that elephant hunting was of greater relative importance to the food system than the trade (Santos 1609), the instability of the ivory trade may not have been of been of high significance to the Teve polity. This temporary boom in the ivory trade also acted to conceal the activities of *sertanejos* (backwoodsmen) on the Zambezi, who from about the late-1530s operated a trade from Sena to the gold mining areas of Manyika (Bhila 1982; Beach 1994), where later evidence also implies that the degree of concentration on mining-based livelihoods increased at this time (Carneiro 1573, see Section 5.4.1.1). The restrictions of death imposed by the Mutapa ruler on the free extraction of gold are said to have remained in place until the late-sixteenth century, and it was thus the Manyika kingdom that formed the focus of the gold trade at this time (Figure 5.7).

Available evidence throughout this period, though particularly biased towards trade and Portuguese activity, would suggest that the fundamental changes evidenced in these factors were of importance across southeast Africa. In addition to food system and biophysical vulnerability, socio-political changes emerging from the arrival of the Portuguese meant that the populations in the Sofala area were moderately vulnerable to climate variability (Figure 5.7). A small cultivatable territory around Sofala was offset by the generally high availability of wild resources, such as fish and fruits, yet the increased demand for foodstuffs resulting from the new Portuguese presence, and perhaps climatic stress, meant that local populations became reluctant to sell grain in times of stress. These increased pressures on food production by the new overlords of the Portuguese are reflected in the reduction in sovereignty and presence of 'slavery' in Figure 5.7. For the Portuguese at the fort of Sofala itself, recurrent food shortages were reflective of an insecure, import-based food system, and they were thus vulnerable to shocks such as drought and temporary population increase from growing Indian Ocean merchant traffic. While food systems in the Mutapa and Manyika areas were less vulnerable (Figure 5.7), livelihood changes enforced by the increasingly unfavourable terms of trade in gold, and reinforced by the disruption to trade at both Sofala and Angoche, meant that export-based livelihoods became unstable, reflected in the strict policy on the mining of gold (Alcáçova 1506). The weight of importance of these activities lay with the elites and their maintenance of power, although freer access to gold provided a coping strategy to the wider population in Manyika in times of stress. The internal conflict in the civil war and changing political relations between the Mutapa and its 'vassal' polities, particularly Danda, may have been a result of such economic changes, and added to political instability. Still, much of the region was only marked by limited and/or sporadic conflict, while further livelihood opportunities opened up in the ivory trade with Sofala. This means that overall vulnerability in the autonomous African communities was low (Figure 5.7). Key factors emerging from this initial comparative assessment of vulnerability therefore include:

- The maintenance of the 'traditional' crop mix with the addition of rice, and the possession and utilisation of other sources of food, equalling low to moderate food system vulnerability in the centralised African polities
- Increased demand for food in the wider Sofala area to supply a fluctuating population, which heightened exposure to climatic stress
    - The possible impact of environmental stress, including drought and a tropical cyclone, on this increased vulnerability context
- Decline in the importance of gold mining as an individual livelihood option in the Mutapa area and implementation of strict policy regarding mining, though gold mining formed a coping strategy to hunger in the Manyika area
- The first evidence of Portuguese meddling in African political affairs and its compounding impact on conflict, but the general stable nature of the period, with an increase in ivory-based livelihood and trade opportunities
- Overall limited reference to, and perhaps impacts of, climate variability in the interior due to the lack of detailed accounts and low vulnerability.

5.4 Climatic stress and the weakening of political structure (1561-1624)

In 1560, Father Dom Gonçalo da Silveira led a Jesuit mission to the Mutapa *zimbabwe* to convert the ruler, Negomo. As outlined in Section 2.2.3.5, suspicion of Silveira's intentions soon grew, and a plot was hatched by traditional Shona leaders and Muslim traders to kill him (Mudenge 1988; Beach 1994; Newitt 1995). Silveira's murder marked the beginning of a period of socio-political instability in Mukaranga and the Zambezi valley, as indicated by the considerable heightening of socio-political vulnerability over this wider period (Figure 5.8), which saw the transformation of independent African polities into essentially Portuguese subordinates. These decades were also a time of vastly increased written recording of climatic stress in the area (Table 3.5), commencing with an outbreak of plague locusts in 1561. The next sections investigate the impacts and relative importance of climate variability in this period.

5.4.1 Responses to climatic stress in the 1560s-1570s

5.4.1.1 Drought, locusts, and famine

The most detailed account of climatic conditions in the aftermath of Silveira's murder was written by Francisco de Sousa over a hundred years after the event, in what he described as a "story told by the people of Mocaranga as was handed down to them by their ancestors":

> "Heaven was not long in punishing the spillage of the blood of the good Abel. Immediately after it happened [the killing of Silveira], an innumerable and almost endless swarm of locusts came down that stopped the light of the sun at mid-day and ravaged the fields destroying the crops, the fruit, and the leaves of the trees, devouring with insatiable hunger all that the land produced to feed the miserable people. A terrible plague followed with terrible results never before seen in the Cafraria. The famine and the loss of life lasted for two years and the Emperor realised that God was punishing him for the killing of the saint" (Sousa 1697, 260-261).

This account, primarily concerned with the death of a missionary, appears to be riddled with biblical myths. Yet as others have suggested, it is plausible that a drought occurred at the time Silveira was attempting to convert people to Christianity, causing traditionalists to use him as a scapegoat (Pikirayi 2003), and that sometime after his murder, drought-breaking rains arrived and led to a plague of locusts. This scenario may well be corroborated by contemporaneous or slightly earlier drought at Inhambane, where Silveira had baptised the ruler in 1560. This is reported by Fernandes (1562) in a description of his residence at Inhambane, which also infers high food system vulnerability and the limited adaptive capacity of local communities:

> "Some years none of the crops grew, on account of drought, and then they live upon meat which they procure by hunting, especially elephants, and upon wild fruits, which some years are very plentiful and sometimes very bad. Otherwise their provisions are only beans and millet… Where there is rain millet is abundant, but where there is less rain it is very scarce... They are great eaters of meat and other things, but especially meat, ten of them can eat a whole cow.
>
> But to come to the point, I almost died of hunger, for though other hardships were felt, hunger was the worst, especially for six months or more, during which I wanted for everything… if I felt very weak at night I ate a few mouthfuls not of bread or meat but a sort of caterpillar or of vegetables of this country, the worst thing possible to my taste, and though I wished it I could not have had more than a little, having only a small cake of it every day. Sometimes they brought me gourds and other fruits of the thicket, for the season yielded nothing else, and the king, who might have lent me something, refused to do so; but I consoled myself, having confidence that though the king of the earth failed me, the king of glory would sustain me" (Fernandes 1562, 151).

In the Mutapa area, oral traditions (Abraham 1962) state that the pestilence and ensuing famine killed thousands, but this suggested mortality is unverifiable. Oral traditions also note that Negomo moved his *zimbabwe* to a stone fort near the eastern bank of the Musengezi river to escape the "pollution brought by the murder of Father Silveira and the subsequent famine and pestilence" (Abraham 1962, 65). By 1563, however, Sousa claimed conditions were very wet and accompanied by floods:

> "It seems that God was appeased with this repentance of the Monomotapa… and after two years the sky opened up with such a deluge of water that the rivers flooded the fields for many leagues, fertilised the land, the famines ended as well as the plague. It was at the time of this flood that the body of Father Gonçalo da Silveira came up from the bottom of the lagoon" (Sousa 1697, 260-261).

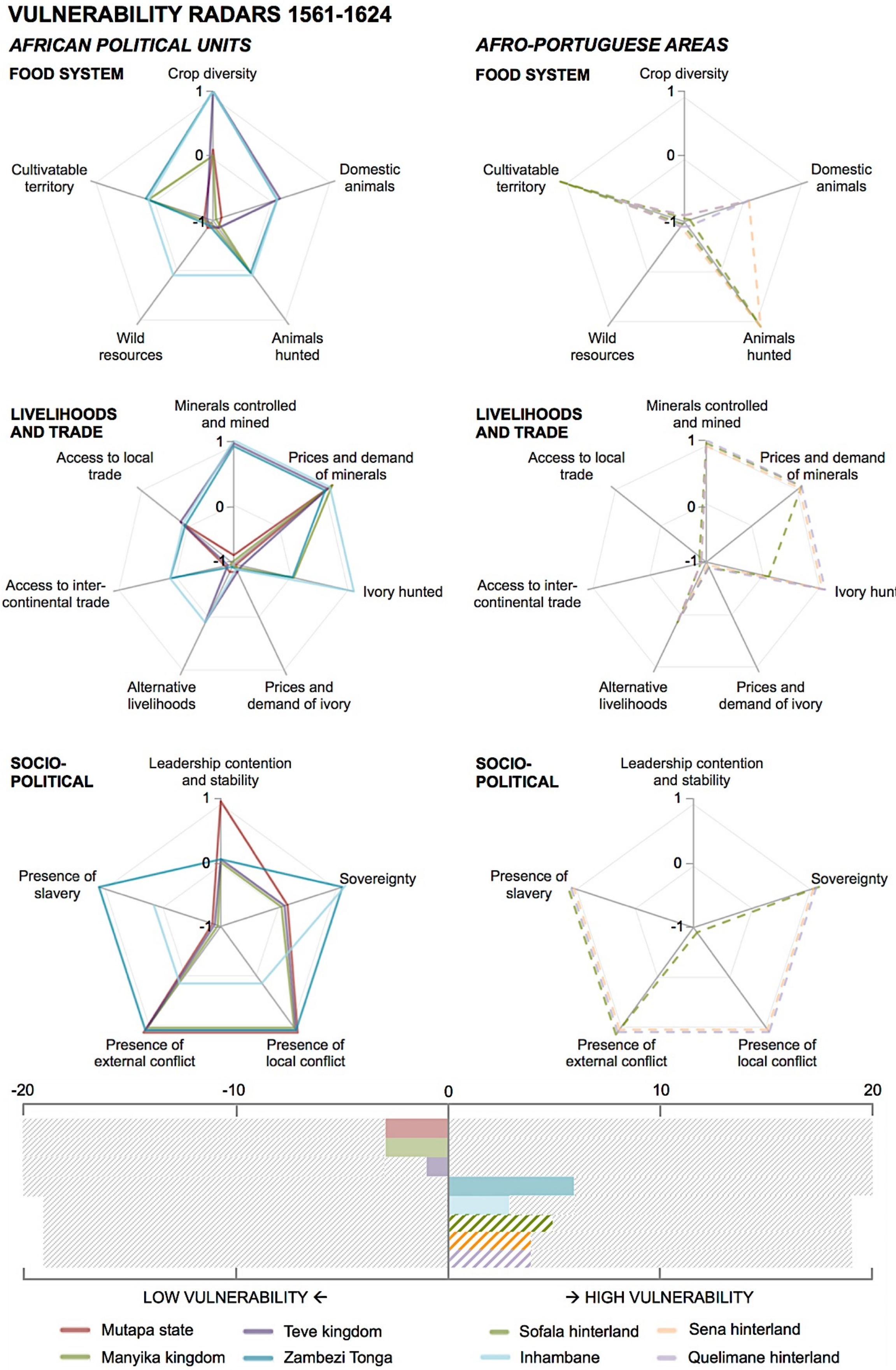

FIGURE 5.8 Vulnerability radars for the Mutapa state, Manyika and Teve polities, Zambezi Tonga, Inhambane, and the Sofala, Sena and Quelimane hinterlands 1561-1624. Biophysical indices are given in Appendix B.

Although the reasoning for these extreme weather events is clearly infused with myth, their occurrence may reflect the high precipitation variability shown by almost all proxy records at this time (Figure 3.9). Indeed, references to climatic stress were frequent hereafter in a period of high variability to the end of the century (Figure 5.9). Significantly, Fernandes also wrote of direct attempts by the Portuguese to interfere in African politics and denigrate traditional beliefs relating to rainmaking. In 1560, when the ruler of Inhambane became the first in southern Africa to be baptised, the Jesuits:

> "Made him own that he did not give the rain that causes the crops to prosper… almost the only cause of such respect as they had for him was that they thought he had power to give them water and could deprive them of it at his will, and when he wishes to threaten them he says he will give them no water" (Fernandes 1562, 148).

This reference almost certainly relates to rainmaking practices at Inhambane, where it is implied that the ruler was believed to have the power to bring rain, as Huffman posits in his model of Zimbabwe Pattern rainmaking (Huffman 2008). The murder of Silveira, however, probably helped prevent this from becoming a reality in the Mutapa state, as Santos later wrote of the continued political and cultural importance of rainmaking in the Shona-speaking polities:

> "When they suffer necessity or scarcity they have recourse to the king, firmly believing that he can give them all that they desire or have need of, and can obtain anything from his dead predecessors, with whom they believe that he holds converse. For this reason they ask the king to give them rain when it is required, and other favourable weather for their harvest, and in coming to ask for any of these things they bring him valuable presents… They are such barbarians that though they see how often the king does not give them what they ask for, they are not undeceived, but still make him greater offerings, and many days are spent in these comings and goings, until the weather turns to rain, and the Kaffirs are satisfied, believing that the king did not grant their request until he had been well bribed, as he himself affirms, in order to maintain them in their error" (Santos 1609, 199).

The murder of Silveira contributed to the formulation of the expansionist policies pursued by the Portuguese over the next two decades (Newitt 1973). This resulted in the formation of an expeditionary force tasked with the subordination of the Tonga communities in the Zambezi valley, the expulsion of Muslims from the area, and ultimately, the subordination of the Mutapa state. Prior to this, though, food shortages became increasingly commonplace towards the late-1560s and early-1570s. At this time, the Mutapa state and the Tonga-speaking communities in the Zambezi valley were still in a state of conflict, which led Monclaro to describe the lack of food in the Zambezi valley in the late 1560s:

> "Their [Mutapa] sieges of any place are of short duration, three days at the most, it is said, because the land is so lacking in food that, even if they resort to the filthiest food, no body of people, however small, may be provided in any part thereof for longer than these three days" (Monclaro 1573, 205).

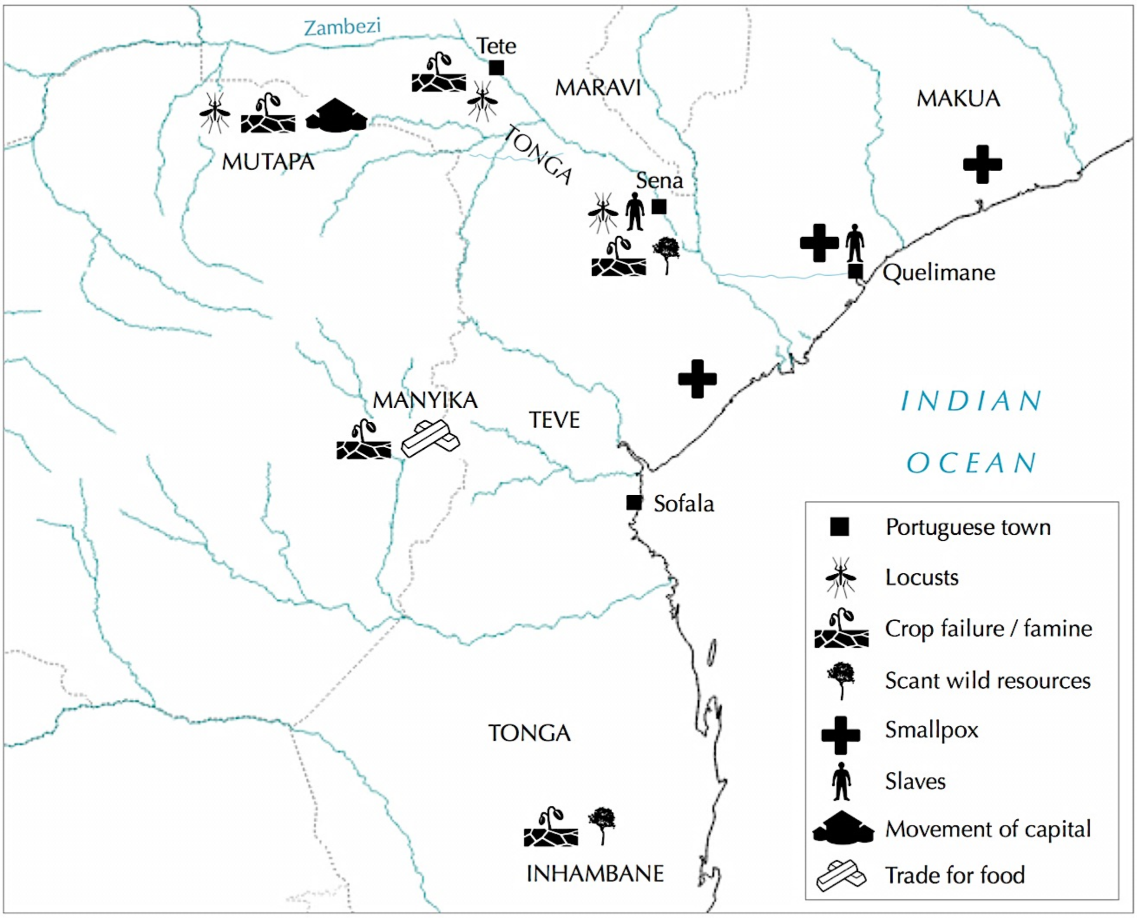

FIGURE 5.9 References to climatic stress, disease and its impacts in the 1560s-1590s.

Nevertheless, in an account clearly influenced by early-colonial ideology, Monclaro bemoans other hindrances, such as a lack of long-term planning, to food production on the southern banks of the Zambezi. Still, the latter part of this statement also appears to reflect drought-induced food shortages in the area, reaffirmed by the statement that the journey from Sena to the Mutapa state consisted of "more than 200 leagues of very dry and deserted land, devoid of provisions" (Monclaro 1573, 246).

> "Their trade with our people along this river [Zambezi] consists of some little ivory, the rest being food… the river itself having fisheries with nets for the purpose. The land is mostly barren, though such barrenness is also due to their being lazy… they sow but little, and if it so happens that one of them is more diligent and active, thus gathering more produce, they straightway resort to falsity to take and eat what he has; saying why should he have more millet than the others, without ascribing this to greater industry; and oft-times for such blame they kill him and eat what is his, and the same goes for cattle, this being the cause of the barrenness. They take no thought for the morrow… and quickly exhaust the produce.
>
> In my opinion the yield would be better if they hoed deeper into the soil, the reason I found [preventing this] was that the earth is very dry down below, wherefore if the seed is sown deep it withers and dies, the one sown nearer the surface being more easily penetrated by the dew, which is thick. The moisture reaches the grain which is closer and profits by it, inasmuch as the rain lasts but little there and the dry weather is of very long duration. This will show the manner of the land and climate, and how dry it is as we ourselves experienced" (Monclaro 1573, 231).

Although these references may have been strongly influenced by the first impressions of the area by the Portuguese, when compared to numerous earlier and later accounts that describe the high fertility and abundant provisions of the lands proximate to the Zambezi river, it appears that these references do allude to dry conditions in this time period. The dry spell again appears to have been followed by locusts, which Monclaro described as having considerable impacts on food production:

> "Of those of our people who died, not all died of poison, but also of illness and poor food, it being scanty because the land only yields millet, and but little, and *meixoeira* [pearl millet], and some few vegetables. There is another food which they call *nachenim* [finger millet], which looks like mustard, and therewith they make their wine… Millet is scanty because of the locusts, the Moors, Kaffirs and Portuguese who have long stayed here commonly holding that locusts only appeared in this land after Father Dom Gonçalo's death, which I have heard all of them say and openly confess" (Monclaro 1573, 224-225).

Similarly, an anonymous account written in 1573 notes that "the climate [of Mukaranga and the Zambezi valley] is unwholesome, and the air is pestilential" (Anonymous, 1573, 220), from which it can be inferred that the locust plagues had not yet dissipated. Apart from learning of food shortages and an increased reliance on wild foods, it is clear millet and rice were the dominant staple crops for subsistence in the Zambezi valley, indicating the limited diversity of grains (Figure 5.8).

If climatic stress was experienced across northern Zimbabwe in the 1560s and early-1570s, the differential vulnerability of the Mutapa state and the decentralised chiefdoms of the Zambezi valley conditioned its impacts. The Mutapa food system remained characterised by low vulnerability in this period (Figure 5.8), while the stability of leadership and functioning of state structures meant that mechanisms of grain redistribution operated from the centre of the state. On the other hand, the food systems in the Zambezi valley were more vulnerable (Figure 5.8), with a smaller diversity of crops and domestic animals, less centralised social networks, as well as an increasing proportion of produced food being traded with the Portuguese in some communities. Moreover, the relative impacts of ongoing conflict between the Mutapa state and the Zambezi valley chiefdoms, limited though they were, were greater on the small-scale chiefdoms, as at this time the Mutapa state was still at the height of its military power. Barreto's expedition from 1571-72 intensified the impacts of food system stress and conflict in the Zambezi valley. In addition to attacking Muslim traders residing in the area, Barreto's army attacked the Tonga chiefdoms whose revolt against the Mutapa were a disruptive influence to Portuguese activities (Beach 1980). The Tonga filled wells and hid their already depleted food supplies from the invading force, and scant provisions of small meat rations were all that was available to feed Barreto's army. On the one hand, this weakness of Barreto's force led to high casualties, and prevented it from the conquest of the Mutapa state, which was its main objective. Yet on the other, the Portuguese force limited their gains to incorporating the Tonga-speaking communities into their jurisdiction at Sena and Tete, bringing new lands, agricultural resources, and crucially, people, under its control, all of which could be used to increase the military capacity of the Portuguese.

Barreto was succeeded as leader of the expedition by Fernando Vasco Homem in 1573, who then led a force of 412 men to the Manyika kingdom. Homem's force went by way of the Teve area, where conflict broke out with the Teve army over right of passage. The ruling Quiteve apparently hid the food in the area to induce hunger on Homem's force, though was defeated soon after and abandoned his *zimbabwe*. Monclaro (1573, 228) thereafter noted that there was a "great lack of food" in Manyika, and this was re-affirmed by the traders interviewed by Carneiro, who had resided in the Manyika kingdom:

> "The witness also said that the land of Manica [Manyika] has little sustenance, not being enough for the people of the land even in a plentiful year. And the witness further stated that the land of Manica is dry and infertile" (Carneiro 1573, 229).

Beach (1987) claims that this 'sulky' account describing dry conditions in the relatively well-watered area of Manyika was coloured and exaggerated by the personal biases of the Portuguese, possibly to avoid increased competition in trade in the event of a successful conquest. Yet given the multitude of records describing the severity of contemporary dry conditions elsewhere (Table 3.5), this account perhaps reaffirms other evidence presented that climatic stress was experienced across a wide area in the late-1560s and early-1570s. According to Carneiro's evidence, one factor that may have made the Manyika population more vulnerable to climatic stress was the increased degree of concentration on mining-based livelihoods and trade:

> "The witness also said that most of the year they eat supplies from outside which they fetch and cause to be bought... having, however, to travel but little to do so and being much more given to trading than to farming" (Carneiro 1573, 229).

This increase in the livelihood focus on trading, most likely in gold, suggests that increased penetration of the interior by private traders and *sertanejos* affected food production strategies, and indicates a difference to the previous period when mining was undertaken in times of food scarcity. Despite Couto (1616, 389) later describing mining as a "poor and miserable business" for the population, Santos wrote that "such is their desire and covetousness for cloth, that they brave every danger in order to extract it from the bowels of the earth" (Santos 1609, 218). Nevertheless, it is doubtful that the focus on mineral export-based trade was a complete distraction to agricultural and pastoral livelihoods (Bhila 1982), and it is more likely that the high magnitude of climate variability at this time was as important in inducing food scarcity in Manyika. Mining-based livelihoods retained importance in Manyika after Homem signed a friendship treaty which gave the Portuguese free access to the mines and to barter for gold. This marked the beginning of the Portuguese *feira* system, which formed a dominant part of trade relations in both the Mukaranga and Manyika areas from this point onwards. On his way back through the Teve area, Homem established peaceful relations, and in 1575, his force withdrew, leading to a brief period of peace.

5.4.1.2 Portuguese penetration and the changing nature of food systems

By the early-1580s, the evidence of Azevedo and Santos suggests that the Mutapa and Manyika areas had recovered from the impacts of several years of climatic and food system stress, with no mention of locusts, and ample food supplies of millet and rice reported. It is tempting to link this recovery with the apparent partial recovery in precipitation in some palaeoclimate records in the early-1580s (Figure 3.5), though this may also have been aided by the interlude in conflict in the decade between 1575 and 1585. Santos (1609, 354) also provides the first detailed insight into the food system of the Teve area, stating that "[Quiteve] sent us presents of fowls, yams, and bread of millet, which is their ordinary food". Crop diversity appears to have been rather low, and significantly, cattle are not mentioned (Figure 5.8). This possible lack of cattle perhaps stems from the uneasy breakaway from the Mutapa state in the late-fifteenth century, and it is reasonable to assume that this, along with the proximity of the ivory trade at Sofala, explains the seemingly amplified importance of hunting as a food source and in centralised political authority:

> "[There are] all kinds of animals, which they catch in the forests and marshes; they spare no kind of flesh… Quiteve is accustomed to hold certain royal hunting parties, taking with him all the men of the city in which he dwells, who are three or four thousand. Tigers, panthers, lions, elephants, buffaloes, stags, wild boars, and many other wild animals are collected. They cut the flesh into many strips and dry it, both for the king and for each one of them. All eat of these spoils at the place of slaughter with greater rejoicing and merriment, and they carry the remainder of the meat to their homes" (Santos 1609, 208, 251).

> "The principal reason why the Kaffirs hunt elephants is to obtain the flesh for food, and secondly to sell the tusks… when the hunters have killed an elephant they call all their family, relations, and friends [and] eat its flesh boiled and roasted, doing nothing else all the time, and although after three days the stench becomes intolerable, this does not prevent them from eating it until nothing remains" (Santos 1609, 322).

This increased reliance on highly organised, intense hunting provided a coping strategy in times of drought and an export-based livelihood opportunity in the mineral-poor Teve area, though is perhaps more an indicator of a vulnerable food system, which necessitated a greater dependence on hunting in periods of prolonged environmental stress (Ekblom 2004).

Although there were differences in the organisation of food production in the centralised polities, a much clearer differentiation existed between these and the communities in the hinterland of the Afro-Portuguese towns of Sofala, Quelimane, Sena and Tete, who now focussed on the production of a surplus. This growing production and sale in increasingly diverse foodstuffs was detailed extensively by Santos (Box 5.2), and formed a prominent part of the commercial activity in the region (Figure 5.10). This may have operated on a smaller scale when Muslim traders ran the Zambezi route from Angoche, yet with the founding of Sena and Tete, where Santos estimated the population at 800 and 600 in the 1580s respectively, and Quelimane, the decentralised communities around these settlements went to significantly greater lengths to respond to these new commercial and diversification opportunities. The situation was different at Mozambique Island, however, where cattle, fruit and rice were imported from Madagascar and the Comoro Islands (Figure 5.10).

BOX 5.2 From subsistence to surplus: changing food systems around Portuguese settlements.

Sena and Tete localities:

"Opposite Sena on the other side of the river, there is a very grand and lofty mountain called Chiri, from it come nearly all the provisions consumed in Sena, such as rice, millet, sweet potatoes, figs, and fowls. In Sena and Tete all year round there is an abundance of Portuguese and Indian figs, there are many pomegranate trees, vines, lemon trees, and palm trees, and an abundance of wild fruit. There are many kitchen gardens where good vegetables are grown. There is an abundance of yams, sweet potatoes, pineapples, and very good melons, gourds, cucumbers, rice, millet and many other vegetables.

There are many cows, goats, and sheep, from (whose milk) they make as good cheese as that of Alemtejo, swine, and a greater number of fowls. All these things are very cheap, but those coming from India to these rivers are sold at a very high rate, especially wine, wheaten flour, boots, clothing and all necessary goods sent from abroad" (Santos 1609, 268).

Sofala locality:

"In the lands of Sofala there are many gardens in which vegetables grow like those of Portugal, and many fruit trees. The meat is generally hens, which are innumerable. The Kaffirs breed them to sell to the Portuguese, and in Sofala they give twelve for a black cotton cloth… There are also many domesticated pigs which are bred among the houses, many goats and cows, wild pigs, and other wild animals" (Santos 1609, 186).

Quelimane locality:

"There are very few cattle, as these Kaffirs are not fond of work, and are more given to dancing and feasting than to husbandry, contenting themselves with the usual food, which consists of rice or millet and vegetables. They also eat rats, snakes, and lizards, and jeer at those who do not. In this land there are numerous tigers, panthers, lions, elephants, buffaloes, gnus, deer, antelopes, and an infinite number of apes and baboons, and the Kaffirs hunt all these animals and eat their flesh… their commerce with the Portuguese is principally in ivory, rice, millet, panicle, yams, and many other kinds of vegetables which the country produces in great abundance. The Portuguese supply them with cloth, tin, and earthenware beads… The men roam about, converse with each other, fish, and hunt, and live merrily" (Santos 1609, 306).

Zambezi valley area:

"When boats are proceeding along the river the Kaffirs who inhabit the many villages on its banks approach in their little canoes laden with fruits of the land, rice, millet, vegetables, fresh and dried fish, and numerous fowls, which things they sell cheap to the passengers, as these lands are very fertile and abundant, and fowls are very plentiful, which they do not eat, but breed to sell to those who navigate this river" (Santos 1609, 255).

Production of a food surplus thus provided a useful supplement to the import commodities derived from the ivory trade, diversified the food system, and may have encouraged a build-up of population near these towns from adjacent small-scale chieftaincies. Despite opening up livelihood opportunities, Newitt (1995) argues that this new source of income was not on a scale to constitute an economic revolution, and that the surplus produced for trade had its limitations. Moreover, with the increasing quantity of food-oriented exports must have come some reduction in the available food for the food-producing population, which exposed the populations of these poorer and decentralised communities to new vulnerabilities. One obvious way in which this manifested was through food shortages, which, as Section 5.3.1.1 noted, could be brought on by either drought-aggravated harvest failure or a sudden influx of people into an area. Population and food demand is not quantified in the vulnerability indices, but is partially accounted for in the presence of 'slavery', and is also tied to the lack of sovereignty in the hinterlands of these towns (Figure 5.8). Overall, however, food system vulnerability in each of the Afro-Portuguese communities was low to moderate, on the one hand reduced by the growing diversity of food production, but limited by the relatively small cultivatable territories, limited cattle, and aside from Quelimane, limited hunting practices. Importantly, though, these accounts demonstrate the growing differentiation in the constitution and organisation of food systems in southeast Africa, which increasingly acted to condition contrasting responses to climatic stress.

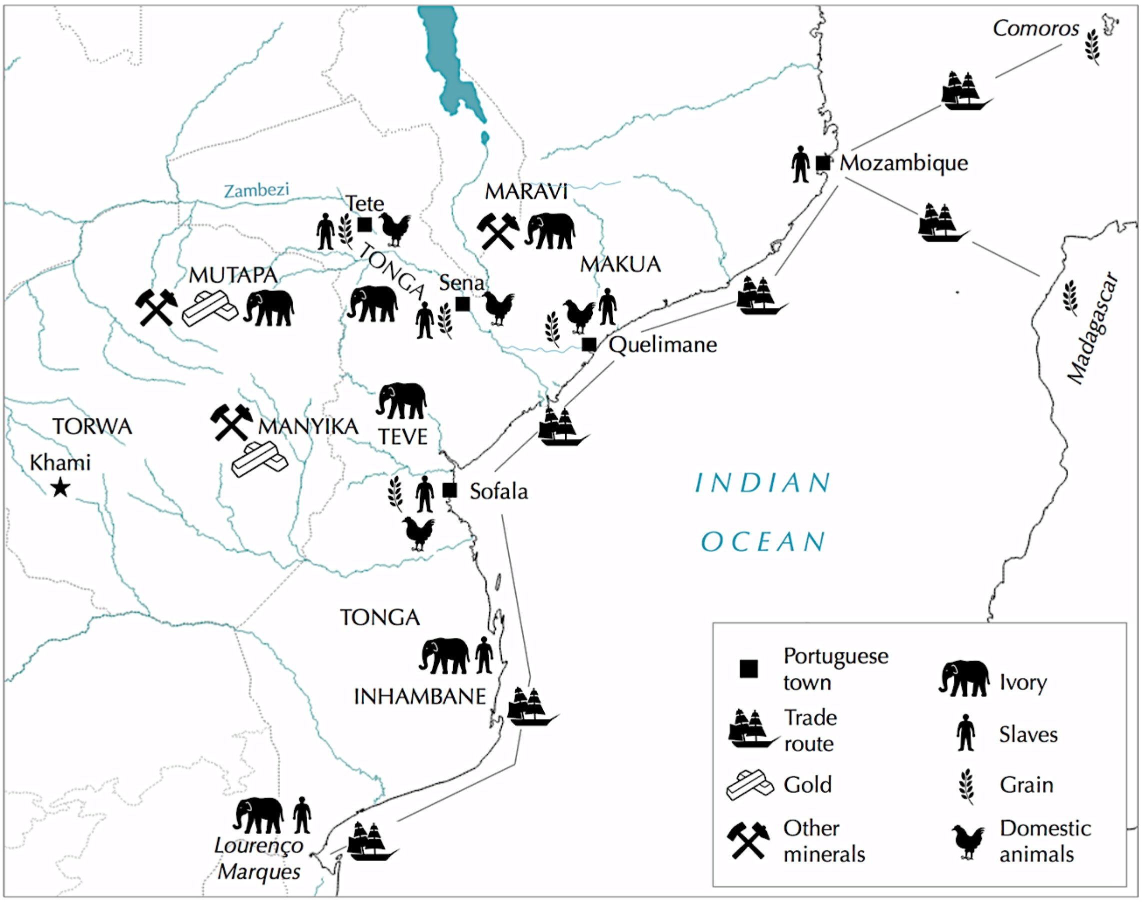

FIGURE 5.10 Southeast African trade in the sixteenth century. Based on Santos (1609).

5.4.2 The weakening of African socio-political structure

In the mid- to late-1580s, food shortages returned with similar if not greater magnitude to the Zambezi valley and Mukaranga, despite the low food system vulnerability of the latter. Santos, writing of 'four chastisements' to affect southeast Africa at this time, reported locust plagues and famine around 1589:

> "The second chastisement was a cruel plague of very large locusts that passed through them in such numbers that they covered the ground, and when they rose in the air they formed so dense a cloud that the land was darkened. During this time there was great sterility and famine, of which numbers died. The damage caused by them [the locusts] was great, as they devoured all the crops, gardens, and palm groves through which they passed, leaving them dried and burnt up as though consumed by fire, so that for the next two years they produced no fruits.
>
> This famine was the third chastisement of this Ethiopia, because there was so great a scarcity of provisions that the Kaffirs came to sell themselves as slaves merely to obtain food, and exchanged their children for an *alqueire* of millet, and those who could not avail themselves of this remedy perished of hunger, so that at this time a great number of the inhabitants of these lands died" (Santos 1609, 319).

The evidence relating to a growing segment of society around the Afro-Portuguese towns translated as 'slaves' appears to demonstrate the response of poorer individuals with little protection from a chief or centralised polity in times of climatic stress, meaning these people sought the 'security' of the inhabitants of Afro-Portuguese towns in order to obtain food. This shows contrasting responses to climatic stress of centralised communities, often with mineral wealth, organised coping strategies and higher adaptive capacity on the one hand, and on the other, smaller-scale communities with a much smaller range of livelihoods to intensify in times of food scarcity, and thus a lower adaptive capacity. This system of 'slavery' was in existence prior to Portuguese arrival, and referred to a segment of the population that were effectively economic chattels tied to Portuguese, Muslims or other Africans (Newitt 1973), though food scarcity was not the only cause of this practice at this time:

> "The slaves of these countries, or the greater number of them, are not natives thereof, but these Kaffirs are such great thieves that they steal children and lure adults into coming to these shores, where they sell them to the Portuguese, or to the Moors, or to other Kaffir traders who carry on this traffic, saying that they are their captives. Others of these slaves are sold by their fathers in times of necessity and famine; others are made prisoners by the kings for the crimes they have committed; others again are taken prisoners in wars" (Santos 1609, 332).

Combined with the suggested, although unverifiable mortality by Santos, the effects of this practice must, to some extent, have further weakened the smaller-scale communities and chiefdoms in this area, while their allegiance to the Portuguese increased the local resource base of the latter. In the coastal areas, an outbreak of smallpox also caused mortality, which appears to have destabilised the populations around Portuguese settlements:

> "The fourth affliction and trouble that overtook this Kaffraria was a severe outbreak of smallpox, of which a great number of people died. This disease along the whole of the

coast is like a subtle pestilence, as it kills everyone in a house where it appears, men, women, and children alike, and very few escape who are attacked by it.

From all these parts of the East [coastal Mozambique] the plague [locusts] is absent, nor is it known that it ever has appeared at any time. The cause of this must be that the climate is very hot, and consumes the vapours and bad air from which this pestilence is usually engendered. However, in its place there is the smallpox, which is very common and as contagious as the plague" (Santos 1609, 319).

The climatic conditions on the better-watered coastal areas at this time are less well-known than in the Zambezi valley and Mukaranga, yet if the extent of these variable but mostly dry years were of regional extent, as the proxy records suggest (Figure 3.8), then the impacts of the smallpox outbreak may have been exacerbated by pre-existing food scarcity and malnourishment. This has been suggested to be the case elsewhere (Kovats et al. 2003; Endfield 2007), and it may therefore be no coincidence that a severe smallpox outbreak occurred at a time of general climatic stress.

This weakening of smaller-scale socio-political structure on the southern banks of the Zambezi and along the coast was compounded by the 'Zimba', part of the Maravi population whose purported cannibalistic pursuits are usually written off as European myth-making (Allina 2011):

"This tribe [the Zimba] in the year 1589 traversed a great part of these lands, killing and eating all that they came across, both human beings and animals, without sparing a living thing, so that one may say these barbarians were a fire burning and consuming Central Ethiopia" (Santos 1609, 318).

Interpretation of this account is set against a backdrop of broader scholarly scepticism over European reports of cannibalism in the era of early modern encounters (Casale 2007; Allina 2011). Newitt (1995, 61), while stating that such graphic tales could be a product of the heated imagination of Friar João dos Santos to excite his European audience of *Ethiopia Oriental*, is reluctant to write this account off as "figments of a superstitious and ignorant Lusitanian credulity". Although not being drawn on the truth of the stories, Newitt professes that they hold importance for contemporary developments north of the Zambezi, possibly linked to the general phase of 'climatic instability' at the time. Pikirayi (2003, 2009) also proposes the possibility that the actions of the Zimba were a response to local 'environmental catastrophes', and similarly resists temptation to write-off the events as fabrication. Allina (2011) adopts a more sceptical stance, and instead suggests that ideas of the Zimba as cannibals were transmitted to Santos through African voices. Where Allina, Newitt and Pikirayi agree, though, is that descriptions of cannibalism were reflective of and heavily tied to the social, political and environmental insecurity in the greater Zambezi area in the sixteenth century. This point is further reflected in the tying of this suggested cannibalism with the interpretation and impact of climate variables. For instance, Santos added that the Zimba ruler took responsibility for climatic conditions:

"The said king says of himself that he alone is the God of the earth, for which reason if it rains when he does not wish it to do so, or is too hot, he shoots arrows at the sky for not obeying him; and although all these people eat human flesh, the king does not, to seem different from his vassals" (Santos 1609, 295).

Key here, then, is that Santos mentions the occurrence of cannibalism directly in tandem with famine, slavery and instability in decentralised communities. In this context, the inevitably exaggerated reports of cannibalism can be seen as symbolic of a more widespread breakdown in the availability of food, and therefore cannot be so easily dismissed as mere myth-making.

The return of climatic stress at this time and in the 1590s appears to be reflective of the shift to the consistently dry conditions of the LIA from *c*. 1600. Food scarcity reappeared in the Zambezi valley and Mukaranga, yet this time it was combined with a more severe short-term threat than the relatively small Portuguese force that had caused instability in the 1570s. This involved the incursions of Maravi armies on Mukaranga, who initiated instability in the Mutapa state. The encroachment of Maravi warriors on the Mutapa state led Gatsi Rusere to call upon the Portuguese to help drive them back, a recurrence of which led to increasing concessions of land, the relaxation of firearms laws and the ceding of all the mines in Mukaranga to the Portuguese. Although there is little doubt that these events occurred, it is important to consider *why* Rusere immediately called on the small Portuguese population and their Tonga warriors to assist in the defence of the state, particularly when considering the apparent size of the Mutapa forces. Suggestions in the mid-sixteenth century of the Mutapa ruler being able to immediately bring 100,000-300,000 warriors to the field of combat (Frois 1561, Homem 1576) are clearly highly exaggerated, yet there is general acceptance of Homem's (1576, 460) claim that the Mutapa state had "considerable might". It is therefore reasonable to suggest that the cumulative impacts of the occurrence of drought, locusts and food shortages in the area weakened the capability of the Mutapa state to combat an invasion of this scale (Figure 5.11). Whatever the case, the outcome of Rusere's decisions to ensure the defence of the state was substantially diminished prestige, economic power and sovereignty, as indicated by the heightened socio-political vulnerability context in Figure 5.8. The state continued to be affected by civil war and conflict with other polities through to Rusere's death in 1624, while the Portuguese now had considerable influence in state affairs.

In addition to climatic stress, the widespread nature of conflict in this period may have also had significant detrimental impacts upon food-producing societies. Although Beach (1980, 1998) has written of the limited mortality in pre-colonial conflict, the 'total war' scenario in the Mutapa state and Zambezi valley from the late-1580s involved multiple actants, spilled over into wide territory and involved large numbers (Mudenge 1988). This may have meant that disruption of the 'little society' through violence, destruction of food and population movements may have jeopardised the true economic base of the state, its food system. Nevertheless, an anonymous account in 1608 refers to the "infinite" quantity of cattle in the state.

Castelbranco, however, notes the impacts of population decline on food production in the Zambezi valley area after half a century of instability:

> "For want of population they are mostly uncultivated, so that when a larger number than usual enter them, there is great scarcity, and the soldiers die of hunger, the provisions imported being sold at an exorbitant price" (Castelbranco 1619, 161).

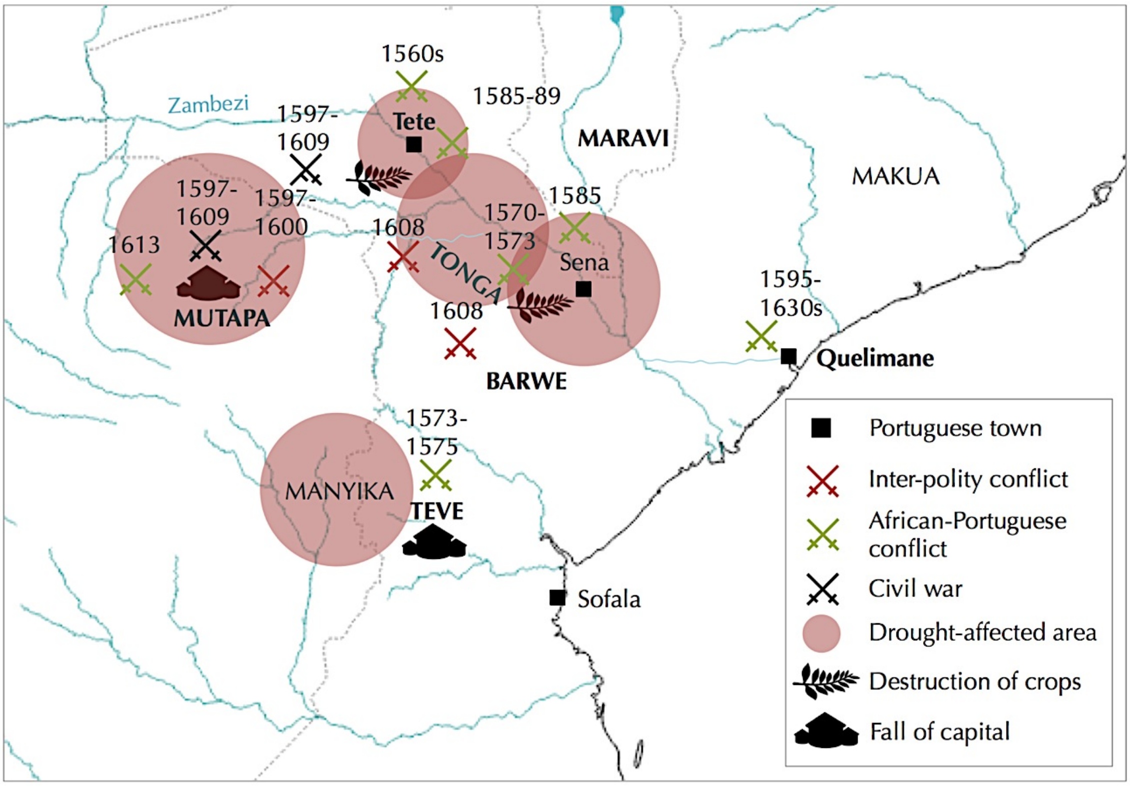

FIGURE 5.11 Areas affected by climatic stress and conflict 1560s-1630s.

The magnitude of climate variability in this period played an important part in the general spread of economic and political insecurity in southeast Africa. The high variability and decreasing quantity of precipitation that marked the 1560s-1590s reflected the transition towards the severest part of the LIA from *c*. 1600. The resultant climate-aggravated food shortages of the 1560s-1590s had considerable impacts on socio-politically vulnerable Zambezi Tonga communities in particular (Figure 5.9), yet also affected the Mutapa and Manyika areas. In addition to other factors, such as a lack of long-term agricultural planning and limited internal social networks, the Tonga groups seem to have been exposed to a number of system-dislocating determinants, including recurrent and severe outbreaks of plague locusts, and conflict with both the Portuguese and Mutapa, which undermined their capacity to respond to external stress (Figure 5.8). The less vulnerable Mutapa state recovered from the impacts of late-1560s and early-1570s climatic stress, but when an outbreak of plague locusts and food scarcity coincided with the attacks of Maravi warriors on the state, it undermined the ability to respond effectively to crises, meaning an enforced reliance on Portuguese aid. The Portuguese resource base in southeast Africa was further strengthened by their expanded jurisdiction over populations around Quelimane, Sena and Tete, some of whom sought protection against food scarcity and the Maravi and Zimba raiders. Indeed, it becomes increasingly apparent in this period that the vulnerabilities and responses of the more centralised African polities were fundamentally different to those of the less centralised groups in the vicinity of Portuguese settlements, whose socio-political vulnerabilities became entrenched as the Portuguese presence became fixed. The Portuguese, with their strengthened foothold in the Zambezi valley, came to the assistance of the Mutapa state, but at a high cost, leading to the decline in prestige, population and power, aided by the decision-making of Gatsi Rusere. This decline was matched in a much more rapid way in the Teve kingdom, whose army was routed by Homem's forces, and returned the society to a focus on agriculture, hunting and a localised system of exchange (Newitt 1995). It can therefore be concluded that the weakening of African socio-political structure was not simply a result of the impacts of climatic stress or Portuguese exploitation. Rather, a convergence of multiple stressors that differed between societies led to system breakdown and socio-political decline, including violence, governance, food system vulnerability and climatic stress.

Key points relating to vulnerability and response to climate variability across this wide spectrum of African and Afro-Portuguese society in this period thus include:

- High magnitude of climatic stress in the late-1560s, early-1570s, late-1580s and 1590s coincident with high variability in proxy precipitation in the late-sixteenth century, with drought, locust plagues and flooding all reported
- Increased food commerce opportunities at Quelimane, Sena, Tete and in the Zambezi valley arising from Portuguese expansion, and the opening up of new vulnerabilities arising from this
- Food scarcity and famine in the Zambezi valley, Mukaranga and Manyika, with particularly strong impacts in the Zambezi valley due to the differential vulnerability of these areas
- High mortality from smallpox in the coastal areas, possibly exacerbated by pre-existing food scarcity
- Differences in responses and coping strategies to food scarcity between centralised polities with hunting- and mining-based livelihood opportunities (Teve and Manyika areas) and decentralised communities (Zambezi valley), where evidence of people selling themselves as slaves for protection emerges
- Increased conflict north and south of the Zambezi, which combined with food shortages to undermine the capacity for effective response in the Zambezi valley communities and the Mutapa state
- The expansion of Portuguese jurisdiction over the Zambezi valley communities, acquisition of Mutapa territory, and increased influence in the Mutapa state, each degrading the sovereignty of African political units
- Attempts by the Portuguese to undermine traditional institutions and beliefs in rainmaking, and the establishment of *feiras* in Mukaranga and Manyika.

5.5 Livelihoods and vulnerability under the Portuguese (1625-1692)

The period between the death of Gatsi Rusere and the rise of Changamire in 1684 marked the highpoint of Portuguese dominance in the region. Until this point, the Portuguese had influenced African political structures while officially remaining on the side-lines, but upon the instalment of Mavura, the first of the 'puppet' Mutapa rulers, they expanded their colonisation and exploitation by asserting influence on the upper levels of the Mutapa state. The treaty of vassalage signed by Mavura in 1629 effectively made the ruler a Portuguese client. The conditions of this clientship included free access to the gold mines in Mukaranga, the payment of tribute to the Portuguese, who now had the final say in political succession in the state, and the annexation of lands surrounding Tete, which were turned into *prazos* (Figure 2.14). Although a brief period of conflict arose in response to these new conditions in 1631, with 6-7000 fatalities (Mudenge 1988), the Portuguese quelled the rebellion in mid-1632, leaving the Mutapa state with diminished sovereignty and autonomy (Figure 5.12). Similar, if less pronounced processes occurred in the other African political units, and this section examines the varying importance of Portuguese dominance for vulnerability, resilience and adaptive capacity to climate variability.

5.5.1 The impacts of Portuguese dominance in the interior

5.5.1.1 Changing governance structures and resilience

The signing of the treaty of vassalage by Mavura had severe consequences on the upper structure of the Mutapa state, a situation which was aided by internal political fractures after years of civil wars. The removal of the *curva* (tribute) payment and other tariffs and tolls cut an important source of income for the Mutapa leadership, and undermined the reciprocal relationships with its wards and villages on which the state depended. The leadership also lost control over some sectors of the economy. Gold mining, for instance, could no longer be controlled or taxed (Figure 5.12), the loss of income from which further reduced leadership prestige. Less can be said about the specific impact of Portuguese dominance on the coordination of social networks. Nevertheless, Conceição noted that the system of service mentioned in Section 5.2 was still in place in the Mutapa state at the end of the century, suggesting that food-related social networks did not completely break down. As was the case in the political role in rainmaking in the Inhambane polity in the early-1560s, the Portuguese probably tried to dismiss traditional beliefs and sought to impose their own. Indeed, in contrast to other Mutapa rulers, Mavura took his conversion to Christianity seriously, which alienated traditional Mutapa leaders and forced the ruler into a position of dependence on the Portuguese at the expense of his own people (Mudenge 1988). This must have altered the nature and perception of the upper levels of the state, possibly reinforcing contemporary internal unrest, but over the long-term this appears to have posed only a minor threat to Shona beliefs (Beach 1980), evidenced by continued references to the political importance of rainmaking.

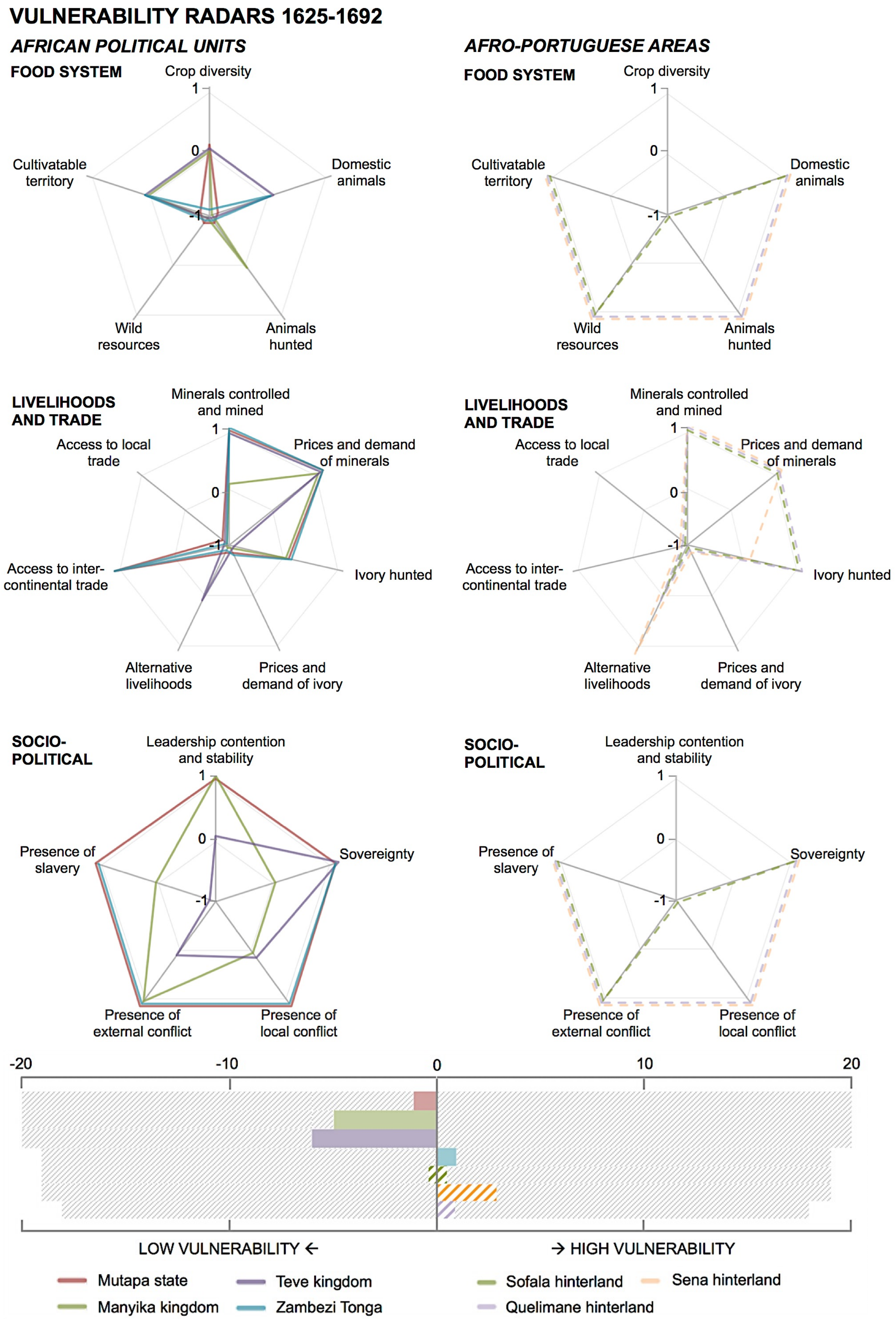

FIGURE 5.12 Vulnerability radars for the Mutapa state, Manyika and Teve polities, Zambezi Tonga, and the population of the Sofala and Sena hinterlands 1625-1692. Biophysical indices are given in Appendix B.

This loss of sovereignty was also reflected in Teve, and to a lesser extent in Manyika (Figure 5.12). For instance, in return for securing Quiteve Peranhe's leadership in 1640, his Teve polity ceded the whole northern part of its territory to the Sisnando Dias Bãyao, which led to the further expansion of *prazos* in the area. Rapid loss of territory radically reduced its prestige and cultivatable territory (Figure 5.12) and diminished its resource base and labour force. Bãyao is also well-known for his expedition into the Torwa state, and meant that by 1644 the Portuguese had now interfered in the political structure of each of the main centralised polities in the region.

To look upon the penetration of the Portuguese as a sole product of mercantile capitalism and possession of gunpowder, however, is only a small part of the story. Perhaps as important were the internal political vulnerabilities of the Mutapa state and other polities, both in their succession systems and the frequency of leadership contention, which led to the seemingly irrational decision-making of seventeenth century rulers in particular. Indeed, Mudenge rightly states that the fact the Mutapa state survived at all shows remarkable resilience. Protracted civil war, external political and economic pressures and climatic stress (Section 5.4) were all important factors that weakened the state, yet its resilience may relate more to its 'little society', or the wider population involved in agropastoral livelihoods, in the face of political instability. This point is well illustrated to the end that even the capture or destruction of the state's *zimbabwe* appeared to do little to directly affect these food system livelihoods. Newitt (1995, 59) echoes this point in stating that "had there had been a great empire of Mutapa, then a ruthless Portuguese *conquistadore* might have overthrown the monarch and seized control of the country, but the small-scale, segmentary nature of Karanga political organisation proved far more resilient than the great military monarchies of South America". The resilience of the population was also aided by the weaknesses of the Portuguese themselves, specifically their lack of effective central command, shortage of manpower and individualistic style of life (Newitt 1973, 1995). Nonetheless, while the most well-known changes to African political units relate to the upper levels of society, this is not to say that the broader population were not affected by the heightened socio-political vulnerability context, and two of these impacts were depopulation and changes in livelihood focus.

5.5.1.2 Depopulation and livelihood security

The resilience of food producing livelihoods did much to aid the sustainability of the Mutapa state, but the instability stemming from the climatic stress, famine and locust plagues of the late-sixteenth century, followed by the mortality from years of civil war and external conflict, appears to have caused devastation in parts of Mukaranga and the Zambezi valley. In addition to loss of population through mortality, a number of people and chiefs emigrated to the southwest of the plateau (Beach 1994). Moreover, women, cattle and food were seized by the Portuguese throughout the Zambezi valley and Mukaranga to reward their followers, and African labour was forcibly recruited to work in the now Portuguese-controlled Mukaranga gold mines (Beach 1994). This general depopulation of Mukaranga is reflected in accounts of the time. Bocarro (1633-49) wrote of several factors responsible for this, including the locust plagues of the late-sixteenth century, and for his part, he recognised the impact of Portuguese conduct:

> "The want of population, which is great throughout Kaffraria, because few children are born, and many plagues of locusts, wars, and carrying off of captives diminish their number. Above all the barbarous custom of taking the *mavi* (killing of suspected wizards) kills an infinite number and destroys countless families… But the principal cause of the want of population is the bad conduct of the Portuguese, from whose violence the Kaffirs flee to other lands" (Bocarro 1633-49, 491).

If Bocarro's evidence is reliable, then it is reasonable to assume that the recurrent outbreak of plague locusts, associated with the increased climate variability in the late-sixteenth century, were a factor which may have encouraged migration to the southwest. Still, Bocarro placed particular emphasis on the conduct of the Portuguese, who had particularly profound impacts on populations living near the gold mines and *feiras* in the heart of Mukaranga and Manyika (Figure 2.14). Portuguese traders and *sertanejos* operating out of self-interest now favoured the forced recruitment of labour and the extortion of tribute to make quick profits, meaning the "poor and miserable" business of mining became unviable as a secure livelihood option for the Mutapa population. According to an anonymous account written in 1683, the impacts of this included the policy of the resettlement of communities away from the gold-producing plateau area, which was initiated by Mutapa Mukombwe. Responses to the convergence of multiple stressors thus contributed to a reversal of Barros's earlier claim that elephants avoided Mukaranga due to its high population to the exaggerated but significant claim that wild animals now roamed around villages:

> "Mocaranga [Mukaranga] has very rich mines. But the little government, and great domination of the Portuguese with whom the natives used to live together, has brought it to such an end, that it is depopulated today and consequently without mines. Its residents ran away, and the king appointed them other lands for them to live as it pleased him. The larger part of this kingdom remained without more people than the Portuguese and their dependents and slaves. It now looks the same that Lisbon will look with three men, but not to look completely deserted: the wild animals came in instead of the residents, and it has so many, and so free; that even inside the houses the lions come to eat people" (Anonymous 1683, 161).

Although the mining areas in Mukaranga were forcibly depopulated, the ruling Chikanga of Manyika at an earlier date had the authority to enforce a change in policy:

> "The reason why big pieces of gold from these extremely rich mines of Manica do not come nowadays is that the Kaffirs are afraid of taking it from the mines when it is in great quantity because the king is immediately informed... [and] gives orders for him to be attacked and have all his property, wife and children taken from him, and sometimes to kill him. And thus, when they strike a big mine, they generally inform the king immediately and the king orders all digging in to stop" (Macedo 1633, 14).

Antonio Gomes, explaining the reasoning for this, related that:

> "[The king] ordered his people not to extract any gold and to till the land and grow food in order to become richer and have more peace and quiet" (Gomes 1648, 78).

This change in livelihood focus also marks a reversal of Carneiro's earlier claim that the inhabitants of Manyika were more given to trading than farming. In reality, subsistence requirements necessitated that food production was always the most important livelihood that involved the greatest number of people, but the impact of conflict led to a change in policy on the degree of importance attached to mining and agriculture by the leadership. Further adverse shifts in the terms of trade towards extortion and forced labour meant that the relative importance of mining and trade to both the economy and leadership continued to decline. That this reinforced the focus on food production is reflected in encounter between Gomes and a Manyika villager, and an observation that infers the decline in the importance attached to trade imports:

> "All this time, at the villages where we stopped, I would talk to the Kaffirs about the things of God, that they should think of their obligations, etc., and one day one of them said '*muzungo*, you speak well but… here we are born, here we grow old without any worries except looking for food'" (Gomes 1648, 79).

> "Beads and cloth are merchandise for the Kaffirs, in the old days they used to come for it at the fairs but covetousness and greed has brought the cloth to their door and this is brought overland in bundles wrapped in palm-tree mats…" (Gomes 1648, 77).

While less significance was attached to export-based livelihoods, contemporary accounts of food systems once again refer to productivity rather than shortages. Bocarro (1633-49) spoke of the region abounding in provisions, including millet, rice, vegetables, cattle and many hens, while Rezende (1634, 412) observed that Manyika was "productive in all kinds of provisions". The Portuguese must have had some influence on surplus-based agriculture in Mukaranga and Manyika, but this was probably limited to a trade with the low number of Portuguese settled at *feiras*, around which emigration had taken place. More significant was that Gomes (1648) reported the spread of wheat, and *milho* - possibly maize - to the interior, which was already in the Zambezi valley by this time, and added to food system diversification (Figure 5.12). Gomes also noted that cattle and sheep remained in high number at this time:

> "In Mocaranga, there are many cattle and five legged sheep, apart from the usual four, they have another in place of a tail that it makes them five legged" (Gomes 1648, 73).

Despite the increase in detailed, first-hand accounts of Mukaranga, Manyika and Teve, it is noteworthy that the generally dry seventeenth century is marked by a dearth of references to climatic-induced stress in these areas (Table 3.5). Only two reports from elsewhere in the region at this time make reference to climate-related events, such as the shipwrecked Bento Teyxeyra Feyo, writing in 1647 around Delagoa Bay, who described famine caused by five years of low rainfall across southeast Africa:

> "And so we went on without millet or sesame, for it was not yet harvest time, and in this place and throughout nearly the whole of Kaffraria it had not rained for five years, causing great famine and a plague of locusts which left not a blade of grass where they passed" (Feyo 1647, 352).

Further north, at Sena, Mascarenhas (1663, 141) provided another direct reference to lack of rainfall, and related that “the fort is now very well provided with water because this place needs it very badly, for the only source here is the rains; this year we were already very short of it because it has not rained”. That these are the only two references to climatic conditions in this period appears to represent a stark contrast to the assumption that extended drier conditions may result in increased hardship for communities. Two points in particular stand as out as possibilities for this. The first is that the magnitude of climate variability itself was greater in the late-sixteenth century (Figure 3.9), which may have led to more frequent outbreaks of locust plagues in contrast to the relatively low variability of the extended LIA drier conditions of the seventeenth century. Secondly, this may relate to the nature of conflict. Despite the expropriation of some cattle by the small Portuguese population and the reduction in the labour force, there is little evidence that civil war alone had a dislocating impact on food systems. Indeed, Rezende wrote of the importance of food production in times of conflict:

> “No one can restrain them from dispersing and going in search of a living. Even if they are victorious in a battle, it needs much to induce them to fight another, for they say they have finished the war, and if in the meanwhile the time for their harvests arrives, they care for nothing but to go and attend to them” (Rezende 1634, 419).

This may have been different in times of ‘total war’, of which the Mutapa-Tonga-Maravi-Portuguese conflict in the late-sixteenth and early-seventeenth century is a prime example, but was perhaps less the case in the civil war that persisted in the period under consideration here. Thus, despite the increased vulnerability context of the Mutapa state as a whole (Figure 5.12), the vulnerability of the food systems remained low, and probably enabled an effective response to the generally drier conditions at the time. Moreover, unlike the Zambezi valley, there was no successful peopling of Mukaranga or Manyika (Newitt 1995). Instead, the focus on and partial relocation of small-scale, garden-based subsistence agriculture, aided by a reduction in conflict towards the middle of the century and the internal divisions in Portuguese society (Newitt 1995), meant that the vulnerability of the wider population remained moderate. This maintenance of the state’s wider structure in the face of external stress was crucial in the shifting balance of power in the second half of the century.

In terms of prestige and size, the decline of the state to this point was profound, involving the gradual loss of Mukaranga, its well-watered arable and grazing lands, and the gold resources that remained. This policy was probably partly a forced migration away from the lawless exploitation of labour around the *feiras* and gold mining regions in the Mukaranga heartland, and partly a policy of Mukombwe to stabilise the population (Pikirayi 2003). A more independent stance was adopted in Mukombwe’s rule, and internal political stability certainly aided the reconstruction of the state structure. Yet this was always underlain by the weaknesses in the Portuguese occupation. In the early 1680s, for instance, the Portuguese population in the centre of the state was just five people, with a further 26 at Tete. Mukombwe may have also been helped by the outbreak of smallpox around the Portuguese settlements on the Zambezi in 1670, which have reduced the numbers of the Tonga population and accordingly the military threat to the state (Mudenge 1988; Pikirayi 2003). Key changes in governance and livelihoods also affected the Afro-Portuguese towns and their hinterlands, whose populations were under the more direct rule of the Portuguese jurisdiction.

5.5.2 Portuguese rule on the Zambezi and Mozambique coast

The Portuguese established a firmer hold over the majority of the Tonga, Makua and Maravi populations in the Zambezi valley, and in the hinterlands of Sena, Tete and Quelimane. Their social relations with these people through intermarriage resulted in an emerging class of Afro-Portuguese, and in turn, changes to socio-political and economic systems, which influenced vulnerability in these areas (Figure 5.12).

5.5.2.1 Food production and security in the Zambezi towns and prazos

Although the Portuguese population on the Zambezi in the seventeenth century was in the low hundreds, estimates in 1634 put the number of warriors that the Portuguese could draw upon at Sena and Tete at 30,000 and 8000 respectively (Rezende 1634), while documents made it clear that some Portuguese recognised that their existence depended on "keeping the natives" in these areas:

> "To explore the Rivers 70 and 80 men are needed on each farm… Progress does not depend on bringing in Portuguese but in keeping the natives. And the more there are of those (Portuguese) the more complaints the natives have and the more they run away… The natives are needed in those lands; and that is enough to make the example of Brasil not applicable to the rivers" (Anonymous 1683, 167).

These lands, as well as the much less important Sofala, were turned into *prazos* (Figure 2.14). Portuguese settlers and *prazo*-holders thus acquired jurisdiction over the people living on these lands, which effectively elevated them to the traditional political positions of chiefs, or *senhors*, over much of the Zambezi valley area. While Portuguese *senhors* collected tribute from *colonos*, or free Africans, and controlled certain economic activities and ritual functions, the major difference was that the *prazo* system was driven by short-term profit, meaning that the intensification of exploitation by short-term occupants of the *prazos* was commonplace (Newitt 1973). The other part of the population living under the Portuguese were the 'slaves', who often sought protection from conflict or famine. Although the *prazo*-holder may have initially offered food and protection, the upkeep of a robust food supply was essential if slave groups were to be held together. Failure to do this could lead to the desertion of a *prazo* or a state of rebellion which could quickly spread to other groups as well as the *colonos*, heightening the vulnerability of the area to further stress (Newitt 1995; Pikirayi 2009). Food security, and therefore climate were key in the dynamics of the *prazo*-system and its population.

Afro-Portuguese society on the Zambezi and the Mozambique coast by this stage appears to have been underpinned by an organised and resilient agricultural base, particularly when compared to previous periods (Figure 5.12). This was in part because the production requirements for the taxable surpluses needed to support the *prazos* increased markedly compared to the surpluses produced to support the town garrisons of Sena, Tete, Quelimane and Sofala in the sixteenth century, and failure to produce adequate food in a drought year could have significant impacts on the social and economic operation of *prazo* society (Newitt 1973; Pikirayi 2009). Consequently, a high number of reports become available on food systems in the Zambezi valley. Firstly, important dietary changes are noted with the introduction of wheat in the Sena hinterland, which appears to have increased the self-sufficiency of the Zambezi towns:

> "In the old days these lands were unhealthier to strangers but nowadays owing to agriculture and the abundance of wheat, everything looks much better… flour used to come from Goa almost deteriorated by the sea and the bread was not so healthy as it is nowadays, made from the wheat cultivated in this land" (Pereira 1663, 137).

By the late decades of the century, food production on the Zambezi seems to have been largely self-sufficient, with a wide diversity of crops, vegetables, fruits and domestic animals forming the staple diet (Table 5.4). Indeed, one account stated that:

> "The rivers of Cuama are the richest provinces the universe has, in my opinion… they have innumerable cattle, wheat and countless provisions, because one thing and the other cost nothing" (Anonymous 1683, 159).

Other key accounts from this period offer detail on the diversity and quantity of and adaptive mechanisms involved in food production. Significantly, Gomes's account notes that long-term planning had become embedded in the agricultural cycle:

> "The vegetable gardens of the Portuguese and people of India who live in those lands have all kinds of vegetables, cabbage, garlic, onions, etc., for all these things grow well and better so in the bush because it is cooler; the land is fertile in everything one puts in, everything grows well. And the Kaffirs around here away from the Zambezi also have plenty of food and cattle.
>
> All these lands produce rice and wheat but the Kaffirs are more interested in other foods, they say these are very light and only the others touch their hearts, apart from wheat they have a silo for all the others, which they call a *quitura* and they keep each kind separately and consider it lucky never to see the bottom of it and to have some excess from one season to the next" (Gomes 1648, 109).

> "The higher lands yield as much wheat as desired. In the month of July, up the river, I saw some which was as high as a very tall man. In Sena they make very good and delicious bread, and the Kaffirs are already beginning to prefer it to their millet. They cultivate it, not only in Botonga, but also in Maravi" (Barreto 1667, 506).

> "These people [of Quelimane] are not agriculturally minded, some times they live on wild fruit and some other times plenty of fish which can be caught at enormous lagoons and is dried during the summer and there is so much of it that it can be caught in basketful. When the hunt ends they divide it so fairly that nobody makes any complaints and in this they are very fair and equal" (Gomes 1648, 48).

TABLE 5.4 Documented food production in seventeenth century Portuguese jurisdiction.

		Sena-Tete	Quelimane	Sofala
Crops	Wheat	x	x	
	Rice	x	x	x
	Maize	x	x	x
	Pearl millet	x	x	x
	Finger millet	x	x	x
	Sorghum	x	x	x
	Sugar cane	x	x	x
Vegetables	Pumpkins	x	x	
	Beans	x		
	Cabbage	x		
	Onions	x		
	Peas	x	x	x
	Potatoes	x	x	
	Yams	x	x	x
Fruits	Watermelons	x	x	
	Lemons	x	x	
	Limes		x	x
	Coconuts		x	
	Tamarind	x		
	Figs	x	x	x
	Oranges		x	x
	Grapes		x	x
	Pineapples	x		x
	Papaya		x	
	Pomegranate	x		
	Mangoes		x	
	Bananas		x	
Domestic animals	Cattle	x		
	Fowls	x	x	x
	Sheep	x	x	x
	Goats	x	x	x
	Pigs	x	x	x
	Dogs	x		
Wild animals	Game	x	x	x
	Elephant		x	x
	Deer	x	x	x
	Fish	x	x	x

Apart from the increased level of food system diversity, each account notes the high fertility and productivity of the area at this time. Similarly, evidence of food shortages and drought is minimal throughout much of the seventeenth century, despite an increased number and depth of accounts from the Zambezi area. This is not to say that years of drought did not occur, for the seventeenth century overall was the second driest of the last millennium in the southern African SRZ (Figure 3.8), but that its impacts were not worth recording. Perhaps, then, this in part relates directly to food system diversity, and the reduced vulnerabilities from conflict in this period. However, the diversity of the food system was not a completely recent occurrence, despite the introduction of wheat and maize at this time. Similarly, the system of tribute and redistribution of grain was clearly operated prior to the assumption of Portuguese as chiefs. Probably more important is the finding from Chapter 3 that the seventeenth century, although dry, was one of the least variable in terms of inter-annual and multi-decadal precipitation variability (Figure 3.9). This means that although precipitation was on average lower than the previous century, it appears to have been less variable, with fewer abrupt shifts, possibly indicative of more benign climatic conditions for the inhabitants of northern Zimbabwe. Rather than climate, the more obvious threat to the inhabitants of the Zambezi valley at this time was that indiscipline and short-term profit-seeking of the very small number of Portuguese individuals that occupied the area. This lack of authority ultimately set the conditions for the weakening of Portuguese hold on northern Zimbabwe and the Zambezi in general. Portuguese dominance in the Zambezi-Limpopo area had varying impacts upon the vulnerability of political structures and livelihoods. Key changes included:

- The loss of sovereignty, territory and economic control in African political units, which undermined the reciprocal relationships on which authority depended, and is illustrative of the destructive influence of the Portuguese on complex African political systems
- A reduction in population due to multiple causes, including climatic stress in the late-sixteenth century, but the resilience of the population at the village level involved in agropastoral livelihoods who continued to underlie socio-political organisation in the in the face of multiple threats
- The maintenance or re-establishment of sufficient authority by Mukombwe to initiate resettlement away from the gold-producing areas in Mukaranga, and the Manyika ruler to reduce the livelihood focus on mining and trade
- Portuguese *senhors* and *prazo*-holders replacing African chiefs, opening up new vulnerabilities by the driving force of short-term profit
- The increase in the diversity of food systems in the Zambezi area, reducing vulnerability to climate variability
- The lack of reference to climatic stress, despite generally drier conditions, suggesting that the reduced variability in precipitation was significant.

5.6 The rise of the Rozvi and climatic stress on the Zambezi (1693-1760)

The era of Portuguese supremacy in northern Zimbabwe and Manyika was brought to an abrupt end by the rise of Changamire and the Rozvi state. Changamire's army destroyed the *feira* of Dambarare in 1693, causing the Portuguese in Mukaranga to flee to the Zambezi towns, while the Rozvi also destroyed the *feiras* in Manyika in 1695. Changamire's policy of the total expulsion of the Portuguese from the interior was largely successful, and meant that the southern shore of the Zambezi, the delta, and the land between Sena and Sofala now formed the extent of Portuguese settlement in the area (Figure 2.13). Although contact was reduced with the interior plateau areas, source material is sufficient to investigate vulnerability and response to climate variability in the late-seventeenth and early-eighteenth century (Figure 5.13).

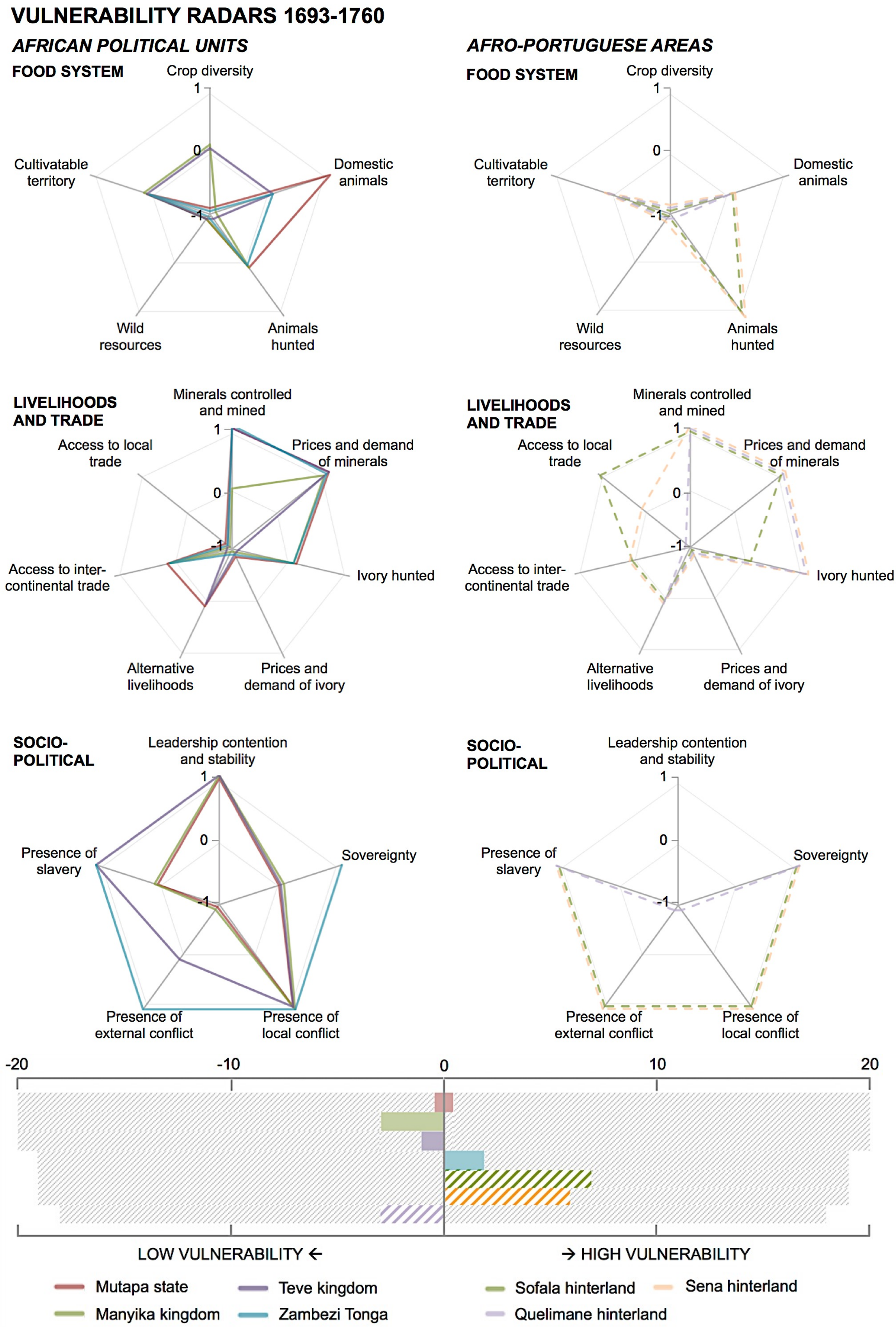

FIGURE 5.13 Vulnerability radars for the Mutapa state, Manyika and Teve polities, Zambezi Tonga, and the population of the Sofala, Sena and Quelimane hinterlands 1693-1760. Biophysical indices are given in Appendix B.

5.6.1 Mutapa, Manyika and Teve in the early-eighteenth century

Despite the decline in the Portuguese presence in Mukaranga, the distance of the Rozvi meant that the Portuguese still exercised a degree of influence over Mutapa political dynamics. Rival political groups backed by either the Rozvi or the Portuguese vied for power in civil wars throughout the early-eighteenth century, with frequent changes of leadership, and it was not until around 1720 that a level of independence from either power was re-established (Mudenge 1988). Manyika and Teve were also subject to Rozvi and Portuguese authority respectively until well into the eighteenth century, and meant that the socio-political vulnerability context remained high (Figure 5.13).

Nevertheless, one could argue that the destruction of the *feiras* in Mukaranga and the related reduction in the state's subjection to extortion, slavery and exploitation (Figure 5.13) would have reduced its vulnerability. This suggests that the internal situation, rather than external factors alone, played a part in keeping the state weak but intact for another century and a half. One key internal change was the shift of the Mutapa capital and state core from Mukaranga to Chidima in the Zambezi lowlands in the second decade of the eighteenth century. It is unclear why this move took place, but this may have been a policy to avert insecurity in Mukaranga, as was the case with the earlier migration away from the *feiras* in the mid-seventeenth century. Indeed, gold production was by this time negligible (Figures 5.4 and 5.13), and the resettlement away from the formerly gold-rich areas to the Zambezi may simply have completed a process begun by Mukombwe at this earlier stage. This move had major implications for the exposure of the state to climate variability. The Zambezi valley is a dryland, tsetse-infested area which makes cattle-keeping difficult. Although the banks of the river can harness agriculture, the area around Chidima receives an unreliable seasonal rain, making it vulnerable to the extremes of both drought and flood. In this new heartland of the state, it was scarcely possible to occupy one site with the usual concentration of people at Mutapa capitals for more than a few years, meaning the rulers often moved their *zimbabwe*, a practice interpreted as superstition by Xavier:

> "Zimboae [zimbabwe] means the same as court and as the palaces of other buildings of which it is formed are made of timber, they can be moved easily from one place to another as they do when they feel like it, which generally happens because of some superstition, which those people have on account of anything" (Xavier 1758, 50):

Another partial reason for this shift may have been climatic stress in the early-eighteenth century. This possible pathway dates back to earlier shifts in vulnerability. In the last decade of the occupation of Mukaranga, the land was described as very rich in food and animals (Sousa 1697), yet accounts of the Mutapa polity in Chidima, although less detailed, neglect to mention cattle (Xavier 1758), and this perhaps attests to a shift in the livelihood base of the state due to the difficulties of keeping cattle in the dry, tsetse-infested valley. Moreover, it was noted both before and after the shift towards the Zambezi that *milho*, possibly maize, had grown in importance as a cultivated grain:

> "They dedicate themselves to raising cattle and cultivating the land, this is what their wealth consists of. They will eat any animal, the more rotten the better… They produce a lot of big grain and small grain maize, fine and scented rice, *nachenim*, and excellent wheat. They had no wheat for a long time and the Portuguese thought that was because in these meridional countries one could not see the north star as if there were not any other stars favourable for bread" (Sousa 1697, 236-241).

Maize, as has already been stated, has relatively high yields compared to millet and sorghum, and has a shorter growing period, though requires higher rainfall and is sensitive to dry conditions in its early growing period (McCann 2001). While its shorter growing period may have offered advantages, even in the dry LIA, the risk of growing maize was that years of moisture stress may have resulted in harvest failure. Perhaps these livelihood changes can be linked in someway to the severe impacts of the 1714 drought in the Zambezi valley. Although primary evidence for this drought is held in Goa and therefore was not consulted, Mudenge (1988) reported that this drought had the worst impact of those recorded by Portuguese writers. This is evidenced in a letter dated 3 January 1715 from the viceroy of Goa to the king of Portugal, where it is stated that more than 200,000 people died from a smallpox epidemic and an extreme drought. This figure, though undoubtedly exaggerated, is unprecedented for loss of life from any event in southeast Africa, but the viceroy accepted it, and proxy precipitation evidence suggests that this period marked the severest dry conditions of the LIA, with a slight increase in the variability of the T7 stalagmite variables in Figure 3.9. Evidence is therefore insufficient to rule out that such climatic stress influenced the decision to relocate to Chidima. Persistent civil wars and political instability may have also influenced vulnerability to climate variability at this time, yet evidence is insufficient to support the possibility that the limited scale of civil wars had a dislocating impact on social networks or the re-distribution of grain.

One connection with this move, and probably after the drought, was that a number of people sought the protection of wealthier Mutapa people and became bondsmen, or 'slaves' (Beach 1980). This has been linked to the emergence of *vanyai*, a military class which in itself helped sustain the state in the face civil disturbances and Portuguese desire for a return to the seventeenth century situation. In addition to renewed military power, the state seems to have retained its religious practices, which again appears to refute the idea that the Portuguese nullified ideological beliefs and the political importance of rainmaking:

> "They do not worship any idols and all their practices consist of venerating their *mozimos*. The *mozimos* are their saints and their saints are their dead in whose impersonations the devils come to them in dreams to ask them for rice, meat, *pombe*, and other things of which they leave offerings on the graves of their ancestors… when he wants rain, he sends these *marombes* to a certain place with their little bags to wake up the *mozimos* so they will turn the clouds into water; and by means of this prayer he contradicts himself for he boasts of presiding over the stars" (Sousa 1697, 240).

For all its internal power struggles, the Mutapa state underwent a period of reconstitution in the late-seventeenth and early- to mid-eighteenth century. Traditional institutions such as rainmaking appear to have been maintained, and the Portuguese were driven back. Yet if the Portuguese were now less of a threat, severe drought appears to have impacted upon a heightened vulnerability context, resulting in high mortality evidenced in the 1714 drought. Moreover, an intensified risk came from their new, dry, lowland environment. There is no corresponding evidence of climatic stress in Manyika or Teve over this period, where food culture appears to have been based on a similar mix of crops to previous periods. For instance, in 1758, Xavier reported that "there is no rice or wheat in this territory [Teve], not because the country is not fertile, but owing to the carelessness on the part of its inhabitants who are quite content with the abundance of *meixoeira* and other vegetables" (Xavier 1758, 38). Despite low diversity of cultivated crops, both Teve and Manyika are better-watered than Chidima, while coping strategies such as the intensification of hunting were long-established. Vulnerability in these polities was therefore marginally lower than in the Mutapa state, but the lack of reference to climatic stress may simply reflect limited source coverage.

5.6.2 Climate variability and the state of the Portuguese jurisdiction

Despite their setbacks, the Portuguese still retained control of the routes where imports could reach the interior, and thus a degree of economic and political power. Military threat to Sena seems to have been averted upon the death of Changamire, and the settlement remained important, though troubled, in the eighteenth century. Enough trade remained with Manyika to maintain the upkeep of the town, though a major issue seems to have been health problems from stagnant water (Newitt 1995). Tete, on the other hand, was more reliant upon the seventeenth century wealth from the Mukaranga *feiras*, whose rapid destruction severely damaged its prosperity and led the Portuguese to consider abandoning it (Newitt 1995). An additional development in the early-eighteenth century was the founding of Zumbo, where professional African traders conducted a trade with the south-western goldfields and the mineral resources of the Maravi area. Trade, however, was only one aspect which affected the prosperity of the Afro-Portuguese Zambezi settlements and the populations in their hinterlands and *prazos*. In 1698, Ribeiro wrote of food shortages at the Sena *prazos*, though these were at first aggravated by reasons other climate variability:

> "[Sena] is practically all in ruins not only in the material sense of the houses whose majority are falling down but also as regards the residents who, having already spent all they used to possess, do not have enough to eat anymore and even less to support their families and slaves. This ruin was and is brought about because for some years they have had their hands tied either by Generals and Governors of the fort… The rivers of Sena are also very diminished because of Changamira" (Ribeiro 1698, 278).

The disordered state of the food system and the slaves who underpinned it may have given rise to the severe and widespread impacts of locust plagues, which Miranda reported between 1736-45:

> "There has also been at times grasshopper plagues that have resembled those that afflicted the obstinate Pharaoh. The closest was in [17]36 and lasted until [17]45 (so say

the people of those days), although it decreased in intensity; however, there were some small ones [locusts] left and when the first rains come in November they come out and dig again at the end of January drowned by the winter rains' they still cause damage to the *meixoeira* (pearl millet) when it is starting to come out, but it is not too terrible. A bigger damage was made by the others during the years I have mentioned as neither the crops nor cultivated or wild trees were left alone, that being one of the reasons why many natives died of hunger. Others gave themselves up voluntarily as slaves to the Goanese or to some other rich countrymen in exchange for a small portion of grain, enough to last one only day… I know that the great numbers of slaves that many people have are a result of the great poverty of these regions suffered in these years [1736-45]" (Miranda 1766, 93).

If there were already problems in slaves obtaining food, famine and plagues made this worse by compelling more people to seek protection from Afro-Portuguese families. When Santos wrote of slavery in the 1580s, he claimed that food shortages were one of a number of reasons forcing people into this system, yet here Miranda claimed that the majority of slaves were victims of food scarcity and plagues:

"Most of them become slaves at a time of famine or grasshopper plague for want forced them to give themselves up as slaves not only to the Europeans, but also to some powerful natives. Some sell their own children to meet the tributes on the land and if they want to release them later on they must give slaves in exchange for each of his children he wants to release. What bigger cruelty! What misery! The poor *mucensses* subject to follow to the letter the custom of the land whether they have a good agricultural year or not and if they do not do it, they are made captive by their landlord. What a cruel law! What barbarian custom!" (Miranda 1766, 106).

This eye-opening account explains how much the system of slavery operated on the Zambezi had changed since the sixteenth century. African chiefs, too, adopted the practice of owning slaves, while *prazo*-holders extorted family members from *colonos* and African communities if lack of food meant they could not meet their tribute payments. This lack of food seems to have been widespread throughout the mid-eighteenth century, and as Miranda again observed, a high proportion of the year was spent subsisting on wild food resources, although this was put down to reasons heavily influenced by colonial ideology:

"They eat such rotten and filthy things that referring to them makes one shy and sick. Finally, they engage in eating, drinking and sensuality at all times and in excess. That is why their harvests do not last longer than six months and for the rest of the year they have wild roots and fruits" (Miranda 1766, 94).

While Miranda does not explicitly refer to drought, Nicholson (1996) reports a later drought between 1744-1745 at Zumbo, while Castro (1763, 63) states that in the year 1758, mines in the Maravi area were abandoned "because of a great drought that was followed by great famine, which forced the residents of Tete to withdraw all their personnel". On the Zambezi, climatic stress (Figure 5.14) resulted in famine, and the general disorder in the Zambezi valley food system, appears to have set-in a cycle of food system dislocation. Numbers of the existing slave population were already subsisting upon wild resources for a substantial part of the year, which was worsened by locust plagues and drought, and led to tributary chiefs and *colonos* selling family members to make up for their shortfall in tribute. People living in small-scale, decentralised African polities such as Barwe thereafter sought protection from the *prazo*-holders as their food supply was hit, meaning even less food was available for the *prazo*-holder to provide for the overall population. One result of this system of land ownership was rebellion, banditry and violence, which in turn affected trade through increased raiding of caravans and the plundering of the *prazos*. This, too, further disrupted the food system, and could also spread amongst other slave groups and to the *colonos*, which led to increased migration to either other *prazos* or local chiefs. The exact numbers of slaves involved in these processes are hard to discern, but the best estimate comes from Miranda, from which Newitt (1995) totalled up 33,500 slaves at the Zambezi settlements and *prazos*.

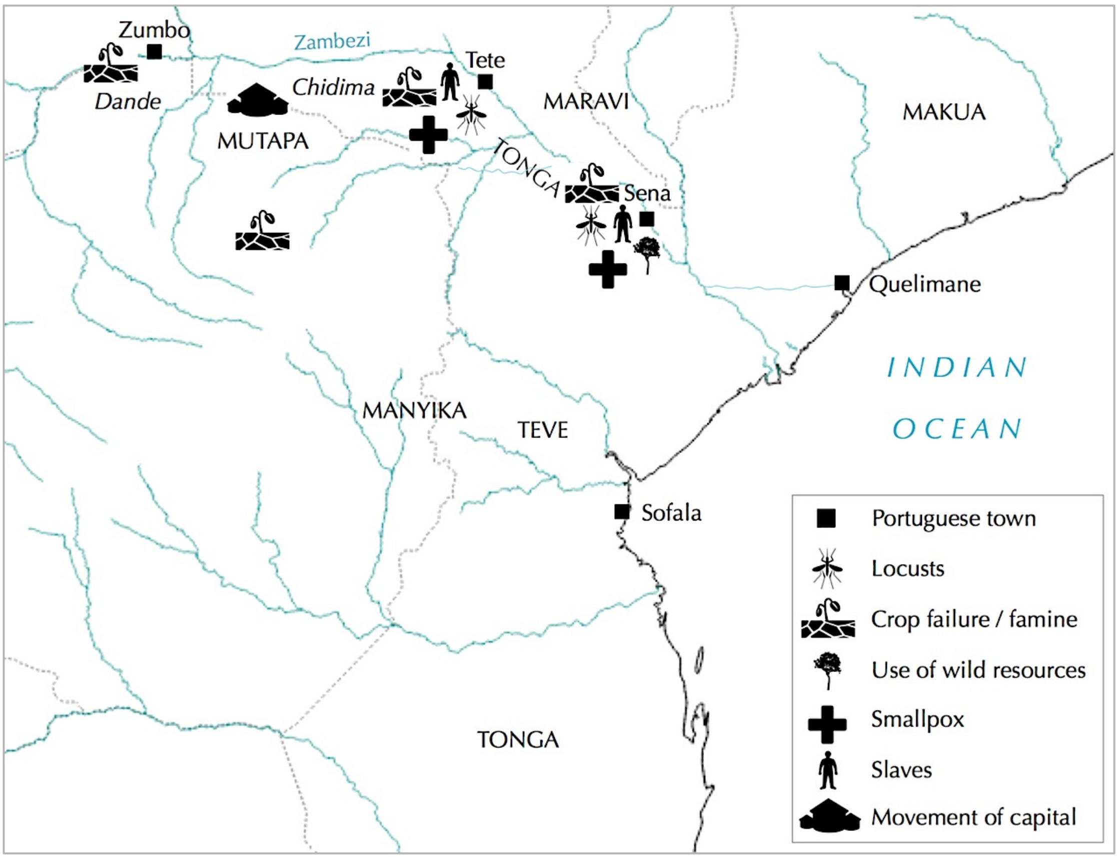

FIGURE 5.14 Accounts of climatic stress and disease in the early- to mid-eighteenth century.

According to Xavier's (1758, 42) account, Sena seems to have returned to a steady state. The town was reportedly "rich in all fresh foods", although he remarked that the place is "not very pleasant". The captaincy of Quelimane and its sixteen *prazos* seem to have fared much better in the eighteenth century. Its agriculture was based upon producing a surplus in the gardens and fruit tree plantations along the coast and in the gardens on the residences of the *prazos*, which was supported by the generally wetter conditions around the Zambezi delta. Quelimane's productivity seems to have resulted in the abandonment of the old system of importing food from Madagascar and the Comoro Islands to Mozambique Island, meaning that this area supported both itself and the gradual rise in shipping traffic for slaves at the time. Xavier also noted that Luabo, the Zambezi delta area proximate to Quelimane, now had sugar mills, which further added to food-related livelihood opportunities. The Sofala area maintained its agricultural production, but the Portuguese town itself was always very sparsely populated, and in the middle of the century Xavier reported that the fort was inundated by the sea due to poor upkeep. Trade continued with Teve and Manyika (Figure 5.13), but was limited to small amounts of ivory and gold.

In the late-seventeenth and early- to mid-eighteenth century, then, a reconfiguration of power and sovereignty took place in southeast Africa. The African polities were once again able to assert their independence, while the Portuguese were pushed back to their towns and *prazos*. As with changes of this magnitude in the previous centuries, some vulnerabilities were reduced, while others were opened up. The most significant of these involved the movement of the Mutapa state to the dry lowlands on in the Zambezi valley, which enforced a more scattered settlement pattern and the loss of cattle, serving to weaken the centre but strengthen the periphery of the state (Pikirayi 2009). There was also growing poverty in the Zambezi towns and hinterlands of Sena and Tete. Internal problems at Sena, aggravated by locust plagues and famine, helped to restrain Portuguese influence, while the reconstitution of society in the Mutapa state, albeit of a lower population, size and prestige, enabled it to remain independent in spite of its ongoing political problems. Significant climate-society interactions in this period consequently include:

- Severe climatic stress in 1714 and the 1730s in Mukaranga and the Zambezi valley
- The shift of the Mutapa state to the Zambezi lowlands at Chidima and the loss of cattle, resulting in an increase in food system vulnerability
- The primacy of climatic stress as a factor in people seeking protection from hunger, yet increasing difficulties in ensuring food supplies on the *prazos* due to internal instabilities and climatic stress
- High capacity for reorganisation in the Mutapa state in the face of climatic stress, external and internal conflict, political instability, livelihood and food system changes, population decline and the movement of the state core itself.

5.7 Climate and socio-political breakdown in Zambezia (1761-1830)

The reassertion of independence in African political units loosened the grip of the Portuguese and pushed them back to the Zambezi and coastal areas, where trade once again formed the mainstay of relations. Nevertheless, the decline in the power, prestige and prosperity of these polities had already set-in. This section examines the role of climate variability in reinforcing this decline and impoverishment from the mid-eighteenth century to the years before Nguni-speaking groups arrived north of the Limpopo.

5.7.1 The Mutapa state to 1830

Political stability, civil war and leadership change was frequent in the Mutapa state to around 1769 (Figure 5.15), and the state thereafter fragmented into the Chidima and Dande areas (Figure 5.3). The 1760s were also a time of drought and locust swarms in the middle Zambezi (Newitt 1995). The results of this breakdown in political authority and climatic stress, according to Beach (1994) and Newitt (1995), were acute problems of banditry, robbery, and the disruption of trade. That banditry only became a serious problem in the eighteenth century, though, relates to underlying shifts in vulnerability. For instance, the lack of cattle in the tsetse-infested heartland of Chidima, and the reduction in other livelihood opportunities such as gold mining, may have encouraged other short-term responses to crop failure, such as raiding for women, food and slaves. The Portuguese withdrew their garrison of the Mutapa capital at this time, but what remained of their lands around Tete was constantly threatened as disorder in the Mutapa state spilled over into the *prazo* lands. In 1769, when Changara commenced his leadership, there was a reduction in civil war. Changara granted the Portuguese free access to the state, as well as permission for the re-opening of the Mukaranga *feiras* deserted 75 years previously. As the trade at Zumbo declined, Pereira sent out African agents to explore the old *feiras* in 1769, but reports came back noting that they had been deserted because "the plagues, wars and famine have wiped out their inhabitants", while in the places people were living, they "lived almost the whole year on fruits, herbs, roots, honey and meat of wild animals" (Pereira 1769, cited in Mudenge, 317). Civil wars between the rival factions returned soon after, and lasted for much of the rest of the century, when knowledge on the state become increasingly scanty.

The Manyika kingdom seems to have remained more stable in the eighteenth century. Its rulers continued to impose strict control of gold extraction, while copper, rubber, cattle, quartz, iron hoes and ivory were traded at the *feira* of Masekesa. An anonymous account in 1780 attested to this:

> "The word of the king is the most inviolable degree and his laws are observed with all respect and, under them is enforced everything concerning the economy and law and order of the republic… he knows how to keep peace in his kingdom by never starting a war unless it is really necessary and avoiding quarrels" (Anonymous 1780, 11).

Towards the end of the century and the beginning of the next, internal divisions weakened Manyika political authority, and upon the death of a ruler the kingdom was thrown into a state of anarchy while succession was settled (Bhila 1982). The end of the eighteenth century, however, appears to mark drought across much of the SRZ in most proxy precipitation records (Figure 3.5), which is also partially reflected in the ships' logbook reconstructions from further south (Chapter 4), known as the *mahlatule* in the KwaZulu-Natal area. Mudenge links this to the beginning of the end for the Rozvi state in the southwest, while in the Chidima area, the drought was reported to have impoverished traders (Newitt 1995). At the time, a chief in the area attacked Zumbo which led to its abandonment. As a result, trade, and consequently the flow of goods into the Mutapa polity declined, while the Portuguese that did maintain contact with the state became more interested in the slave trade than gold or ivory, leading to another pressure on the state (Figure 5.15).

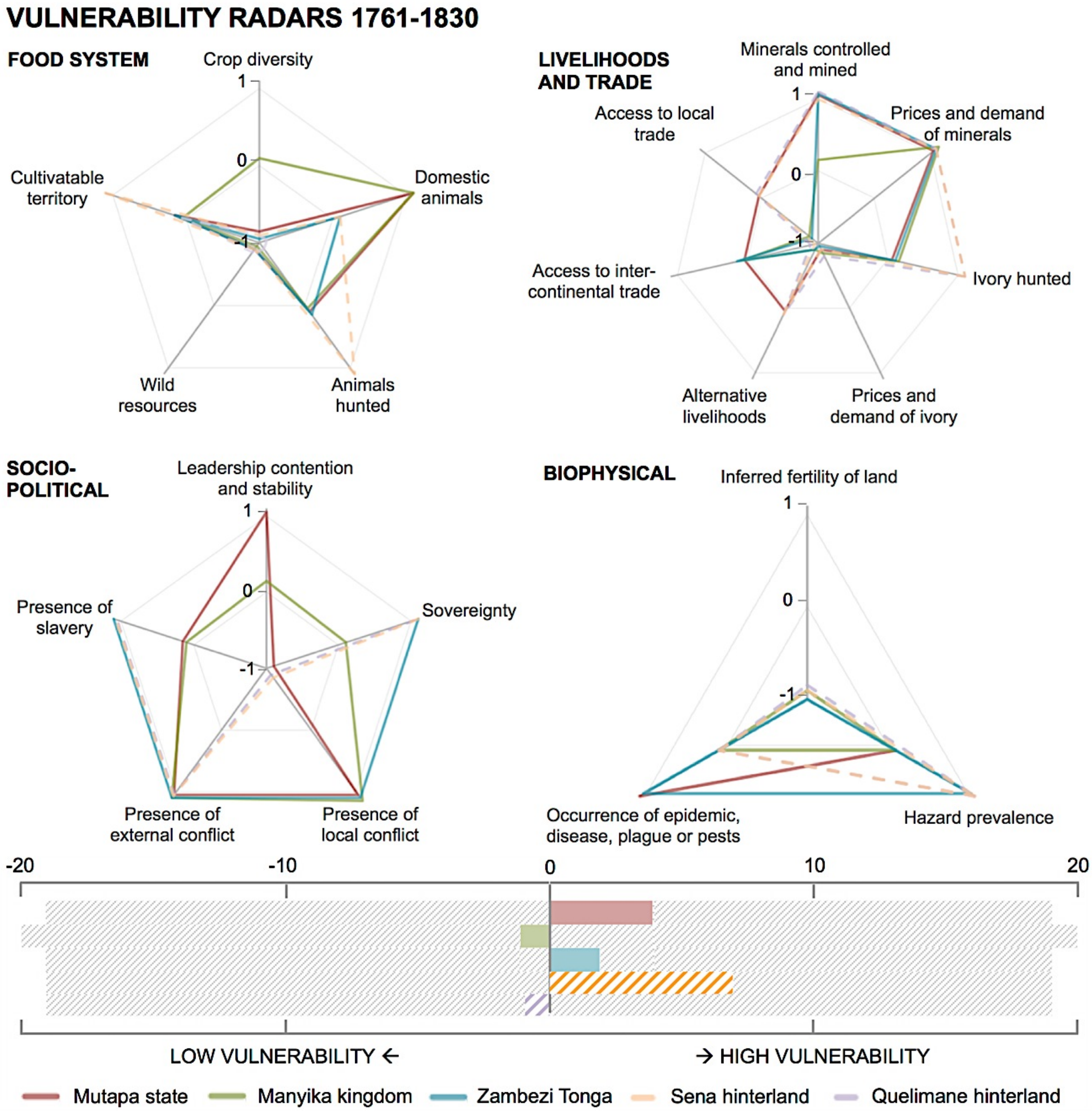

FIGURE 5.15 Vulnerability radars for the Mutapa state, Manyika and Teve polities, Zambezi Tonga, and the population of the Sofala and Quelimane hinterlands 1761-1830.

In an examination of sources held within the Lisbon and Maputo archives, Newitt (1995) argued this late-eighteenth century moisture stress represented a 'great cycle of drought' that lasted until 1830, with extended clusters of dry years between 1794-1802 and 1823-1830. The drought in the 1820s is better-documented in the Portuguese sources, and appears to have affected a wide part of the region (Figure 5.16). Notwithstanding the dearth of sources on the Mutapa state in the early-nineteenth century, the Zambezi valley downstream of Tete was affected by extended drought and famine, with locust plagues arriving in 1828 (Newitt 1988). It is therefore reasonable to assume that the adjacent lowland area of Chidima was also affected by the apparently regional climatic stress of the late-1820s, which impacted upon an already fragmented and politically unstable state. This meant that in the decade prior to the arrival of Nguni-speaking communities, the state, though alive, was characterised by a high number of problems across all levels of society.

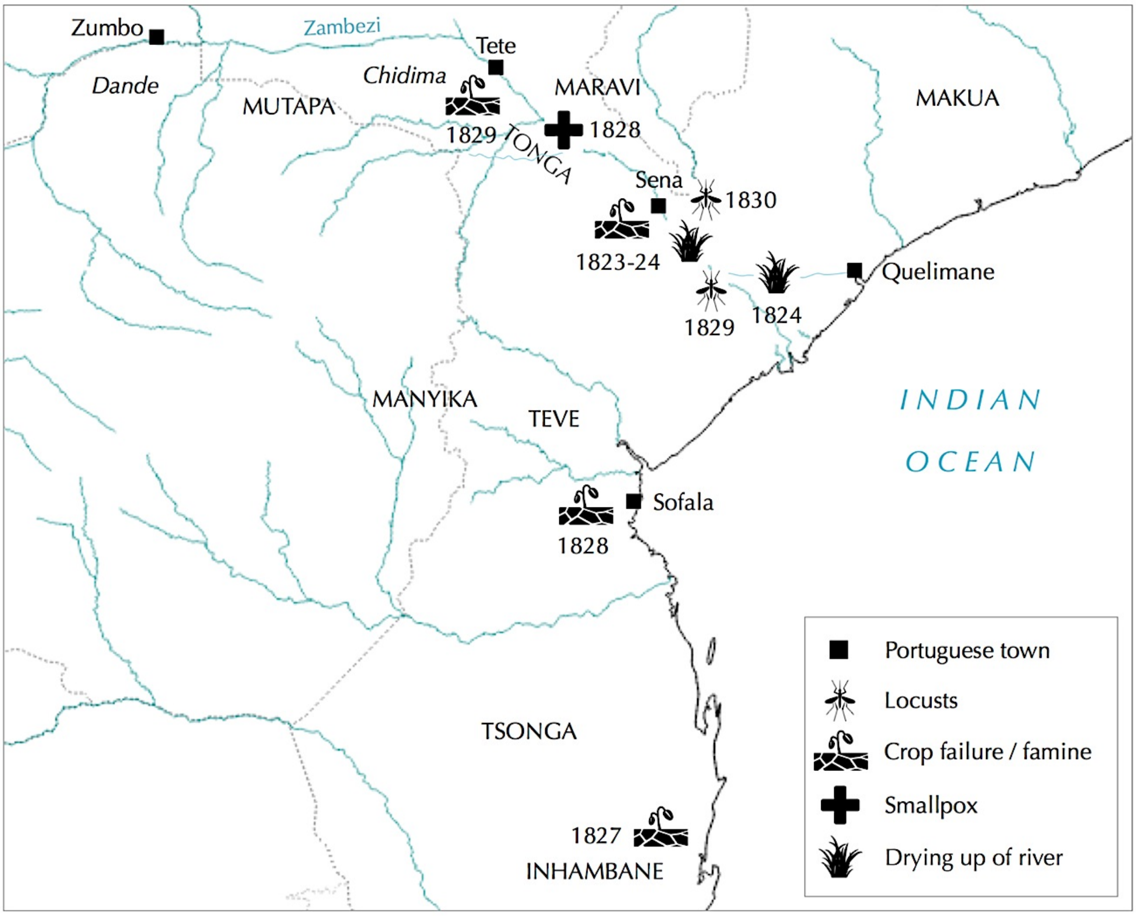

FIGURE 5.16 Reports of climatic stress in the Zambezi valley and Mozambique coast in the 1820s based upon Newitt (1988). Years labelled indicate first mentions at each location.

If the Mutapa at Chidima were highly vulnerable to climatic stress, its limited quality for cattle-keeping meant that no Nguni communities settled in the area itself (Beach 1994). By contrast, the areas of Butua, where the Rozvi were based, and Teve and Manyika experienced considerable pressures of conflict and raiding from groups led by Zwangendaba and Nxaba, which brought about the end of the Rozvi state in the 1820s. According to Mudenge (1988), the early-nineteenth century droughts weakened the Rozvi to these pressures. In the Teve area, Silva (1830) also reported that the combination of violence and banditry caused hunger at the *feira* of Bandire:

> "They spoke of the same shortage of food and people dying [at Bandire] as we have here to a great extent caused by the devastation made by some barbarians designated as Machites who went through there destroying everything" (Silva 1830, 147).

A reference the following year, however, may suggest that successive years of drought were responsible for such hunger, which ameliorated in 1830-1831:

> "The soil of Bandire has changed for it now produces without difficulty maize, big potatoes, Iugo, peanuts, etc." (Silva 1831, 4).

The 1820s marked the breakdown of inter-continental trade with Manyika and Teve, a situation which was forced by multiple factors, including conflict, persistent political instability and succession disputes, the decline of gold mining to negligible levels, and climate variability. The migration and raiding activities of Nguni-speaking communities did cause insecurity, but this was of variable significance, and by its very nature focussed on areas where cattle populations were high like the Rozvi in Butua. Indeed, the desolation reported by later nineteenth century diarists such as Pacheco, Baines and Sealous reflected a process of gradual impoverishment, at times exacerbated and accelerated by increased vulnerability to and magnitude of climatic stress, that begun two centuries before the arrival of Nguni groups.

5.7.2 The decline of Sena and growth of the slave trade

In the second half of the eighteenth century, the importance of Sena appears to have declined, and the seat of government on the Zambezi was transferred to Tete. This probably reflected the situation of the diminished gold trade with Manyika and the increasing importance of the Portuguese-Maravi trade in minerals at Zumbo. At Sena, Miranda (1766) reported the increasing occurrence of elephants and hippopotamuses causing great damage to the crops on the *prazos*, and by the early-nineteenth century, the town itself was in ruins, with its inhabitants in poor health and high rates of infant mortality (Newitt 1995). Around 1810, Ferrão alluded to a general breakdown in food production and social relations on the *prazos*:

> "I cannot ascertain what quantity of grain is collected annually from the plantations, because few of the inhabitants have any idea themselves of what their ground produces, for, as soon as the grain springs up, they are continually making use of it, which causes a great waste, and many in consequence are driven to the necessity of subsisting one-third of the year on wild herbs. The slaves have no certain allowance, but live as they can, which is often by robbing their masters" (Ferrão, 1810, 372).

It was not until the 1820s, however, that this breakdown became complete. According to Newitt (1995, 252), "the severest drought ever recorded" was followed by famine around Sena from 1823 or 1824, which lasted with little interruption until 1829, and smallpox in 1828. Plague locusts also arrived in 1827 and 1829 (Figure 5.16), when Vasconcellos e Cirne wrote that:

> "Day after day the sun was covered by the passage of clouds of these insects and they destroyed the most extensive fields and the interior for league upon league so that even the herds of animals died for lack of food" (Cirne, 1827, cited in Newitt 1988, 21).

Such sustained drought in mid- to late-1820s is found in the ships' logbook reconstructions and in the Nicholson et al. (2012) chronologies for Mozambique and Zimbabwe, although is perhaps surprisingly not reflected in the tree-ring records from northern Zimbabwe (Therrell et al. 2006). The quantity and weight of evidence for climatic stress and famine in the Zambezi valley provided by Newitt (1988) (Figure 5.16), though, is convincing, and appears to have had significant implications for the agricultural economy. As Ferrão's evidence suggests, the labour requirements for agricultural production on the *prazos* had already begun to break down at the beginning of the century, and so the prolonged nature of this drought impacted upon an already vulnerable society. Further disruption to agricultural production meant that the protection and support of the slave populations was undermined, while *colonos*, who struggled to pay tribute, may have deserted the *prazos* altogether, leaving them subject to invasion by bandits (Newitt 1973, 1995). Indeed, in 1829, Cunha wrote to the governor general and described the "deplorable state of decay" in Sena "because of the great famine which has reigned there for four successive years… there are no hands to do the cultivating since all the slaves are scattered through the various lands" (Cunha 1829, cited in Newitt 1988, 34). Drier conditions were also reflected in that parts of the river beds in the delta dried up, preventing the access of canoes carrying trade goods to Sena (Figure 5.16). Thus, evidence suggests that the decline of Sena and its *prazos* to 1830 was highly related to drought and locusts on an agriculturally-dependent society, the growing irrelevance of the town for trade, and to a certain extent, the limitations imposed on this by climatic conditions.

By the coast, the town of Quelimane and its hinterland were less vulnerable to severe shortages due to successive years of crop failure as it could be supplied by the sea, while it also receives more reliable rainfall than the Zambezi valley. Moreover, the economic viability of Quelimane was not solely dependent on agriculture, for this was the period when the international slave trade grew out of Mozambique. Towards the end of the century, large supplies of slaves began to reach the Mozambique coast, including from the Zambezi (Figure 5.17), when demand for labour increased from French sugar producers in the Indian Ocean islands. The Portuguese made involvement with the French slave trade legal in 1785, causing a marked increase in slave exports from the coast, and at the same time, ivory prices rose (Alpers 1975), returning the Mozambique coast to commercial prosperity. The slave trade grew in importance in the two decades between 1790-1810 as dealers in Brazil increasingly turned to Mozambique, while agreements signed with the British in 1815 and 1817 led to the slave trade being limited to southern hemisphere ports, which effectively legalised and bolstered the Mozambique-American trade (Alpers 1975; Newitt 1995). One of the terms of this agreement was that Brazil could no longer import slaves after 1830, which led to a short-term increase in exports from Mozambique, to above 30,000 in 1828 and 1829, in the years immediately prior to the treaty coming into effect.

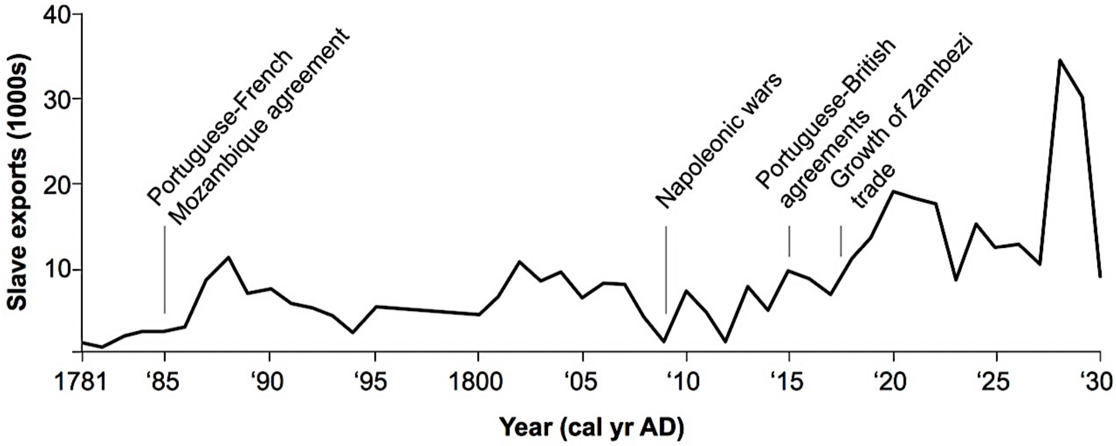

FIGURE 5.17 Slave exports from Mozambique 1781-1830. After Newitt (1995).

One source of increasing prominence to meet the demand was the Zambezi, where slaves were transported to Quelimane and Mozambique, and this may have accounted for some of the depopulation reported by Cunha in the late 1820s. The growing threat of free men being captured and sold abroad in the early part of the century made it easier for *prazo*-holders to maintain their slave populations, while at the same time, existing slave bands were used to conduct slaving expeditions (Newitt 1995; Pikirayi 2003). Newly captured slaves and *colonos* could thereby easily be sold and sent to the Mozambique coast and then shipped to Brazil for quick profits. Although the slave trade at this time was partially demand-driven, this eventual happening also had its roots in the form of clientship that had developed before the Portuguese came to southeast Africa, and became the vehicle for the shipment of slave populations to the coast. With the combination of the breakdown in wealth derived from the gold trade at the Zambezi towns, social instability on the *prazos* and periods of sustained drought, *prazo*-owners may have increasingly sought to make a quick profit by selling their labour force to the coastal towns. Indeed, taking into consideration that famine, aggravated by drought and locust plagues, led people to seek the protection of *prazo*-holders, climatic variability and stress played its part in the multi-causal events that fostered the Zambezi's implication in the slave trade. Key climate-society interaction in this period therefore relates to:

- Recurrent climatic stress in the Zambezi valley, which was a significant factor in the instability, banditry and decline in the lowland Mutapa state at Chidima
- The interaction of climate variability and conflict in the Manyika and Teve polities, leading to their weakening
- The decline and depopulation of Sena due to the interaction a breakdown in social relations on the *prazos*, drought, locust plagues and famine in the 1820s, the slave trade, and pressures of conflict
- The overall breakdown of socio-political order in the Zambezi valley.

5.8 Summary: trajectories of vulnerability (1505-1830)

This comparative analysis of vulnerability and response to climate variability over a wide spatial and temporal scale has revealed a general trajectory towards increased vulnerability in the Zambezi-Limpopo area (Figure 5.18). When combined with the magnitude, direction and frequency of precipitation variability analysed in Chapter 3, this reflects an increase in the recorded impacts and response to climate variability. This situation is most striking for the Mutapa state, whose vulnerability context worsened in almost every period, primarily due to socio-political and livelihood-related factors, and later due to increased food system vulnerability in its new lowland location. The combination of these factors led to a general increase in the significance of drought-related impacts, leaving the state in an irreversible state of decline by the eighteenth century. Nevertheless, the Mutapa state did show high resilience in the face of multiple stressors, and even when central polity authority broke down, the evidence presented here suggests that food production was not dislocated as has been proposed previously.

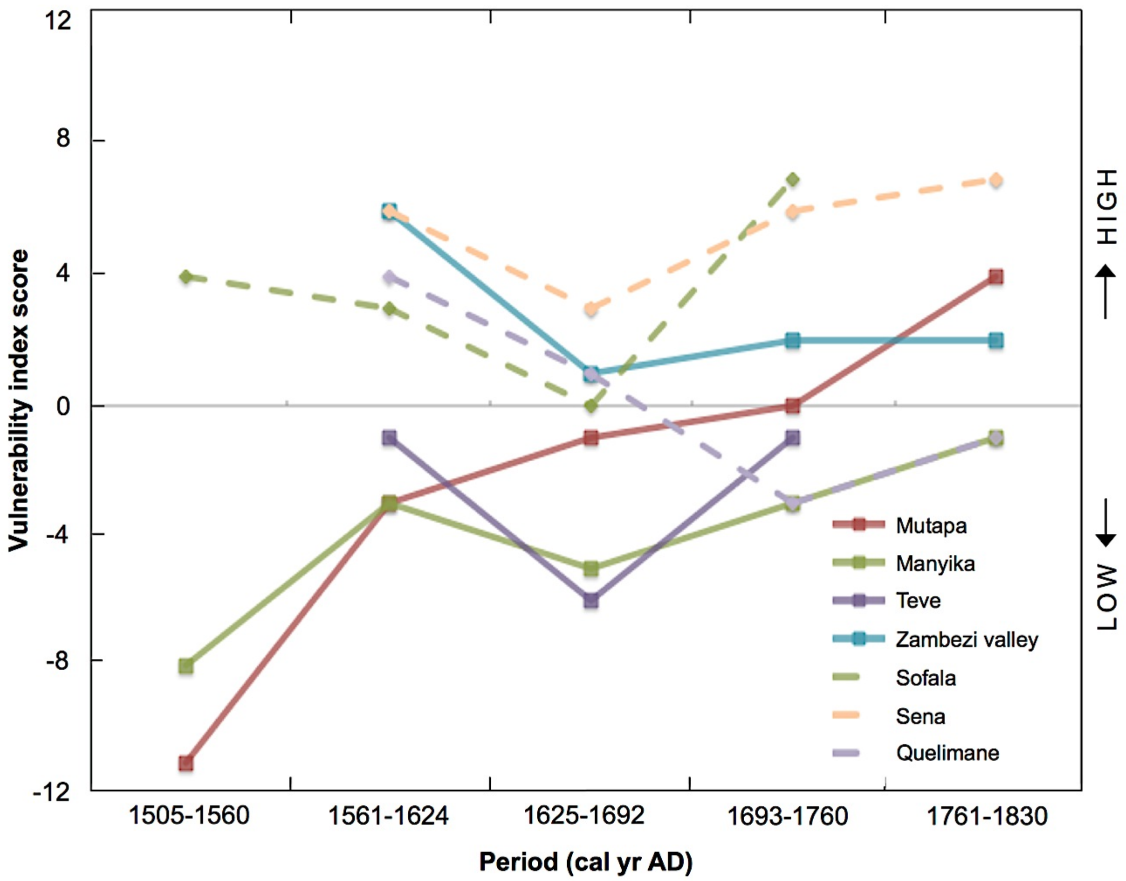

FIGURE 5.18 Trajectories of vulnerability.

This increase in vulnerability was reflected to a lesser extent in Manyika and Teve, where these constituents of vulnerability were not undermined to the extent of the Mutapa state, which in part relates to differences in the degree of Portuguese interest and exploitation in these polities. Although source coverage is slightly lower in these areas, vulnerability seems to have stabilised as early as the late-sixteenth century. A key reason for this appears to have been the alternative livelihoods available to these polities and the degree of control retained over these sectors of the economy, including the ivory and gold trade, despite the decline in political and economic importance of the latter. This is in contrast to the Mutapa state, where the Portuguese concentrated their most exploitative activities, and ultimately contributed to migration away from Mukaranga. Although the lack of cattle in the Teve area increased food system vulnerability on the one hand, the extensive use of hunting and the availability of marine food resources meant that alternative sources of food could be utilised. Therefore, while the lack of reference to climatic stress in these polities is in part due to reduced source coverage, both of these polities were less vulnerable than the Mutapa state by the eighteenth century.

The Zambezi towns and the decentralised Tonga-speaking communities were generally characterised by high vulnerability, and in parallel, frequent occurrences of climatic stress. Although much of the Zambezi area underwent a diversification in food systems, the populations in these areas were exposed to socio-political vulnerabilities stemming from the short-term profit driven *prazo* system, and the at times unstable relationships between Portuguese *senhors* and slaves. Severe climatic stress was present in a number of periods in the above analysis, with locust plagues also prevalent. This is partially related to the drier environment of the Zambezi valley, but it is clear that the occurrence of climate-related stress both occurred in times of high precipitation variability and tended to overlap with other stressors, such as widespread 'total war' scenario conflict or a breakdown in trade. On the other hand, the vulnerability of populations in the Quelimane area remained stable over the periods where sufficient information was available. This relates to a number of factors, including its distance from conflict and the diversity of the food system, while its well-watered situation meant that drought was less frequent. Thus, while the ultimate survival of these political units until well into the nineteenth century demonstrates resilience, the fragility of the political system and the economy was often exposed by external stressors, two of which were periods of high precipitation variability and successive years of severe drought.

Chapter 6. Climate, conflict and food security: the origins and events of socio-political transformation in KwaZulu-Natal (*c.* AD 1760-1828)

Historical studies on the KwaZulu-Natal area in late-eighteenth and early-nineteenth century have done much to aid understanding of the processes of change that spread across a wide region south of the Limpopo. Few recent studies, however, have used the increasing availability of source material to investigate the dynamic of interaction between climate variability, conflict, and, above all, food security, that were once, if simplistically, placed at the heart of explanations for socio-political transformation in this region (see Section 2.3). Although a recent volume by Eldredge (2014) critically and effectively uses European written records and African oral sources to trace the socio-political history of the Zulu kingdom during Shaka's reign, this volume gives only negligible attention to climate or the environment in contrast to earlier work on the origins of state formation in the area (Eldredge 1992). The present assessment seeks to fill this gap by first re-examining the importance of climate variability in socio-political transformation in KwaZulu-Natal between *c.* 1760-1817, and chiefly by investigating the interaction between climate, conflict and food security in the Zulu kingdom as it established political dominance over KwaZulu-Natal in the late-1810s and 1820s.

The first research area will consider the hypothesis that climate variability and the *mahlatule* famine were part of a dynamic that contributed to political centralisation in the late-eighteenth and early-nineteenth centuries, which led to the growth of polities like the Mthethwa and Ndwandwe. However, this section will draw more speculative conclusions, as in the case of Great Zimbabwe, because the reliance upon oral traditions and lesser availability of inter-annual climate records means that climate variability and human activity can only be loosely tied. The approach will become less hypothetical in the re-analysis of the consolidation of the composite Zulu kingdom and the events in adjacent areas throughout Shaka's reign in the 1820s, as dated written sources can be used in conjunction with oral evidence, allowing the significance of climate variability in these processes to be interrogated. The focus on the Zulu kingdom is not to assume that this was the only polity of significance in this part of Africa, or that they were the chief instigators of regional events, but rather that the superior quantity of source material gives greater scope to examine climate-society interactions and for the application of the conceptual frameworks outlined in Section 2.4. As in the previous chapter, specific attention is given to the vulnerability of food systems and the socio-political dynamics that influenced this, which in turn conditioned the resilience and response of communities to climate variability. Conversely, this analysis will not attempt to quantify vulnerability. This is because the research questions asked and sources utilised are not of sufficient breadth to require or generate comparative spatial and temporal perspectives from a range of indicators. Before commencing this evaluation, the sources, methods, and source criticism are discussed.

6.1 Sources and methods

One problem common to many studies of KwaZulu-Natal in this period is that they only make partial use of the range of primary oral and written sources available, or fail to critically analyse the biases and exaggeration that stem from European involvement. This chapter will use both European sources, in the form of written diaries, books or journals published by traders and missionaries, and African sources, in the form of oral traditions collected in KwaZulu-Natal in the early-twentieth century. These sources are of very different origin and style to those utilised in Chapter 5, and are outlined below.

6.1.1 Written sources

The earliest eyewitness records of KwaZulu-Natal are from the observations of Europeans (Table 6.1). The first of these to pass through the region were shipwrecked Portuguese, who left patchy accounts of a relatively narrow trail across the area. These accounts provide some information on the economic and socio-political situation of the people they encountered on their journey to Delagoa Bay or the Cape of Good Hope in the sixteenth to eighteenth centuries, yet it was not until the 1820s that written accounts become sufficiently detailed to use in detailed historical studies.

The permanent installation of British colonial rule at the Cape in 1806 and the exploration of the southeast African coast by the Admiralty had brought it to the attention of British traders. As a result, Francis Farewell and Henry Francis Fynn, along with a group of Afrikaners, Englishmen and African servants set out on an exploratory voyage to the area in 1824, where they landed at Port Natal, now modern Durban. Although Farewell published some letters in the Graham's Town Journal in the late-1820s, it was Fynn who provided the most detailed account of his time in KwaZulu-Natal. By this time, the Zulu kingdom was firmly established under Shaka, and Fynn's diary includes accounts of his frequent contact with the Zulu ruler. Fynn lent his original notes to his brother, which are said to have been buried with him on his death sometime before 1830. While he rewrote them a few years later, it was not until 1951 that the diary was eventually edited and published. Fynn (1836, 15-16) wrote that his objective was to offer "an insight into the revolutions the various tribes have undergone and the rise and progress of the Zulu nation", however, some controversy over the diary as a source on the Zulu kingdom emerged after the discovery of a letter received from Nathanial Isaacs, a fellow trader in KwaZulu-Natal, in 1832, which read:

> "I am most anxious, my dear fellow, to see your work out – when do you intend to publish? – the sooner the better, and endeavour to exhibit the Zooloo policy in governing their tribe, I mean show their Chiefs both Chaka and Dingaans treachery, and intrigues. Make them out as blood thirsty as you can, and endeavour to give an estimation of the number of people that they have murdered during their reigns, and describe the frivolous crimes people lose their lives for. Introduce as many anecdotes relative to Chaka as you can, it all tends to swell up the work and makes it interesting" (Fynn letters 1835-1860, 10).

Despite the apparent suggestions of this letter, much of Fynn's diary was written while he was at Port Natal, before the letter was received (Eldredge 2014). Moreover, notwithstanding references condemning Shaka, Eldredge (2014) notes that Fynn's narrative is equally reflective of his attachment to the local communities into whom he informally married and regarded as victims of repressive leadership. While such biases are crucial in analyses of Shaka's leadership and the scale of violence, then, these debates should not obstruct the *critical* use of this source to investigate food system vulnerability and evidence of climatic stress. Nonetheless, related observations on culture, governance and conflict must be treated carefully, not least as Fynn's diary was one of a number of sources which fostered the notion of the '*mfecane*'. On a similar note, Wylie (1995) has also shown that Fynn's tendency to exaggerate, although in many cases overt, frequently permeates his statements. Perhaps also relevant here is that Fynn had to rewrite part of the original material, meaning detail on weather- and climate-related factors may be either missing or unreliable.

The other major source on KwaZulu-Natal at this time is Nathanial Isaacs' two volume *Travels and Adventures in Eastern Africa*, published in 1836. The book contains an account of Isaacs' experiences as a trader based at Port Natal, where he arrived with Captain James King in 1825. Isaacs and King travelled with the objective of making contact with the party led by Farewell and Fynn, and to "open an intercourse with the natives" (Isaacs 1836, Vol. I, xviii). However, King's boat was wrecked upon arrival, so he and Isaacs remained there until a replacement could be made. Isaacs resided intermittently in KwaZulu-Natal until 1832, travelling extensively and partaking in the ivory trade. The letter from Isaacs to Fynn in 1832 and his hopes to excite the European audience of his book certainly suggests that his accounts contain distortions and exaggerations, especially concerning Shaka's rule (Etherington 2001). Thus, as with Fynn's diary, particular caution will be used when analysing evidence on governance, as well as the nature and causes of conflict, but it is accepted that critical analysis of economic, livelihood and food system aspects can contribute to this investigation.

TABLE 6.1 European sources consulted relating to early-nineteenth century KwaZulu-Natal.

Source	Location	Timeframe	Information
Stuart and Malcolm (1969)	British Library, London	1824-1830s	Diary of Henry Francis Fynn (Fynn 1836), first-hand accounts of KwaZulu-Natal
Fynn collection	KCAL, Durban	1835-1860	Fynn letters
Maclean papers	KCAL, Durban	1826-1828	First-hand account of the Zulu kingdom
Garden collection	KCAL, Durban	1851-1853	Two volume diary of time spent travelling in KwaZulu-Natal with Fynn
Theal (1898-1903) (9 vols.)	British Library, London	1552-1830s	Records from shipwrecked travellers and British Admiralty
Bird (1888) (2 vols.)	Online	1495-1845	Annals of Natal, compiled evidence of Fynn, Shepstone and others.
Gardiner (1836)	Online	1835	First-hand account of KwaZulu-Natal
Isaacs (1836) (2 vols.)	Online	1825-1830s	First-hand account of KwaZulu-Natal

A number of other eyewitness accounts were written on KwaZulu-Natal from the 1820s and 1830s. The first of these was by a young teenage boy named Charles Rawden Maclean, referred to as "John Ross" by Fynn, who had lied about his age and ended up stranded with the Natal traders in 1826. Maclean met Shaka that same year, and arguably got a closer insight into the internal workings of society in Shaka's then capital, Bulawayo, than any other European (Eldredge 2014). Maclean stayed in KwaZulu-Natal for three years, but only wrote of his experiences in his later life, which he spent on trade vessels in the Atlantic. Missionary Allen Gardiner travelled in KwaZulu-Natal in 1834-1836, and published his observations on Zulu customs, while an additional account from the early-1850s comes from Captain Robert Garden, who kept a diary of his travels with Fynn in KwaZulu-Natal, and this reveals additional material to that found in Fynn's diary. These accounts therefore supplement the two more well-known eyewitness accounts of KwaZulu-Natal in the 1820s. The reports, though of variable reliability, represent unique, first-hand accounts of the Zulu kingdom and its neighbours at this time. Furthermore, in contrast to the strongly utilitarian focus of the Portuguese documents considered in Chapter 5, each of the observers frequently turned their attention outwards from the wagon camp of European society, and offer considerable information about African society itself. Despite their potential value, though, these sources must be supplemented by oral histories and traditions where possible to be used confidently and robustly.

6.1.2 Oral histories and traditions

Late-eighteenth and early-nineteenth century history was also told by African communities in the form of oral histories (eyewitness accounts) and traditions (passed down through one or more generations). To date, only limited use has been made of the body of oral sources that exist, while according to Eldredge (2014), many studies that have considered these are flawed by unintentional misunderstanding or uncritical acceptance. The major body of oral evidence was obtained through recorded interviews conducted by James Stuart, a Zulu interpreter and clerk to the Resident Commissioner and Chief Magistrate in Pietermaritzburg in the 1890s. Stuart's role led him to an interest in the history of the Zulu communities he administered, and between the 1890s and 1920s, he interviewed over 150 men and a handful of women at his home. Stuart's informants were primarily the children and grandchildren of those who had lived in Shaka's reign, though a number of those interviewed had lived in this period. Stuart left behind an extensive collection of assiduously recorded interview notes, which have since been published and translated by Wright and Webb in an ongoing six-volume series. Owing to his meticulous recording, these sources are explicit in their origins and points of transmission, yet this evidence has been criticised as 'tainted' by some as it was recorded by a colonial official with biases typical of men of European descent born into nineteenth century colonial Natal (Cobbing 1988b). Despite such claims, the volumes make it clear that Stuart challenged the informants to provide detail and questioned inconsistency where it was present (Eldredge 2014). Much like the written sources, the traditions contain exaggeration and fictional elements, but these were documented as emphasis rather than fact. To write all of this evidence off, therefore, is to ignore the care and precision applied by Stuart in its recording. Indeed, this evidence is paramount to an understanding of the role of climatic stress and food security in socio-political transformation in KwaZulu-Natal.

One further source of oral evidence frequently used is the published work of the missionary A.T. Bryant, the most famous of which is his 1929 *Olden Times in Zululand and Natal*. However, several issues make use of this source problematic (Wright and Hamilton 1989; Eldredge 2014). While Bryant did publish oral evidence, inbuilt in his writings are his own fictional inventions and exaggerations which he wrote as an amateur historian with the aim to entertain a European readership. This was admitted by Bryant himself, who in a letter to James Stuart in 1929 spoke of the "dearth of solid historical stuff" and "frequent presentations of obvious trifles and historical inessentials" (Bryant 1929, cited in Eldredge 2014, 15). Bryant's work is therefore of very limited value as a primary historical source, and has been widely discredited as such (Wilson and Thompson 1969; Wright and Hamilton 1989; Wright 2010; Eldredge 2014). Its mistaken assumptions and distortions about the emergence of the Zulu kingdom, however, persisted in the work of some scholars (Hall 1976; Ballard 1986). As a secondary source, Bryant's work is in keeping with its historiographical contemporaries in that emphasis is placed on the military and political organisation of 'tribal' society (Wright and Hamilton 1989).

Oral histories and traditions must also be critically consulted, for they contain ideological content reflecting both the interests of rulers and the products of political struggles that take place between the rulers and the ruled (Wright and Hamilton 1989). Traditions therefore express worldviews that where possible must be unpacked and cross-checked against other testimonies and independent primary evidence to be used with confidence. Another advantage of the *James Stuart Archive* (*JSA*), however, is that interviews were conducted with people from a number of geographic areas, family lines and political affiliations, which means that the voices within the traditions were both opposed to, and supportive of, Shaka's rule (Eldredge 2014).

6.1.3 Investigating food security, climate and conflict

Utilising and combining the source material introduced above presents a number of challenges, primarily relating to bias and reliability. These issues can be addressed by appropriate source criticism, and the approach adopted by Eldredge (2014) is broadly followed here. Essentially, this means that the reliability of information held within independent sources will be evaluated by its presence or absence in others, thereby allowing confidence and reliability to be assessed. Thus, if evidence appears in multiple, independent sources, that is, oral and European evidence, then it is regarded as more reliable even though the sources may disagree in their details. By contrast, if evidence appears in only one source, it will be treated as less reliable.

While this scrutiny can aid the removal of bias and fabrications in the oral and European sources, this method will only be rigidly followed where the evidence concerns historical events, practices or customs. On the other hand, the varying foci of the source content necessitates that where evidence relates to aspects such as climate variability, or even food system dynamics, the European sources will be drawn upon more extensively. This is because the fully dated records kept by Fynn, Isaacs and Gardiner were written at the time and thus sometimes recorded weather and climatic phenomenon, crop failure, famine and disease with a much higher degree of spatial and temporal accuracy. The oral evidence, by contrast, was mostly recorded over half a century after such events took place, and primarily draws attention to renowned famines such as the *mahlatule* and *mbete* rather than the specifics of the rainy season and food production in single seasons. This means that in some cases, where there appears to have been no motives for Europeans to alter the evidence for their own interests, one type of source material will be drawn on more than the other.

Using these methods, the sources will be analysed according to the frameworks outlined in Section 2.4. Analysis of the period *c*. 1760-1817 (Section 6.2) will rely upon a broader range of sparse evidence to re-assess suggestions that climate variability, combined with food system changes such as the adoption of maize cultivation, played a part in political centralisation. Climatic reconstructions such as proxies from KwaZulu-Natal and the logbook reconstructions (Chapters 3 and 4) provide context for questioning this. Contemporary or later oral and written evidence will then be used to examine changes to the vulnerability context of the region. Specifically, this will focus on how the processes of centralisation observed in polities such as the Mthethwa influenced the impact of climatic changes and higher precipitation variability in this period. The later analysis of food security, conflict and climate variability in the Zulu kingdom in the 1820s (Section 6.3) is aided by a greater quantity of source material. Oral traditions give numerous accounts of life under Shaka's reign, while European observers wrote extensively on food production, food system stress, internal socio-political dynamics and conflict, yet only sparsely on climate variability itself. Therefore, Section 6.3 will primarily examine the vulnerability of the Zulu food system and that of its subordinate chiefdoms, analyse the extent of food system stress in KwaZulu-Natal in the 1820s, assess how much of this was borne out of heightened conflict, and then examine whether the precipitation variability was a significant factor in the events of these years. As previously stated, this will take the form of written analysis, with illustrative quotes being used where appropriate. As in Chapter 5, this investigation will be attentive to other causal factors, but will not discuss these at length as the superior quantity of source material, especially in the 1820s, means that the analysis will mostly focus on the dynamic of interaction between food system vulnerability, conflict and climate. Crucially, however, the analysis will be framed by the chronology of historical events within and beyond KwaZulu-Natal.

6.2 Climate and the origins of political transformation in KwaZulu-Natal

The range of explanations for the development towards centralised political units in KwaZulu-Natal in the late-eighteenth and early-nineteenth century are well-known. Trade, population growth, the formation of age-set groups (*amabutho*), the elaboration of politically important rituals, as well as strong leaders, all have general acceptance in the literature as key contributory factors. Some scholars also place climate variability and the adoption of maize in this group of dynamics, beginning with an apparent amelioration of LIA cool-dry conditions after *c*. 1750, and intensifying in the aftermath of the *mahlatule* famine at the turn of the nineteenth century. These factors, mostly due to lack of evidence, remain speculative, but through the incorporation of new historical climatic evidence, a re-interrogation of oral traditions, and cautious use of later European written records, this section re-examines these possible lines of explanation.

6.2.1 Shifts in vulnerability: climate, maize and trade (*c*. 1760-1790)

The last half of the eighteenth century was characterised by a number of major shifts in the vulnerability context of the populations and political units of KwaZulu-Natal, three of which relate directly or indirectly to the dynamics of interaction between climate and society. The first, and the backdrop to several other changes, was the apparent shift from severe LIA cool-dry conditions detected in almost all palaeoclimate proxy records (Figure 3.5), to the warmer and wetter conditions detected in the Karkloof tree-ring record in the second half of the eighteenth century (Hall 1976). The reliance of this proposition on a single tree-ring sample, despite its location within KwaZulu-Natal, is problematic, and cannot alone demonstrate that either local precipitation did undergo an increase or that this was significant for human livelihoods. The recent development of diatom records from Lake Sibaya, KwaZulu-Natal (Stager et al. 2013), although of a relatively low resolution, show good correspondence with the Karkloof record (Figure 6.1). If these proxies are taken together, a recovery of precipitation is evident from at least *c*. 1750, which then exceeds the means of both proxies by about *c*. 1760. By *c*. 1770-1780, inferred precipitation reached its highest levels in the entire tree-ring record, and since *c*. AD 800 in the Lake Sibaya diatom (Section 3.2). This trend towards wetter conditions is also observed in the proxy records from Lakes Nhauhache and Nhaucati in south-eastern Mozambique (Ekblom and Stabell 2008; Holmgren et al. 2012), and strongly indicate that this period was marked by predominantly wet conditions.

6.2.1.1 Precipitation variability and the spread of maize

While it is important to note that the aforementioned proxy records are the only long-term, relatively high-resolution records available from KwaZulu-Natal, and are subject to limitations, their precipitation inferences give weight to, or at least do not rule out, the hypothesis that generally wetter conditions facilitated the production of higher crop yields from about *c*. 1760 (Hall 1976). According to Hall, a key impact of this shift in precipitation conditions was to increase the production potential of marginal agricultural land (Figure 6.2), which mostly consisted of hill-slopes with low moisture retention and highland areas with agriculturally poor soils. In the early-eighteenth century, Hall states that this land was only suitable for agricultural production in anomalously wet years in the context of reduced mean annual rainfall during the LIA, and thus could not be continually exploited. That wetter conditions after *c.* 1760 followed around two centuries of persistent and intense drier spells (Figures 3.6 and 6.1), certainly could have increased the proportion of annually cultivatable land. Nevertheless, there is little evidence to suggest that the climatically enhanced agricultural potential of these marginal lands alone led to widespread cultivation or population growth in these areas in the late-eighteenth century. Rather, a more significant shift in climate-society interaction came with the spread and cultivation of maize by some groups in KwaZulu-Natal from approximately the early- to mid-eighteenth century. While evidence here is also sparse, there exists enough to suggest that maize was part of a multi-causal pathway that contributed to socio-political change in parts of the region.

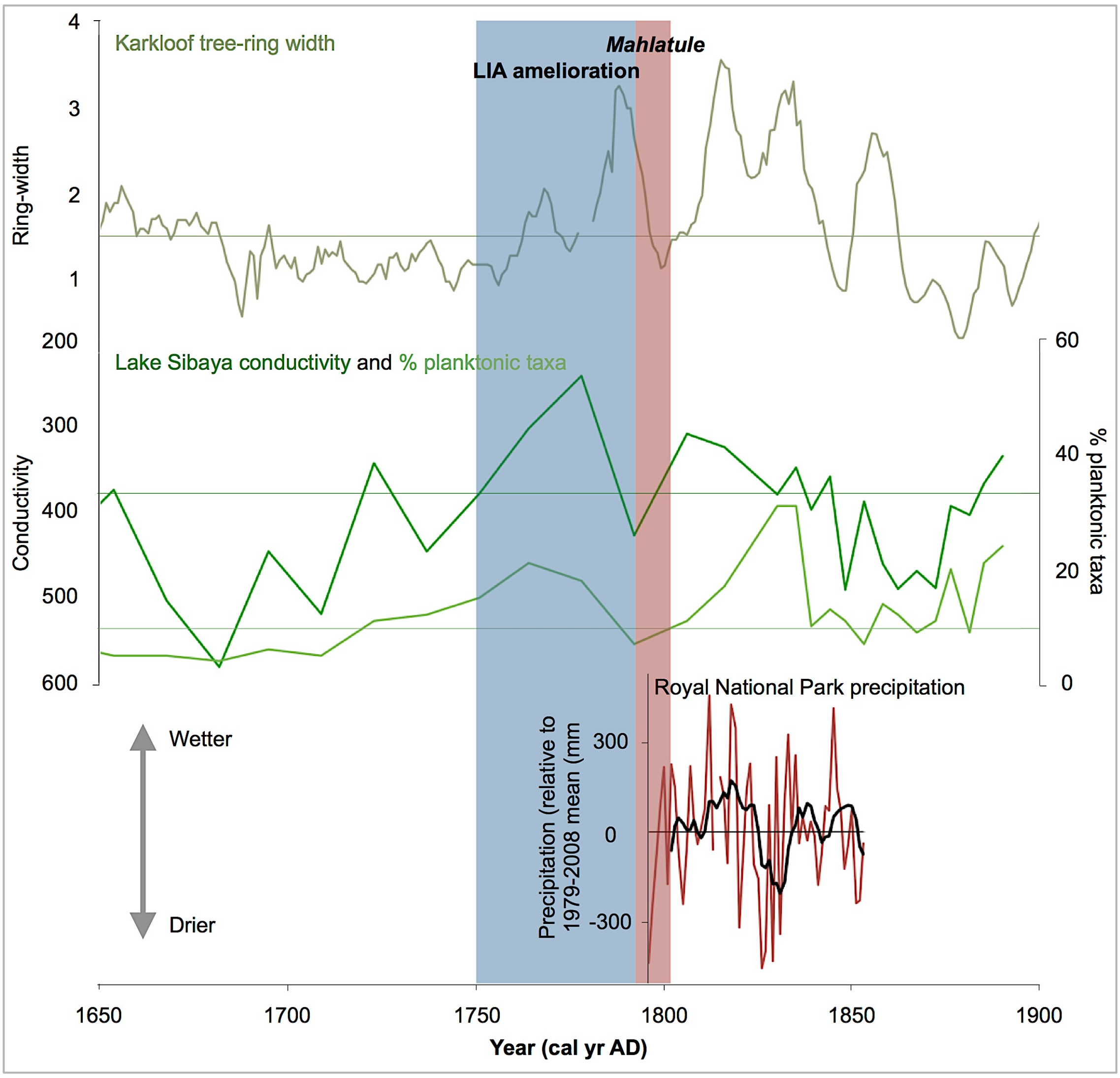

FIGURE 6.1 KwaZulu-Natal palaeoclimate proxy-documentary records.

Evidence for maize cultivation in the eighteenth century is patchy and thus it is difficult to assess its relative importance across KwaZulu-Natal. In the absence of archaeobotanical remains, Maggs (1982, 1989) has shown that the presence of large grindstones, associated with the preparation of maize, were predominant in the early-eighteenth century at two sites in the KwaZulu-Natal interior grasslands including Mgoduyanuka (Figure 6.2). As no such evidence is available for the Phongolo-Thukela area of KwaZulu-Natal at this time, this may indicate that maize first spread across the well-watered parts of the highlands, perhaps indirectly by way of the 'trade convergence zone' on the South African highveld. As Section 2.3.2.2 explained, maize has a relatively short growing period, has higher yields per unit of land and labour than any other grain, yet is more water-demanding than sorghum, and is highly sensitive to drought in its early growing period (McCann 2001). Cultivation of maize was therefore a calculated risk, but its ability to withstand a shorter growing season over slow-maturing sorghum may have offered advantages and aided its expansion, even in the drier early-eighteenth century. It is therefore possible that maize was an 'emergency crop' in parts of the KwaZulu-Natal highlands, as suggested in other areas of southeast Africa such as the Limpopo and Eastern Cape (Crais 2003; Ekblom et al. 2012). As wetter climatic conditions occurred in the latter half of the eighteenth century, maize cultivation may have become less of a risk in these areas, and could have produced multiple crops in an extended growing season. This was later evidenced by Isaacs (1836), where three maize harvests were reaped in some years. The increased food production and reduced risks of moisture stress may therefore have aided population growth in the interior.

The importance of maize in the crop mix in the coastal lowlands and Phongolo-Thukela area in the eighteenth century is less clear, and the best evidence comes from John Gama, one of Stuart's interviewees, who stated in 1898 that:

> "Originally there was no maize; only sorghum was known, and the people were dependent on it. It was sorghum that was greatly prized. I am of this opinion because often when I was a boy I saw them cultivating maize in small plots only, to provide a little food for the autumn. It is clear that sorghum was the first crop, for I and others used to ask why little maize was cultivated. The old people would reply that maize had been unknown before and had been introduced only recently. They thought that maize seed had come from the small settlement of whites at Ndinisa (Delagoa Bay). That is all they said. The old people who told me this were deceased long ago" (John Gama, 142).

As Gama was born in 1841, it is reasonable to assume that the elders he refers to were born in the latter decades of the eighteenth century, and that maize was a "recent" introduction at that time, probably as a result of increased trade connections with Delagoa Bay. Perhaps of more interest, though, is that Gama's testimony notes that maize was only cultivated in small plots in his youth in the mid-nineteenth century. This evidence appears to be corroborated for the 1820s-1830s in Fynn's diary, which states that maize was not a dominant staple among the Zulu but formed part of a mix of sorghum and millet. The reasons for this are unclear, as it would be expected that maize had greater suitability for the soil and land in well-watered lowland areas (Figure 6.2). Yet simple application of the premise of 'favourable' climatic conditions is problematic, and conversely, it may be the case that when maize reached these areas in the late-eighteenth century, the much wetter climatic conditions hindered the establishment of maize cultivation. Indeed, unlike sorghum, maize is highly sensitive to waterlogging in its early growing period, and an increased occurrence of very wet years could have exposed local agriculture to a different kind of moisture stress. Such conditions occurred in some years in the apparently drier early-nineteenth century, as Fynn wrote that excess rainfall was among a list of factors that *inyangas* (rain doctors) were charged with preventing.

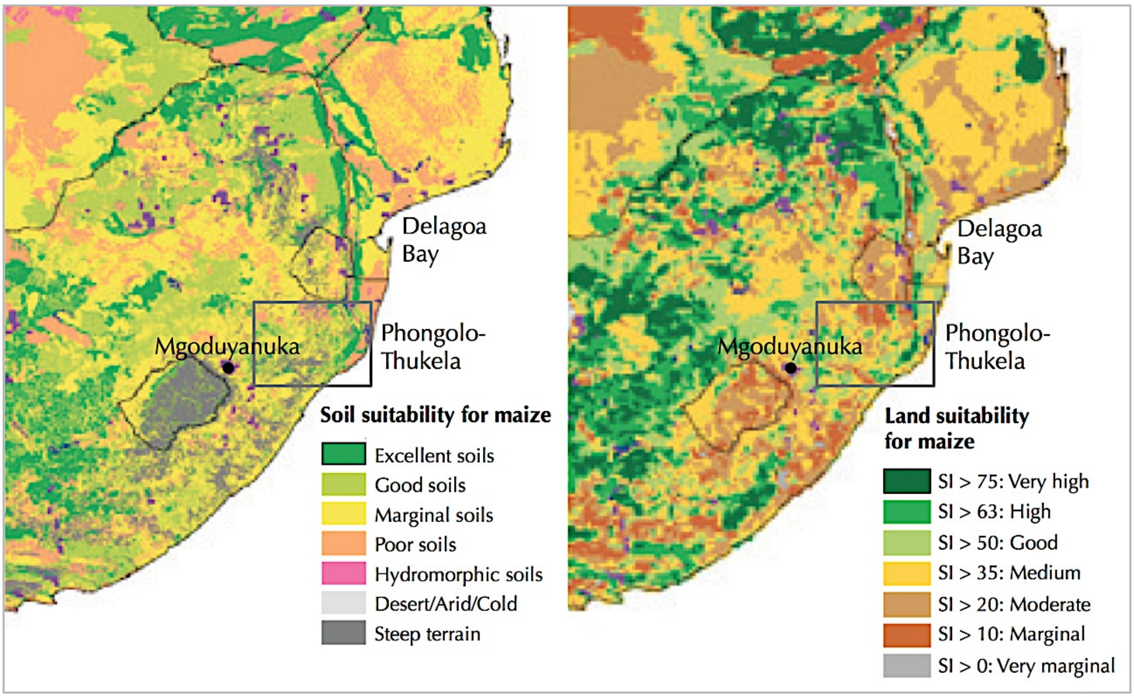

FIGURE 6.2 Soil and land suitability for maize. Data source: Soil Atlas of Africa (2013). Highlighted area: Phongolo-Thukela area, KwaZulu-Natal. Note that these indices do not consider rainfall, of which the highlighted area receives a relatively high amount.

One other line of evidence further complicates this picture. This is found in the oral testimony of Baleka ka Mpitikazi which alludes to the birth of Shaka in 1787. Here, Baleka stated that Shaka's mother, Nandi, became pregnant at a time of disease:

> "Before the name Tshaka [Shaka] became current there was a disease which called people's stomachs to swell out; the name of that disease was '*itshaka*'. So when Nandi [Shaka's mother] was pregnant, people were constantly saying that she was sick, suffering from *itshaka*, and she was continually being given medicine" (Baleka ka Mpitikazi, 5).

The significance of this statement is that the disease in question appears to be kwashiorkor, a nutritional condition that causes swelling of the belly, and is associated with dependence on a maize diet, lack of protein, or general famine (Williams 1933; McCann 2001). Eldredge (2014) overlooks this tradition, and points to another which claims that *itshaka* was a word used to cover for the pregnancy of an unmarried girl. However, the other informant, Jantshi, also notes that *itshaka* referred to a disease, which may have been prevalent in the late 1780s, and as such means that the extensive cultivation of maize in the Mthethwa-Zulu area at this time cannot be ruled out.

The evidence on maize cultivation in KwaZulu-Natal at this time is highly fragmentary, and the extent to which it was cultivated is therefore uncertain. While maize does not appear to have been the dominant crop cultivated across all parts of KwaZulu-Natal at this time, it was probably a significant constituent in the crop mix in certain areas in the late-eighteenth century. In parts of the interior grasslands, where maize appears to have been a staple, its high yields, encouraged by contemporaneous wetter conditions, could have contributed to population growth (Maggs 1982, 1989; Ballard 1986; Huffman 2004, 2006, 2007; Wright 2010). Although this pathway remains a possibility, it is questionable as to how population growth in these marginal and highland areas provided stimulus for socio-political centralisation. Indeed, research has shown that the important development of *amabutho*-based social and military organisation originated in the coastal polities such as the Mthethwa, where the extent of maize cultivation is unclear. On the contrary, similar processes elsewhere may have owed more to a defensive response to Mthethwa growth or simply as an imitation of this new organisation (Wright 2010; Eldredge 2014). Such a response may itself have been a factor in the increase in stone-built structures in the interior, often used as a proxy for population increase. Thus, if wetter conditions were important in these areas, then this may have only aided, rather than promoted, the move towards more centralised and stratified chiefdoms.

6.2.1.2 Trade, cattle and amabutho

A number of economic, social and political changes also reframed the vulnerability context of KwaZulu-Natal to climate variability in the last third of the eighteenth century. Along with Zwide's Ndwandwe chiefdom, the Mthethwa under Dingiswayo had consolidated authority over neighbouring chiefdoms. This was made possible by the introduction of *amabutho*, the system of social organisation based on the recruitment of age-based groups, sometimes referred to as regiments, by Dingiswayo, and later adopted by Senzangakona's Zulu chiefdom. The introduction of *amabutho* in part demonstrated a rapid response to competition over new trade opportunities. Specifically, after 1750, the ivory trade at Delagoa Bay increased markedly, offering its exporters access to metals such as copper and brass, as well as prestige goods like beads, which could increase a chief's wealth and coercive power. The changes in trade were therefore accompanied by those in social organisation, and youths were now incorporated into *amabutho*, where they received training for hunting and warfare (Hedges 1978; Wright 2010). To these ends, the 'productive forces' of agriculture, through maize cultivation, and hunting, through changes in social organisation, were transformed in different areas in KwaZulu-Natal. This dynamic was further changed by the fall in demand for ivory from around *c.* 1780, and its replacement by demand for cattle to supply American whaling ships. This shift was of deeper significance in

KwaZulu-Natal than the ivory trade, for cattle were of much higher social value, as they formed the basis of exchange and investment, while they were also a vital component of the food system. As Mbovu ka Mtshumayeli, one of Stuart's informants put it, "our great bank is cattle" (Mtshumayeli, 28). Fynn (1836, 48) later claimed that it was the Mthethwa that "monopolised" this trade with Delagoa Bay through the intermediaries of the Mabhudu or Thembe chiefdoms, and described its scale:

> "In the first year of his [Dingiswayo's] chieftainship he opened a trade with Delagoa Bay by sending 100 oxen and a quantity of elephant tusks to exchange for brass and beads. Prior to this, a supply of these articles was brought to that country from Delagoa Bay by the natives. The trade thus opened by Dingiswayo was henceforth carried on an extensive scale, though the Portuguese never in person entered the country. The encouragement held out to ingenuity brought numbers round him, liberal reward in cattle being given to any of his followers who devised anything new or ornamental. Milk dishes, pillows, ladles of wood, ivory earrings, or snuff spoons were produced… A brass manufactory was also established; generally a hundred men being employed in that work" (Fynn 1836, 10).

According to Hall (1976) and Ballard (1986), this export of cattle was made possible as wetter conditions allowed livestock populations to grow substantially in the late-nineteenth century. This would seem to be reflected in the increased importance and quantity of cattle in bridewealth (*lobola*) exchange for wives. According to oral evidence, *lobola* for the general population grew from one to 10 heads of cattle:

> "The ordinary people's *lobola* consisted of the payment of cattle, at first one or two head, then three. Afterwards this was raised to five, with an additional beast called the *lugege*. Later on 10 heads were claimed" (Mabola, 7).

However, rather than climatic conditions, this seeming increase in cattle was perhaps equally due to the centralisation and accumulation of herds through increased tribute demands in certain polities, like Dingiswayo's Mthethwa, than through natural increase enhanced by wetter conditions across the whole of KwaZulu-Natal. The accumulation of herds was achieved through raiding and the capture of booty by the centrally controlled *amabutho*. Although this was a frequent occurrence before the mid-eighteenth century, raiding and counter-raiding were amplified in the late-eighteenth century due to both increased external demand through Delagoa Bay, and increased internal demand to replace the exported cattle and reward the *amabutho*. These new dynamics may therefore have allowed Dingiswayo to enforce the submission of neighbouring political units to his overlordship. Although this was often referred to in oral testimonies as the 'killing of nations', Dingiswayo established his dominance throughout the region by a process of incorporation and subordination, which involved little violence (Eldredge 1992, 2014). Fynn (1836, 10) stated that Dingiswayo re-distributed a proportion of the defeated group's oxen to his *amabutho*, while cows were generally returned to their owners in order to facilitate continuum in local reproduction, to ensure "amicable union" and that their submission was at least in part on a voluntary basis. Similarly, through encounters with Zulu informants, including Shaka himself, Fynn claimed that Dingiswayo gave strict orders that such raids should not involve the plunder of all property and the destruction of all the people, and gave an example of one instance to the contrary:

> "In one instance they had attacked a tribe not willing easily to submit and during the contest, the Mthethwa destroyed their cooking utensils and broke the stones used for grinding corn which so exasperated Dingiswayo that, on their return they were denied admission into his presence, and he went crying about his kraal: 'Why have the people broken the pots of the Khondlo?' By such mild means he conciliated his enemies and several tribes voluntarily became tributary to him and joining him in battle he so extended his army as to make himself respected by his friends and feared by his enemies" (Fynn 1836, 10).

According to Wright (2010), similar processes of centralisation and growth took place on a more aggressive level in the Ndwandwe polity. Subsequently, the expansion of other chiefdoms, such as the Dlamini, Hlubi, Qwabe, Cele and Thuli (Figure 6.3), were possibly a defensive response to the relatively rapid rise in power of the Mthethwa and Ndwandwe.

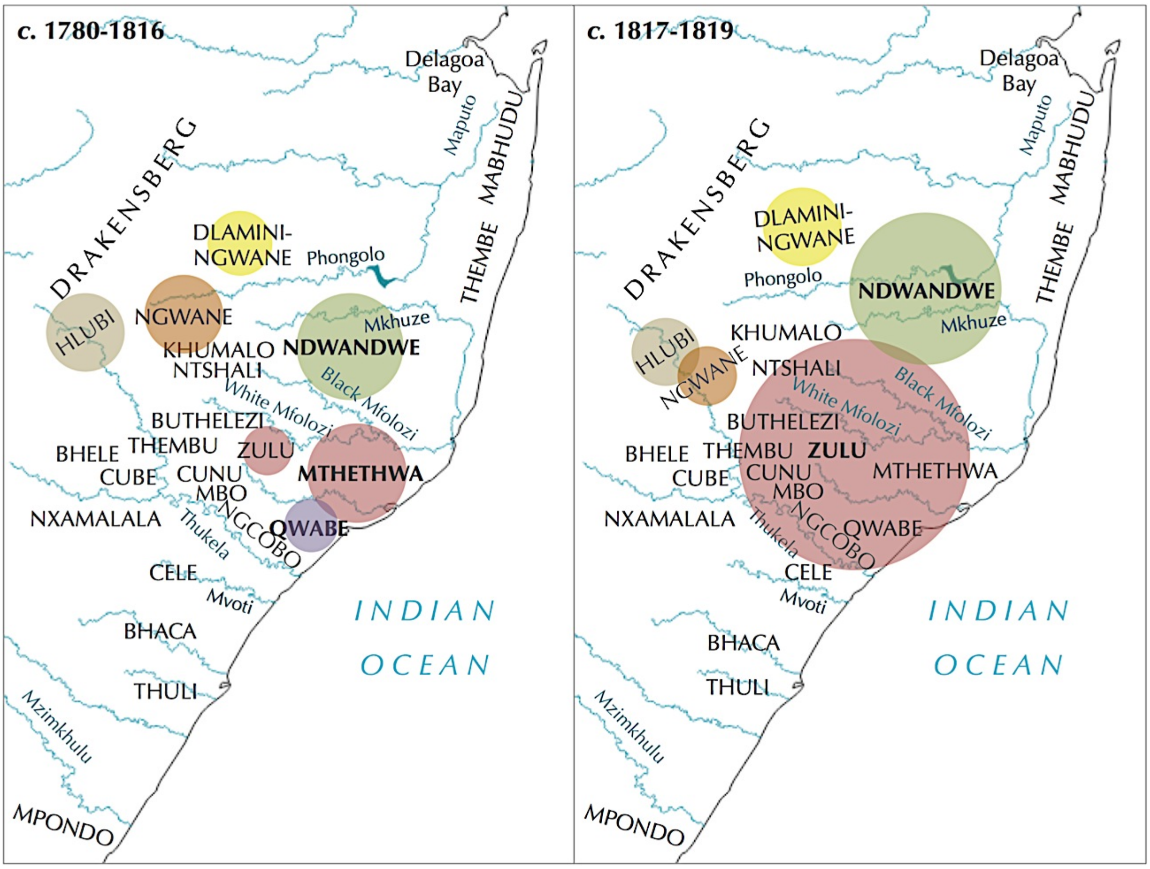

FIGURE 6.3 Political units in KwaZulu-Natal *c*. 1780-1816 and *c*. 1817-1819.

Thus, changes in economic and livelihood opportunities and activities were harnessed, directly or indirectly, into changes in social and political organisation and promoted inequalities both between and within polities in KwaZulu-Natal. Internal class distinction was manifest in greater power exercised by the aristocracy over commoners, who were subject to the chief's ritual and managerial authority, as well as his growing coercive power (Etherington 2001; Wright 2010). While the predominantly wetter climate of the period reduced the exposure of the population to drought, and possibly increased exposure to waterlogging in the coastal areas, it was the innovation of certain groups and their leaders that transformed new opportunities and competition into centralised political power. However, this transformation brought with it a number of comparatively novel, or intensified vulnerabilities to those that preceded it. Dependence on maize may have been high in some areas, while cattle were being exported in significant numbers to Delagoa Bay, a large number of which were obtained or had to be replaced by raiding. Together, these new conditions meant that when drought struck in the last decade of the eighteenth century, the impact on a population with increased exposure and sensitivity to climatic stress was exacerbated.

6.2.2 The *mahlatule* famine: causes and consequences (*c.* 1790s-1816)

In addition to the palaeoclimate proxy records shown in Figure 6.1, the ships' logbook-based precipitation reconstructions for Royal National Park and Mthatha provide evidence for drought at the end of the eighteenth and beginning of the nineteenth century. It is unfortunate that there are currently insufficient digitised logbook observations to extend these inter-annual reconstructions further back to explore the length of the drought that spanned the *mahlatule* famine, yet the rain-years commencing in 1796, 1797, 1798 and 1801 show negative departures from the mean, with 1796, 1797 and 1801 exceeding -1 standard deviations. These results suggest that the drought was a physical event of significant magnitude and formed part of the mechanism that caused famine. The *mahlatule* famine was known vividly by some informants. In 1909, over a hundred years after the event, Lunguza told Stuart that:

> "I know of the *Madhlantule* famine, when we were obliged to eat grass. Grass was pounded up and cooked. Also, the *ingcengce* plant, also *uboqo*, like sweet potato, black roots. It was cut into pieces with a sharp-edged stone, put in the sun to dry, then was mixed with curds and made a porridge of. It was not bitter. *Ingoni* grass was beaten, like *upoko* millet, ground up and kneaded into a dough. This grass was cut with an assegai and then threshed, the seeds beaten out and ground. This was good food. Dogs were also killed and eaten" (Lunguza ka Mpukane, 342).

Moreover, further oral evidence from Stuart's assistant, Ndukwana, has been interpreted to by Hedges (1978), Ballard (1986) and Ó'Gráda (2009) to represent the *mahlatule* famine, despite the claim that this occurred in Shaka's time. This famine was noted to be of greater severity than the *mbete* famine of 1861:

> "Ndukwana says there was a great famine in Tshaka's [Shaka's] days which caused people to go and buy among Magonondo's people near the Mkondo river and Mhlongamvula hill. This famine was a general one, and far greater than the *Mbete* famine in Mpande's time, which only affected part of the country. People had to protect their gardens against human beings. For starving people would make their way into a garden and eat raw the green mealies [grain] growing there" (Jantshi, 201).

Suggestions in the literature that the above evidence relates to the *mahlatule* rather than a famine during Shaka's rule seem accurate, for he describes the famine as a "general" one of wide extent. If the *mahlatule* famine was of greater severity than the *mbete* famine, it might be expected that its impacts also included cattle mortality, the drying up of rivers, and the employment of rain doctors from elsewhere in the region, all of which were said to have occurred by Mtshayankomo ka Magolwana (108-111) in the *mbete* famine. Documentary evidence of the *mahlatule* famine also comes from Barrow (1801), who wrote of numbers of cattle that had perished on the highveld, indicating the regional extent of the drought.

6.2.2.1 Subsistence crises in KwaZulu-Natal

The human significance of the drought was not simply a result of its physical magnitude, as the exposure and sensitivity of subsistence agriculture and climate-sensitive livelihoods was high at this time. Maize, of recent introduction, was highly sensitive to water-deprivation, a factor that led environmental historian James McCann to note that "when they plant maize, farmers walk a slender tightrope of risk" (McCann 2001, 249). Maize also has limitations in its storage potential, for which early-nineteenth century evidence from KwaZulu-Natal shows that it could be stored and sealed underground in cattle enclosures for a maximum of one to two years (Isaacs 1836). Sorghum, on the other hand, can withstand greater moisture stress and could be stored for two to three years (Hedges 1978). Unfortunately, evidence is insufficient to map the dependence on different grains across KwaZulu-Natal when the drought hit with any confidence, which would aid consideration of its differential impacts. However, if the archaeological evidence of maize as a staple in parts of the interior grasslands is extrapolated more widely, it is reasonable to expect that any severe reduction in rainfall quantity or a delay of the rainy season would have been important to drought-sensitive maize. Similarly, if later written evidence of Zulu dependence on sorghum as part of a mix of crops is cautiously backdated, this may suggest a less vulnerable food system. The sustained nature of the drought, however, must have reduced the efficacy of stored grains across KwaZulu-Natal, while there is no evidence of trade networks in foodstuffs on a significant scale at this time or in the early-nineteenth century. Together, these circumstances mean that the shift from very wet to relatively sustained dry conditions must have had substantial impacts on both maize and sorghum cultivation and the increased population that depended on it.

Climatic stress would have also impacted the livestock population, which, as Section 6.2.1.2 discussed, had already undergone changes in its distribution, demand and use in the previous two decades. The cumulative impacts of consecutive years of drought would have reduced the productivity of grasslands and consequently year-round nutrient supply, meaning those in the highland areas would have to keep their cattle in the lowland winter grazing areas for longer periods (Hall 1981). Still, the general decline in grassland productivity must have been accompanied by a decline in the quantity of dairy products produced, and possibly led to the slaughtering of herds for meat consumption. By contrast, cattle in the lower river valleys, which supported year-round grazing, could be moved nearby to the humid coastal grasslands. The overall impacts of sustained drought on an exposed food system meant that wild plant resources, as noted by Lunguza and later by Fynn (Appendix C) were relied on, and imply that subsistence crises of varying severity had developed across KwaZulu-Natal.

6.2.2.2 Drought, food scarcity and political centralisation

The societal consequences of food system dislocation in KwaZulu-Natal have been conceptualised as a trigger for the amplified political centralisation, raiding and violence of the early-nineteenth century in that they were attempts to cope with environmental change (Hall 1976; Guy 1980; Ballard 1986; Eldredge 1992). This has been conceived in two ways. The first centred around the notion of 'over-population' of either livestock or humans, a situation that would have apparently been solved by extending control over more arable or pastoral land, necessitating the use of violent conflict and giving rise to political centralisation (Guy 1980). There is little support for this suggestion, and it has been dismissed on a number of grounds (see Section 2.3.3.2; Hall 1981; Eldredge 2014). The other hypothesis, which has been advanced in different ways by Ballard (1986) and Eldredge (1992), is that increased social inequalities and unequal access to productive resources in the late-eighteenth century led to the breakdown of traditional responses to famine (Eldredge 1992), and so the *mahlatule* provoked expansion and political revolution among the Mthethwa, Zulu and Ndwandwe polities who sought "security from starving marauders" (Ballard 1986, 369). This hypothesis has been given little scrutiny in the literature and will be reanalysed here.

It is first important to point out the inadequacies of this pathway as it has been previously postulated. Ballard, for instance, claimed that the *mahlatule* famine "set entire families, tribes, and perhaps whole chiefdoms into restless, desperate motion" and that these droughts "produced famine of such magnitude that it led to a serious breakdown of social, political, and economic institutions", which then led to the political re-alignment of chiefdoms (Ballard 1986, 369). Moreover, Eldredge (1992, 28) discussed the suggestion of the possibility that the proportion of "habitable lands" decreased, which led to conflict over cattle, grain and water. The problem with these particular claims is that they are supported by little or no evidence, and certainly not to the length that Ballard suggests. Beyond these exaggerated points, however, more subtle ideas may underlie the general suggestion of the importance of food scarcity in political centralisation and conflict in KwaZulu-Natal.

Contrary to Ballard (1986), and as Eldredge (1992) recognised, inequalities and political re-organisation had already been generated within political units in the late-eighteenth century. In the more centralised polities like the Mthethwa, the aristocracy and ruling families had increased their wealth and power, and were supported by the commoner families in the heartland of the kingdom, from where the *amabutho* were drawn. The food security of both of these tiers was mutually reinforced through the provision of agricultural and grazing lands, the acquisition of cattle and the payment of tribute. Moreover, in later years, Isaacs (1836, 291) observed that in the Zulu kingdom the *amabutho* from all parts of the kingdom met twice a year to plant two "immense fields" for the king. Although this evidence refers to a later period, it is probable that such processes took hold with the centralisation of chiefdoms in the late-eighteenth and early-nineteenth century, and as Isaacs notes, that these harvests were shared. Rather than the *breakdown* of social institutions and robust response to famine, this model of socio-political organisation would suggest the *development* of new social networks and food redistribution in times of stress. Therefore, although drought did affect these polities, they may, as political units, have had a greater preparedness and were more resilient to climatic shocks. However, as Eldredge (1992) rightly points out, the growth of the upper two social classes through trade and changes in social organisation produced greater inequalities within these kingdoms. This promoted the growth of a much poorer segment of society, who often lived in the outer reaches of the political and fertile agricultural heartland, possessed few cattle, and were generally viewed as inferiors and outsiders. As these populations had less capacity to combat food shortages, and had only very limited access to the enhanced social networks within the kingdom, they may have been more reliant on wild food resources from an earlier stage of a prolonged drought, and would be drawn to the central areas of the polity. It is therefore possible that these populations represent the "starving people" that tried to consume crops raw in gardens noted by Ndukwana (Section 6.2.2).

Such a situation may have also arisen with the amplification of inequalities *between* chiefdoms in the late-eighteenth century, including the control of fertile agricultural and pastureland (Daniel 1973; Guy 1980, 1994). Small-scale, decentralised political authorities may have also had less advanced systems of food redistribution, which reduced their adaptive capacity. Furthermore, as Etherington (2001) suggests, small, famine-stricken groups lacked the capability to raid or expropriate food stores on any significant scale. Thus, as later historical and oral accounts observe, coping strategies may have been limited to subsisting off the wild foods listed in Appendix C and wild animals. A dependence on these resources in a prolonged drought, as seems to have been evident in the *mahlatule* famine, meant that a more desirable option was to offer allegiance to more centralised political units with more highly organised food systems, particularly those in well-watered, fertile lands proximate to the coast such as in the Mthethwa polity. Evidence for similar processes was later noted by one of Stuart's informants, Dinya ka Zokozwayo, referring approximately to 1829. Dinya stated that when a chief distributed food among his kraal, people came to *konza* (offer allegiance to) him. Rather than the generation of "starving marauders" who initiated conflict, then, these fragments of evidence suggest that further processes of political centralisation may have been aided by both the low adaptive capacity of the poorest to cope with consecutive years of drought, and the growing potential of centralised polities to provide livelihood opportunities and security to those who submitted to their authority in times of stress. Further centralisation can therefore be viewed, as

Eldredge (1992) initially suggested, as a process of the incorporation of populations into already growing chiefdoms as opposed to reactionary political formation initiated by a need for greater security against bandits and raiders seeking food.

To further advance this pathway, however, requires additional evidence that centralised political units had a higher level of resilience to climatic shocks and food system dislocation. This is first evidenced in Ndukwana's statement (Section 6.2.2), which mentions that the starving people attempted to eat the "green mealies" (grain) growing there. This implies that crops did not fail altogether in the Mthethwa-Zulu area, possibly due to the well-watered nature of the coastal lowlands or the cultivation of a greater mix of crops. The prime evidence for higher food system organisation, though, relates to the custom of the 'first fruits festival', or the '*umkosi*', for which there exists considerable oral and written evidence. The most detailed of these are from the later accounts of Fynn, writing with regard to the Zulu kingdom from 1824, and Isaacs, writing of the late-1820s. According to these accounts the *umkosi* involved:

> "An annual feast observed when the chief eats the first fruit of the season, prior to which not even a fallen grain may be eaten under penalty of death" (Fynn 1836, 1).

> "Before eating the new year's corn, the warriors all meet at the king's; when his majesty, decorated with herbs and corn leaves, and bedizened with beads and bangles, surrounded by his warriors and attended by a great number of boys, performs a ludicrous ceremony, and announces his permission for them to eat of their new crop. Standing at the head of the kraal he runs backwards and forwards three times towards the warriors, followed by the boys, whistling as loud as they are able; each time throwing a calabash, as indicative of his command for them to garner and eat of their new food" (Isaacs 1836, Vol. I, 291).

On first glance, it seems plausible that this strict enforcement could have been implemented as an adaptation after the *mahlatule* famine to tightly control the consumption of food and to ensure a larger harvest. However, numerous statements rule out this possibility. Fynn (1826, 1) himself noted that the festival enabled "the year in which any remarkable event occurred to be traced with some probability of correctness", and on that basis referred to events in the mid- to late-eighteenth century. Much further back than this, in 1593, the survivors of the wreck of the *Santo Alberto* described what may also be evidence of the *umkosi*, which would appear to reflect Robert Garden's (1853, 123) suggestion that it was practised from "time immemorial":

> "Coming in sight of some negroes' houses, which were those of the guides who accompanied them, these, fearing our people would injure their crops of millet, which surrounded the houses, left the road, and guided them where there was no grain. The chief captain noticing this, inquired the cause, and on learning it ordered a halt and issued a proclamation that no one should touch anything belonging to these Kaffirs, under pain of death." (Lavanha 1593, 299).

Although European writers complained of the unjust nature of this law, Isaacs wrote of its efficacy in preventing crop shortages and consumption of immature crops:

> "On the other hand there is something salutary in this decree; for were there not a preventative against cutting the green corn, the natives, who care not for the morrow,

> but are satisfied with what the present produces, would consume the greater proportion of their produce in its growing state, and leave but little for that part of the year when they would mostly require it" (Isaacs 1836, Vol. I, 56).

According to Stuart's informant, Mabonsa, the *umkosi* also seems to have been practised in other polities such as the Hlubi chiefdom, though was modified during the reign of Shaka when the chiefdom became tributary to the Zulu kingdom. This gives reason to believe that in a number of centralised polities, the custom aided the tight control of harvests, which in turn buffered or retarded the impacts of drought and reinforced food security. In later years, Garden (1853, 123) wrote that the *umkosi* probably "was never attended with more ceremony, nor its forms more rigidly enforced than during the reign of Chaka [Shaka]". Yet if the potential late-sixteenth century evidence for the punishment of death is accepted, then it is clear that Shaka had little to do with this stringency. Rather than its stricter enforcement, however, the *umkosi* seems to have taken on a new role, possibly around the late-eighteenth and early-nineteenth century, as it became the central occasion for bringing the *amabutho* together and for military planning. Fynn, for instance, related that:

> "When the king intends eating the first fruits of the season all the people and families attached to regiments are called to his residence where the men appear in their war dresses and a feast is given on the occasion and a national dance takes place at that time and no other when the names of their enemies are shouted in degradation. Any chief's tributary not appearing is considered as an enemy and killed in consequence. This annual meeting lasts three or four days and defines kings from chiefs who dare not presume to such a privilege… The last and grand day, the king enters the circle of his soldiers with his seraglio grandly decorated… During the meeting the king informs them of his intending to attack some foreign power which takes place early in the winter months, the rivers being only passable at that time" (Fynn 1836, 304-305).

In addition to controls on food production and distribution, which became increasingly centrally controlled as the eighteenth century came to a close, the evolving function of the *umkosi* may demonstrate that food security increasingly became tied, although in part only ceremonially, to military expansion. Indeed, a major feature of the early-nineteenth century was territorial expansion by certain political units. A cause of this was probably that the incorporation of greater numbers of people, as well as the growth of *amabutho*, meant that additional fertile, well-watered land was needed (Eldredge 1992). Extending control over such lands was a way through which food security and the provision of arable land for a growing population could be achieved. The differential impacts of drought itself may have provided an opportunity for more resilient units to achieve this over weaker neighbours, and could therefore have been part of the stimulus for Mthethwa expansion under Dingiswayo, and Ndwandwe and Dlamini-Ngwane expansion under Zwide and Sobhuza, the latter two of which eventually led to the conflict between these polities. These changes also accord with changing gender identities through the growing employment and dominance of women in agriculture, leaving men free to accumulate booty through raiding (Eldredge 1992; Etherington 2001). Although this change was often associated with the reign of

Shaka, as below in the oral testimony of Gedhle, it is clear that these processes started much earlier with the development of *amabutho*:

> "I may observe that, in the days that preceded the great upheaval identified with the reign of Shaka, men used to be in the habit of working in gardens, and not women only. They moreover devoted themselves to other industrial pursuits; they were more inclined to labour. When, however, Shaka turned his attention to war he, terrible tyrant that he was, diverted the natural inclinations of men by establishing what was practically the whole people into a standing army. This spirit of aggressiveness caused men, when they were not actually engaged in battle, to lead a more or less indolent experience, casting the duty of labour chiefly upon the women." (Gedhle, 254-255).

Considering the validity of Eldredge's original hypothesis overall, then, there appears to be little evidence to argue against food security and drought as contributory factors to late-eighteenth and early-nineteenth century socio-political change. Moreover the evidence considered here strengthens the link between these factors and highlights their importance in reinforcing and promoting political centralisation and territorial expansion. It is doubtful these changes were a direct response to drought and the impacts of the *mahlatule* famine, primarily because they had been initiated before the *mahlatule* famine occurred, yet drought may have been an accelerating or exacerbating factor in a society and economy already undergoing significant changes. There remain a number of speculative aspects to this discussion, primarily due to restricted climatic and historical evidence, though it is clear that this period was characterised by a number of unique stressors in KwaZulu-Natal.

As political centralisation grew, rulers continued to use diplomacy and warfare to consolidate and expand their chiefdoms. Between about 1810 and 1815, Dingiswayo absorbed independent neighbouring chiefdoms into his Mthethwa polity, while similar processes occurred in other powerful chiefdoms like the Ndwandwe and Ngwane (Figure 6.3). By this time, all of these neighbouring chiefdoms in KwaZulu-Natal had also adopted the military system developed by the Mthethwa. In about 1815, Zwide forcefully drove the Ngwane north across the Phongolo, leaving the Ndwandwe and Mthethwa dominating the area south of the Phongolo. At this time, Shaka was serving in the military under Dingiswayo and had built up a power base, yet upon the death of Zulu chief Senzangakona in 1816, Dingiswayo installed Shaka as Zulu chief. Conflict between the Mthethwa and Ndwandwe intensified in the early-1810s. Dingiswayo's forces captured and released Zwide more than once in these encounters (Eldredge 2014), yet early in Shaka's reign, in about 1817 or 1818, the Ndwandwe attacked the Mthethwa, which led to widespread disturbance, the capture of Dingiswayo and his death. These events were precedent to the emergence of the Zulu kingdom under Shaka, and the next section examines the interactions between food security, conflict and climate variability during his reign.

6.3 Food security, conflict and climate in the Zulu kingdom (1817-1828)

After the death of Dingiswayo at the hands of the Zwide, Shaka's Zulu chiefdom rose to prominence. This process involved an outward expansion from an inner core south of the White Mfolozi, with the diplomatic incorporation and military subordination of smaller chiefdoms into the overlordship of the Zulu kingdom. Most studies seeking to explain events in KwaZulu-Natal in this period, however, have either structured investigation around the framing of the '*mfecane*', or have sought to refute this idea by focussing on the evident myths of the 'wars of Shaka' notion. Such investigation has done much to elucidate the chronology and attribution of events involving the Zulu kingdom during the reign of Shaka, yet as a consequence, knowledge of the other explanations for the process of expansion and later instability of the kingdom at this time has been suppressed. One area that has already been recognised as crucial for the maintenance of political authority, but has received little detailed attention during Shaka's rule, is the ability to both feed the population and ensure the distribution of adequate cattle. As this section will further demonstrate, food security was a key factor that was inherently intertwined with conflict and precipitation variability.

There were numerous precedents in KwaZulu-Natal for the emergence of powerful political units and conflict before Shaka became Zulu chief in 1816. *Amabutho* were widely used in military encounters and food production by centralised chiefdoms, while the Thuli are said to have used stabbing spears, an innovation often credited to Shaka, two generations before they became used by the Zulu in 1815. These factors therefore cannot alone have been responsible for its expansion (Eldredge 2014). The Zulu chiefdom expanded quickly in the early part of Shaka's rule with the voluntary or involuntary incorporation of neighbouring chiefdoms, as well as their manpower and cattle, into its authority. Immediately after this initial consolidation, Zwide attacked Shaka, but his army was driven back to the Mhlatuze river, after which the Ndwandwe retreated to reconsolidate, and subsequently fragmented (Wright 2010). This left the Zulu kingdom as the dominant power in a large area of KwaZulu-Natal, where Shaka consolidated between the Mkhuze and Thukela rivers.

The general processes involved in Zulu political consolidation are well known. Its dominance over other chiefdoms was chiefly connected to the control it could maintain over its large *amabutho* and a strict military system, and for its part, diplomatic, aggressive and innovative leadership. Yet for all its strengths, the Zulu kingdom was not a politically united one (Eldredge 2014). Shaka's rule was despotic in character, but his power was not absolute, and subordinate chiefdoms retained hereditary chiefs and thus a degree of autonomy (Wright 2010). With the pressure of conflict, and as will later be shown, climatic stress, ensuring food security was key across the kingdom. Before assessing how conflict and climate variability impacted food security, the following section examines evidence for the vulnerability and resilience of the food system in the heart of the Zulu kingdom and its subordinate chiefdoms.

6.3.1 Food security in KwaZulu-Natal: Zulu consolidation (*c*. 1820-1826)

The Zulu kingdom was considerably larger than its predecessor polities, but was also differently structured. Previous mechanisms of political control used by the Mthethwa were utilised to solidify the social classes and exact tribute from its subordinates (Wright 2010). The increased centralisation at the heart of the kingdom and the continuing amalgamation of other chiefdoms, though, gave rise to changes in the dynamics of the food system in KwaZulu-Natal in the 1820s. In order to analyse differential food security within these components of the Zulu kingdom, it is first necessary to investigate the state of the food system at the centre of the kingdom.

6.3.1.1 The central Zulu kingdom

For all the processes of centralisation in KwaZulu-Natal, political units ultimately continued to depend on their ability to provide subjects with opportunities to build up holdings of cattle, the provision of agricultural and grazing land, and adequate food production to feed their populations. The homestead, or village, remained the key unit of social and economic organisation, and provided the cattle surplus and labour power on which the aristocracy depended. The maintenance of this structure demanded a relatively high degree of organisation of the food system, a situation that becomes evident in the sources relating to the core of the Zulu kingdom in Shaka's reign.

The earliest written observations of Zulu agriculture in the 1820s were recorded by Fynn, who noted the cultivation of a mix of crops (Table 6.2). According to Fynn, maize was only grown in small quantities in the central Zulu kingdom, which agrees with John Gama's evidence that referred to the mid-nineteenth century. By contrast, sorghum, or 'Guinea corn' was said to be the principal crop as part of a mix of maize, the two millets and non-cereal crops. This may be due to the aforementioned versatility of sorghum and its root structure, as unlike maize, sorghum can remain dormant through dry spells and reverse the wilting process when the rains resume, while it can also tolerate waterlogging, facilitating its cultivation along river banks during the rainy season. Although sorghum takes longer to mature than the other grains at between at least four to over six months, maize demands higher soil fertility and precipitation to be advantageous over other crops. The limited importance of maize in the central Zulu kingdom was perhaps also reflected by the rejection of maize beer in favour of millet, the traditional beer-making grain, which according to Fynn was primarily grown for this purpose, and perhaps also demonstrates that maize remained cognitively marginal (Hall 1998). This cultivation of a mix of grains with various requirements was one of the most effective ways to ensure a consistent supply, and was further enhanced by the physical environment of the Zulu heartland, which provided well-watered land, good soils and hillside locations for the agriculturalist to choose the types of environment best suited to the requirements of each cereal (Guy 1980, 1994).

TABLE 6.2 'Crops grown by the Zulus'. Fynn (1836, 304-306).

Name of crop	Description
Imbela, Indian corn (maize)	Only grown in small quantities by the Zulus, but it is the principal food of the tributary tribes. It grows from six to 12 feet in height, producing sometimes five to six heads to a stalk. They commence planting in June and it is ripe in the beginning of September. By September they have a second crop and in March they have a third, some years having green corn all the year through.
Ambela, Guinea corn (sorghum)	The principal crop of the Zulus, requires longer time in coming to maturity than the former [maize], only one crop being produced during the season.
Lupoco (finger millet)	Grow about one feet in length, is six months coming to perfection, is grown principally for making beer which is a most pleasant beverage and it often intoxicates the drinker.
Inquatola (pearl millet)	A grain in length and appearance in stem and seed similar to the bulrush [pearl millet] and is very apt to be destroyed by birds. It is principally used for making beer which is stronger than the *lupoco*. It is frequently ground with water and eaten raw. A piece of this raw, the size of a penny roll will prevent the pain of hunger for several days during a journey.
Massombann	Grow underground, something of the flavour of a potato but a little bitter, the stem is 18 inches high from which a leaf like sage rises parallel from two sides, the stem being square.
Amatuimbers	A plant, the leaf and growth being similar to the water lily but the flower different in shape and of a pink blue colour. The food is like the potato underground and is something like that vegetable but has a glutinous matter on it. These are as large as the largest size potato.
Beans	Beans are of two kinds, the one *imboombas* are a running bean and are similar to the French beans. The other kind *inteubues* (*inhlubu*) is produced from underground with one bean in each pod, leaves similar to trefoil attached to the stem without stalks.
Sugar cane	There are four kinds of sugar cane. One is the West Indian kind and is planted in pieces underground in low damp soil and is very prolific. Only used to eat sometimes preserving a winter stock by burying underground.
Pumpkins	Pumpkins of a small and inferior kind were used the *seloue* (*selwa*) pumpkin introduced on our arrival are in more general use.
Melons	Melons, similar to water melons in appearance they use to make soup. Gourds are universally planted and while young and tender form a principal part of their diet till they become hard when they are scooped and used for beer, milk and water vessels. I have seen 3 which hold 18 gallons.

It may well have been this diversity of cultivated crops in the Zulu kingdom that led Fynn to write that:

> "The Kafir tribes may be almost exclusively considered a pastoral people as the quantity of grain produced by any part of them is barely sufficient for three months of the year. To this rule the Zulus are, however, an exception; they are entirely an agricultural and pastoral people" (Fynn 1836, 24).

While such differential aspects in the food system of KwaZulu-Natal as a whole will be examined in the following section, it is important to note that there also existed a relatively high level of organisation in agriculture in the Zulu kingdom. Isaacs wrote of the collection and burning of grain stalks for the replacement of soil nutrients through ash distribution, and added that land was left fallow for one year after several years of tillage (Isaacs 1836). Similarly, Fynn and others wrote of storage practices:

> "When the corn is ripe, it is plucked and stacked into a reed basket work, some being six feet high and 15 feet in diameter, from whence it is threshed at the beginning of winter, some being put into baskets for immediate use, a few bunches of cobs are preserved for seeds. The remainder is put into cellars in the cattle kraals. These are dug into a conical shape, the entrance being only large enough to admit a young lad, round the sides and bottom. It is covered with the wild plantain leaves, the top being covered with stalks crossed, which is filled up with earth" (Fynn 1836, 303).

> "It is true that the air being shut out, the weevil, that scourge of Kaffraria, is less rapidly propagated, so that the Zulus can reckon on their store. The same precaution keeps out the rats, who require only a few weeks to demolish the harvest, for the Zulus obstinately refuse to admit the cat as a domestic animal" (Bird 1888, Vol. I, 463).

This organisation, as previously related, was accompanied by a high level of centralisation. The *umkosi* retained its strict penalties for non-compliance, while Fynn and Isaacs note that the *amabutho* were obligated to work in the king's fields:

> "The king is supplied with corn by every regiment and their families planting every year, exclusive of what is planted by their own families" (Fynn 1836, 25).

> "The Zoolas have peculiar ceremonies with regard to the planting of corn. They meet twice a year, from all parts of the nation, at the residence of the king, to plant two immense fields for his majesty's use. At harvest no one is exempt from working in the king's fields and gardens, and the monarch personally appears at the head of his warriors to aid in gathering the corn" (Isaacs 1836, Vol. II, 291).

When combined, the maintenance of a mix of crops, advanced levels of storage, and politically important reinforcing rituals appears to resemble a resilient agricultural system at the heart of the kingdom. Though crops were crucially important, cattle were both a source of dairy and meat products, as well as high social value. Cattle could also be tightly controlled by the leadership, though at first do not seem to have been possessed in large numbers, possibly because of losses in conflict with the Ndwandwe (Hedges 1978). Oral evidence relating to Shaka's early reign indicates that the increase in cattle quantities for *lobola* payments in Dingiswayo's time was later reversed, while Fynn claimed that Shaka tightened the penalty for theft of cattle to death:

> "The *lobola* was only one beast to begin with, and afterwards a second beast, no more, for all the cattle belonged to the king. It was very hard indeed to get cattle, and if you should accumulate many you would be accused of making a chief of yourself, whereupon someone would report this to headquarters, and some pretext for killing would be found. It was therefore very hard to get cattle. Only notable warriors were presented with them by the king." (Lunguza ka Mpukane, 317).

> "Those of the eastern tribes who have been restricted by the penalty of death from committing theft, have substituted, in its room open war on all who possess them. Thefts of cattle from one another were practised during the life of Dingiswayo, and until Chaka assumed the chieftainship of the several tribes in the surrounding country, when death alone became the penalty, which at once put a stop to that description of plunder, not a single instance of cattle stealing having occurred during the twelve years I was in the Zulu country." (Fynn 1836, 24).

While increasing restrictions on cattle, these measures helped reinforce the already growing rigidity of lines between the social classes. Coupled with the regulation of marriage (Wright 2010), this meant that the state could control the establishment of new homesteads or 'production communities'. Yet both oral and written evidence suggest it was cattle raiding that grew the herds of the Zulu kingdom to the proportions that European traders witnessed in the mid-1820s. Oral accounts made frequent mention of cattle being 'eaten up' (expropriated) and brought to the Zulu heartland, some of which were then divided amongst the *amabutho*:

> "One had to fight for one's food in the Zulu country. You would get nothing unless you did. This would take place when the beasts were killed; they would fight for the intestines, for these were not apportioned to anyone" (Mkando ka Dhlova, 160).

> "Tshaka [Shaka] used to award warriors who showed courage in fighting, ten, twenty, or thirty head of cattle for their bravery" (Melapi ka Magaye, 87).

> "The domestic animals of the Zulus consist of cattle, sheep and goats. Of the former they possess amazing numbers, the major part of which belong to the King, out of which the military are supplied with meat and small droves. A few compared to the immense numbers seen belonging to individuals. These cattle are of four kinds. The original stock is of the middle size and give from two to four quarts of milk at a time. A second sort are without horns having a thickset body and are considered better milkers than the former. A third kind they call Umsootu, having been taken in immense droves from the Bechuanas and other inland tribes. These are of the largest size weighing from 800 to 1000 lbs. and yield superior meat to any of the other kinds. Of these they have very large droves. Another sort are those taken east of Delagoa Bay called Sochangans, after the name of the king of the tribes from which they were captured. These are very small, but are considered superior milkers" (Fynn 1836, 327).

Although Fynn's account refers to the end of Shaka's reign, cattle numbers increased in the Zulu kingdom through its initial raids and the incorporation of neighbouring chiefdoms. Both oral and written reaffirm the earlier suggestion that this attracted the attention and sometimes voluntary submission of other communities:

> "The Zulus had a characteristic of killing cattle, and the people of other communities, seeing the meat, went to *konza* them. The Zulus were wealthy in cattle and so were able to kill freely" (Baleni ka Silwana, 29).

Where surplus cattle could be accumulated on an individual basis, this gave the opportunity for the *amabutho* to form their own homesteads, which were then subjected to demands for tribute by political rulers in the form of grain, cattle, young women and the labour power of men. If the homestead retained adequate quantities of these resources, however, this also attracted the attention of poorer individuals, who would perform tasks such as cattle herding or clearing and hoeing gardens:

> "Private kraals belong to individuals who, having sufficient cattle, are sure of getting sufficient people to establish a kraal either from the regiment or stragglers in distress" (Fynn 1836, 286).

This reciprocal system fostered a dependence on sources of food and social wealth, particularly cattle, which frequently needed to be replaced. Rather than a lust for territorial expansion, then, the process of Zulu consolidation was partly as a result of a continuous need for the redistribution of cattle. As there was only a certain amount of tribute that could be demanded from the kingdom's homesteads before the socio-political system would be undermined, these cattle could only be acquired by raiding other chiefdoms (Etherington 2001). This process resumed after the breakup of Zwide's polity as the Zulu kingdom extended their rule between the Black Mfolozi and the Mkhuze over the chiefdoms formerly subordinate to the Ndwandwe.

Among the other domestic animals in the Zulu kingdom were sheep and goats, which were possessed in much smaller quantities. Fowls were later introduced and were sometimes eaten by young people, but Fynn stated that other foods than beef, mutton and grain were only eaten out of necessity. Of the wild animals, Fynn added that buffaloes and elephants were hunted extensively, while monkeys were trapped for their skins. Wild plants, as listed in Appendix C, could also be resorted to, though this typically only took place in times of moisture stress, which does not seem to have been prevalent in KwaZulu-Natal at the time of early consolidation under Shaka. Examination of evidence on the Zulu food system in the 1820s thus gives the appearance of a resilient, highly centralised system. A mix of crops and high numbers of cattle formed the backbone of the Zulu kingdom, while social networks and the socio-political organisation of the kingdom suggest an overall low vulnerability to drought. This vulnerability, however, was not the same in the chiefdoms subordinate to the Zulu kingdom, which the next section studies.

6.3.1.2 Subordinate chiefdoms

By 1824, the Zulu kingdom had consolidated over a wider region in KwaZulu-Natal (Figure 6.4). In addition to the small chiefdoms in its immediate hinterland, larger chiefdoms such as the Qwabe became subordinate to Shaka. This brought a larger population, enriched cattle resources and a wider range of physical environments into its domain. Formerly independent chiefdoms were now subject to new systems regarding the distribution of cattle and land, and this gave rise to new power dynamics between rulers and the ruled. Moreover, between 1824-1827, Shaka further attempted to reinforce his authority internally and expand his influence to new chiefs and territories to the north, south and west, much of which was witnessed by European traders. However, the incorporation of chiefdoms and people was not always peaceful, or for that matter, successful. The breaking apart of formerly independent chiefdoms sometimes sent a number of its people and its chief into migration, while at other times they remained in their location and *konza'd* Shaka and the Zulu. Where chiefs gave allegiance to Shaka, they retained their chieftaincy as subordinates in a layered political hierarchy. Where resistance to Zulu rule was considerable, this sometimes resulted in violent confrontation and loss of life. The impacts of this political, structural and demographic change and conflict on food systems involved the amplification of imbalances in cattle ownership, the subjection of polities to new customs, and substantial impacts on vulnerability and food security, which are discussed next.

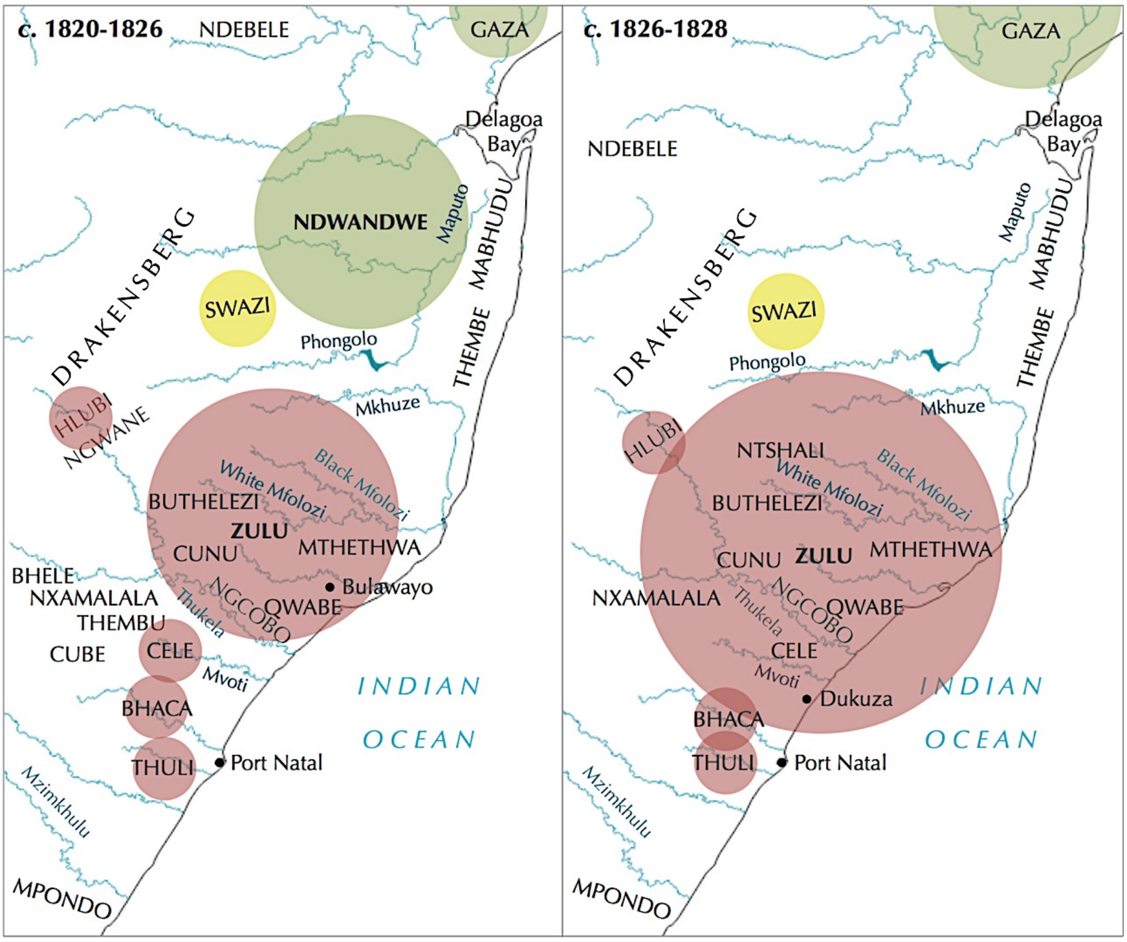

FIGURE 6.4 Political units in KwaZulu-Natal *c*. 1820-1826 and *c*. 1826-1828.

The chiefdoms incorporated into the Zulu kingdom early in Shaka's reign were both proximate and also relatively weak. Indeed, this reflected the limited strength, manpower and expansive capability of the Shaka's polity at this time. With the aid of the dethroned Mthethwa polity, however, Shaka incorporated these chiefdoms relatively peacefully and often through voluntary submission, giving the Zulu control of greater territory, manpower and resources. It is difficult to uncover evidence on these small subordinate chiefdoms, but crucially, despite being subject to tribute in the form of cattle, evidence does not suggest that droves of cattle were expropriated from these chiefdoms and taken to the Zulu heartland. For instance, Fynn's earliest encounters revealed that the subordinate chiefs "possess large flocks" but were at the disposal of the king (Fynn 1836, 327). This observation in part led to Fynn's assertion that "The tribes may be considered almost exclusively a pastoral people as the quantity of grain produced by any part of them is barely sufficient for three months of the year" (Fynn 1836, 24). Fynn also remarked that while maize was only grown in small quantities by the Zulus, it was the principal food of the "tributary tribes" (Table 6.2).

Differences in crop dependence were matched with changes to politically important rituals, such as the *umkosi*, which reinforced the authority of the chief. Chiefs who had performed the *umkosi* in their formerly independent polities could no longer do so, and as the Zulu kingdom expanded beyond its immediate neighbours, chiefs sought to replace the *umkosi* with other ceremonies that would not be seen as imitating Shaka's supreme authority. For instance, Mabonsa explained that:

> "We [Hlubi] had a custom similar to the *umkosi* in our tribe but called *igagane*, held every year. But it was a different affair. People used to go and beg permission of the king to eat pumpkins, on the ground that there was a famine at their kraal. People would, as it was called, 'ask for the gourd', i.e. pumpkins. The king would then wait till the *igagane* was called up. It was the *igagane* which afforded general information that all might partake of the new fruits as the king himself had partaken thereof. In Zululand this custom of first-fruits was much more stringently observed than with our kings. We held the *igagane* at the same time that the Zulus had their *umkosi*.
>
> The word *igagane* only came into vogue after Tshaka began to reign, for it was forbidden to hold the *umkosi* ceremony. It used to be *umkosi* among our tribe previously to Tshaka. We were prohibited from practising the custom as it was intended our tribe should become extinguished in order that Tshaka's nation should be augmented" (Mabonsa, 21).

However, available evidence does not suggest that a more devolved form of the *umkosi* was performed everywhere, and a number of observations by European traders suggest that the tying of rituals like the *umkosi* in the neighbouring subordinate chiefdoms to central Zulu authority became less sympathetic to local climatic, agricultural and nutritional needs. Both Isaacs and Fynn, for example, observed that:

> "On crossing some corn fields, [we] gathered a head or two, which one of the natives perceiving, he ran towards us with his spear and forbade our plucking any more. We afterwards ascertained that the poor fellow was impelled to remonstrate with us from a sense of duty, the laws of Chaka being severe against any one gathering corn without the king's permission, or until he himself had commenced cutting. This is a severe law, and injustrious to the natives, who are deprived of the gratification which the green corn affords them, and in consequence of its being obliged to stand too long before it is cut, a great deal is often completely destroyed by rot" (Isaacs, Vol. II, 87).

> "In some parts of his territories the natives are in a state approaching to starvation; although they have a bountiful supply of corn in the ear in almost a condition of decay, they are not permitted to touch it until a general order to garner it is promulgated… From this want of providently securing for their future subsistence they are, in the interim of seed-time and harvest, at times greatly straitened for vegetable diet, and obliged, for weeks, to subsist solely on milk and such animal food as chance may furnish" (Isaacs, Vol. II, 291).

> "The non-observance of the custom never fails of being punished with death to the whole kraal of people to which the culprit belongs and their cattle go to the king who generally defers it till late in the season and the early crops are spoilt on the field. Picking a fallen corn is as bad as eating it" (Fynn 1836, 304).

While the purpose of expanding central ritual practice was aimed at winning wider acceptance that Zulu ancestors were the ultimate sources of welfare across its territory (Wright 2010; Eldredge 2014), the dependence on maize as opposed to sorghum, varying harvest dates and differences in climatic conditions such as the quantity and timing of rainfall gave rise to problems of crop decay, and in turn, hunger. Indeed, even in the relatively limited extent of Zulu territory, considerable differences exist in these climatic variables, as well as in the fertility and agricultural potential of soils. Thus, attempts to achieve ideological hegemony over a large area were countered by the overall inefficiency of centralised ritual and food system practices. On the one hand, the expansion and amalgamation of the *amabutho* of these formerly independent chiefdoms both increased their potential to obtain cattle through aggressive means, secured their agricultural and grazing land and incorporated their population into a bigger social network. Yet on the other, subordinate polities were subjected to increased demands for tribute and centralised rituals like the *umkosi*, both of which may not have been sensitive to local needs. The integration of neighbouring chiefdoms into the political overlordship of the Zulu kingdom was therefore achieved with varying degrees of success. While the resilience of the composite Zulu kingdom as a political structure may have been increased, at least in the short-term, the vulnerability of the subordinate polities to climate variability was also increased.

6.3.2 Food system stress: conflict, drought and instability

As the Zulu kingdom began to expand considerably further outwards in the early- to mid-1820s, its increasing ranks of *amabutho* were often employed in conflict to raid or enforce the submission of the more distant independent chiefdoms. Where allegiance was not voluntary, this could involve the expropriation of significant numbers of cattle, human mortality in the hundreds, or occasionally the thousands, and, according to some, the destruction of crops (Ballard 1986; Eldredge 2014). The Zulu were certainly not the only party in KwaZulu-Natal involved in conflict at this time, and other sizeable polities such as the Ngwane, Hlubi, Thembu and Chunu chiefdoms formed part of a wider zone of instability on the fringes of the somewhat more stable Zulu kingdom (Wright 2010). Indeed, critical examination of European sources has done much to reveal the gross exaggeration insofar as Zulu culpability in the amplification and extent of violence is concerned. Fynn and Isaacs, for instance, believed that:

> "It may be here necessary to state that on Chaka becoming chief of the Zulus he determined to exterminate every tribe he was at that time acquainted with which he so far succeeded in doing as to leave swept bare the surrounding country. He succeeded in his conquests the whole country from Delagoa Bay to St John's… The number of souls whose death he occasioned I have been asked to conjecture exceeds a million" (Fynn 1836, 20).

> "This African Mars ultimately depopulated the whole line of coast from the Amapoota River to the Ootogale" (Isaacs 1836, Vol. I, 325).

Although such exaggerations remain uncritically accepted by some parts of the literature, Eldredge (2014) estimated that the total mortality from Shaka's major military encounters may have been no more than 10,000, many of which were Zulu warriors, and no more than around 20,000 when earlier campaigns and civilian mortality are included. Despite this important re-framing of the sources and extent of conflict in KwaZulu-Natal in the 1820s, its consequences, particularly on food systems, have often been generally overlooked. This is recognised by Eldredge (2014, 283) who adds that "many more people died from the aftermath of the battle, whether from displacement or loss of food resources that resulted in hunger and famine". The extent to which such tactics or destruction was employed, however, is uncertain, and can only be verified where both oral and European sources agree.

The earliest mention of the destruction of food in the oral and European sources relates to Shaka's retreat against Zwide's approaching army in 1818. According to two of Stuart's informants, Shaka was advised to hide all the food in his territory as Zwide depended on mealie bread and so would starve and there should be a famine (Baleni ka Silwana, 9, Mmemi ka Nguluzane, 271), whereas Fynn claimed that Shaka destroyed grain and cooking utensils on a wide scale. While the accounts disagree in their detail, they indicate the manipulation of food supply to put another polity at a disadvantage. More generally, European traders frequently spoke of the destruction of crops as part of a range of "inhuman atrocities" committed by Shaka's forces. Fynn noted that during the reign of Dingiswayo and Shaka:

> "It was customary to make attacks annually on some foreign tribe, the months June and July and August being chosen as best adapted, there being sure to find corn, either green or harvested, and their own requiring no further trouble beside the rivers being passable during those months. They never fail in committing the most inhuman atrocities… not omitting when leaving, to destroy the corn which they have not been able to consume by mixing it with the worst filth.
>
> Many of the inhabitants who escaped from the spear were left to perish by starvation, their cattle were taken and grain destroyed, thousands were, for years, left to linger on roots of a most destructive character. One sort in particular could not be eaten unless cooked for twenty four hours in three different waters. The sharp cravings of hunger led them frequently to meet the fate which they knew awaited them, when insanity invariably followed, they frequently cast themselves from mountain cliffs or were devoured by tigers or wolves" (Fynn 1836, 21-22).

This description is clearly infused with great exaggeration, and indeed contradicts Fynn's earlier evidence which states Dingiswayo despaired upon hearing that cooking utensils were destroyed in a raid. Moreover, Isaacs (1836, Vol. 1, 278) wrote that neighbouring chiefdoms sought to "excite the commiseration" of Europeans by spreading exaggerated reports of the destruction committed by Zulu forces. Oral evidence from Mbovu ka Mtshumayeli, however, does suggest that warfare in the 1820s was distinct in comparison to previous accepted conventions, but more so in relation to the acquisition of territory than the destruction of food:

> "There is a law or recognised custom among the natives regarding warfare, a law transgressed by Tshaka, to the effect that the victors must not spoil and seize the country of their foes, nor kill women and children. This was the rule prior to Tshaka's day, and correspond in a way to the agreement of Geneva re explosive bullets and other cruel acts. The country was not taken. Tshaka, however, established colonies like Europeans" (Mbovu ka Mtshumayeli, 44).

Following a number of studies on the nature and scale of warfare in KwaZulu-Natal at this time, Eldredge (2014) asserts that these instances of 'total war' involving the killing of people were comparatively rare. Moreover, other Europeans such as Allen Gardiner, a missionary in KwaZulu-Natal the 1830s, Charles Maclean, Isaacs, and at times Fynn himself, asserted that the accumulation of cattle was the aim of conflict rather than causing destruction and committing atrocities:

> "The several bloody and exterminating wars of Shaka appear to have had no object in view other than to enrich himself with cattle of the conquered tribes; to obtain these was a sufficient incentive to engage in the most daring and arduous enterprise" (Maclean 1839, 86).

> "The acquisition of cattle is the grand incitive to war among all the tribes in this part of Africa; and peace of any long duration is only to be expected by those who, like the Bushmen, are unencumbered with this envied description of property" (Gardiner 1836, 266).

Nevertheless, this does not rule out the possibility that crops were destroyed in conflicts that escalated beyond cattle raids or the incorporation of people. Such reasoning may apply to the increase in conflict in Natal in the 1820s, where European traders based at Port Natal frequently wrote of what was in their view the dislocating impact of conflict on food systems:

> "This unhappy region was depopulated by Chaka and other marauding tribes who fled from his terrible outrages; and it was in this uninhabited state when, on our arrival, we found only a few stragglers who had escaped indiscriminate massacre. These were in the extreme of want and misery, barely subsisting on a scant supply of roots, often poisonous, and the cause of many deaths" (Bird 1888, Vol. 1, 84).

> "In a former part of my evidence I have stated, that on my arrival in this country [Natal] in March, 1824, there were no inhabitants in the District south of the Itongati. There was neither huts, cattle, nor grain. There were, however, many natives spread over the country, the remnants of tribes destroyed by Chaka, seeking sustenance from noxious as well as harmless roots, so that more were destroyed by this wretched fare than were preserved. Seldom more than two natives were then seen together. This was occasioned not only by the great difficulty they experienced in obtaining food, but from their distrusting each other. Some of these from a necessity had become cannibals" (Bird 1888, Vol. I, 132).

That much evidence is overtly centred around the notion of the 'depopulation' of Natal, however, raises suspicion, for Fynn was concerned with bringing the potential of Natal for formal colonisation to the attention of the Cape Colony and Britain. Thus, claims for the deliberate destruction of food are at best characterised by gross exaggeration to serve narratives of devastation and depopulation, and at worst are inextricably tied to a narrative of the advancement of colonists' claims as potential bringers of peace to an empty land. This latter point is later reflected in Fynn's evidence printed the Natal Mercury in 1853, where war and famine are tied together:

> "With regard to their claims on the land [Natal], the native population of this district may be thus classed:
> 1. Those who for many generations have continued on their native soil under all the difficulties of war and famine.
> 2. Those tribes who formerly occupied this country, were driven from it by the wars of Chaka, and returned to it, either under the first English settlers, the Dutch Boers, or the present government.
> 3. Those who dwelt originally beyond this district, but have entered it from time to time as refugees" (Bird 1888, Vol. I, 114).

If the destruction of food was confined to rare events of 'total war', it is perhaps noteworthy that famine is so frequently mentioned in European evidence, and to an extent in the oral testimonies. Part of this may also relate to the progression of colonists' claims as bringers of organised food production, and this is certainly reflected in some evidence, yet the extent to which famine is mentioned and its presence in independent oral sources also suggests that other stressors may have induced hunger in Natal and other parts of the region. A prime stressor for which there is substantial evidence from multiple independent sources is the increase in cattle raiding, particularly in Natal, to supply the growing population of the Zulu kingdom and its *amabutho*. In 1824, and shortly before his death in 1828, Shaka ordered long-distance cattle raids on the Mpondo chiefdom south of the Mzimkhulu. The numbers of cattle garnered from Faku's Mpondo chiefdom were in the thousands, and even when Gardiner travelled there in 1835, he observed that:

> "The Amapondas having suffered so severely in their wars with Charka have, in consequence, become great beer-drinkers; and even now that they are gradually recovering their losses by the increase of their cattle, I fear this baneful habit, induced by the scarcity of milk, is likely to be of long continuance" (Gardiner 1836, 266).

Loss of cattle also in part seems to have induced food scarcity elsewhere south of the Thukela. This was noted by Isaacs in his travels in this region, although the reasons he gave for this were inevitably much-exaggerated and unreliable:

> "Their [community near Port Natal] cattle had been taken from them, and they were often destitute of the means of subsistence. Were it known that they possessed even corn, the Zoolas would destroy them to obtain possession of it, consequently, they seldom planted any, but subsisted chiefly on fish, and such esculents as grew spontaneously in the vicinity of their residence" (Isaacs 1836, Vol. I, 73).

> "We proceeded to the residence of Umkileeper, a poor tributary chief to the Zoolas, who having been subdued by Chaka, had never been able to recover his former wealth and greatness. He had little or no food, but he gave me a pumpkin, which was all he possessed" (Isaacs 1836, Vol. II, 190).

> "We proceeded onwards from this place to the abode of a small tribe which had been subdued and nearly annihilated by the Zoolas in the reign of Chaka; they were poor and harmless, depending entirely for food on the little corn and esculents they can raise. It is true they do raise but little of either, for were they to possess the most flourishing crops, instead of eliciting the commendation of the sovereign, to whom they are tributary, it would be the signal for their execution" (Isaacs 1836, Vol. II, 195).

Shortages of food also appear to have given rise to dietary changes even at the chiefdom level. Fynn later reported with regard to the Thuli chiefdom that:

> "The only instance in which any number of a tribe held together was in the case of the Amatuli [Thuli], under the regent chief Matuban. They were dispossessed of their cattle… Owing to their destitute condition they caught fish for food, an abomination with all Kafir tribes. In a few years they again possessed, but fish and Indian corn had become their favourite and regular diet" (Bird 1888, Vol. I, 132).

Thus, while cattle were in short supply, maize grew in importance, a factor perhaps reinforced by its relatively high productivity and shorter maturing period.

Despite the alleged importance of maize, Fynn also reported that the quantity produced barely lasted for three months of the year (Table 6.2). The only exception to this was apparently the Mpondo chiefdom, who occupied a "country of the most luxurious soil" (Fynn 1836, 24). This appears to be reflective of wider food shortages, which seem to have been a key factor in the instability of the 1820s, and is illustrated at length in the evocative but exaggerated account of Shepstone.

> "Naturally, the means of subsistence furnished by their cattle and other smaller domestic animals had failed first, for they were eagerly sought after by Chaka's soldiers; their stores of grain held out longer, but in time they were exhausted also, and as hopelessly as the cattle, for their granaries could not be replenished by cultivation, because cultivation attracted attention, and had therefore to be abandoned. To live at all without their usual food seemed impossible. Their dogs had long been too weak to capture any, and, lean and hungry as they were, had been eaten by their masters. Wild roots were the only means of subsistence within their reach. These were scarce, required much labour to procure, and afforded but light nourishment after all. No wonder, then, that the country was filled with the dead, and that, as the natives express it, the assegai killed people, but hunger killed the country. Many poor wretches, who could, crawled towards the Tugela to be "picked up", as they termed it, by Chaka's haughty vassals. There they could at least get food, whatever the government might be" (Bird 1988, Vol. I, 159).

Hunger, in the view of European writers, as well as many of Stuart's informants, gave rise to cannibalism south of the Thukela (Box 6.1). The alleged presence of cannibalism has gained uncritical acceptance in some parts of the literature (for example, Ballard 1986). It is clear from just a fraction of the overall oral evidence on cannibalism listed in Box 6.1, though, that beliefs of its existence were always tied to the loss of cattle and thus a major source of protein by a community. Hamilton (1998), Wright (2010) and Eldredge (2014) have also suggested that cannibalism should be taken as a metaphor for disorder, pointing to the translation of *amazimu*, a word used to describe raiding groups, which was translated into the settler literature as 'cannibals'. In addition, it is reasonable to believe that Europeans had good reason to perpetuate such accounts for the reasons detailed above.

The reality that appears to be embedded within the written and oral sources suggests that the 1820s, particularly after the arrival of the European traders in 1824, was a time of severe food system stress. This arose in part due to loss of cattle to both a growing centralised kingdom as well as a number of smaller chiefdoms who engaged in raiding at the same time. Yet it is difficult to reason with the arguments put forward by European traders that food system stress was simply a result of Zulu expansion or local conflict, or the view that maize could not be cultivated because it attracted attention. Significantly, evidence also suggests that drought may have been an important factor in the prominence of food shortages, hunger and famine in the sources. The Africa-wide precipitation dataset of Nicholson et al. (2012) proposes that the first three decades of the nineteenth century were dry across southern Africa. Yet it has already been argued that these reconstructions, despite claiming to be attentive to local variation, vastly oversimplify local inter-annual differences, and so cannot alone be relied upon to demonstrate drought in KwaZulu-Natal at this time. Sources relating to the interior highveld and Kalahari do make reference to drought between 1820-1823 (Eldredge 1992; Nash and Endfield 2008) (Figure 3.6), but the logbook-based reconstructions in Chapter 4 do not reveal similar conditions in at stations in KwaZulu-Natal or the Eastern Cape. In the later 1820s, however, the SRZ logbook reconstructions make clear that KwaZulu-Natal experienced years of consecutive drought between the rain years of 1824-1829 (Figure 4.8), while dry conditions were also observed at this time in the adjacent Eastern Cape (Vogel 1989) (Figure 3.6). Furthermore, Webster (1979) refers to three years of drought in KwaZulu-Natal between 1827-1829, and elsewhere in the region, Newitt (1988) has shown that the years from 1823-1830 were a period of prolonged drought from about Sofala to Mozambique Island.

BOX 6.1 References to cannibalism in early-nineteenth century KwaZulu-Natal.

References to cannibalism

"It seems impossible to imagine that in a cup so brimful of sorrow there should be room for one additional drop. But there was room, and that drop was the bitterest of all. In terror of wild beasts, in still greater terror of Chaka's ruthless soldiers and vassals, maddened by hunger, and altogether demoralized by the circumstances which surrounded him, a man conceived the horrible idea of feeding upon his fellow-man, and at once put it into practice. Starving wretches, in misery equal to his own, rallied round him, and a band of cannibals was soon formed, to be increased by two or three in other parts of the country. Driven first by necessity, they acquired a taste for this revolting practice, and continued it long after the necessity ceased" (Bird 1888, Vol. I, 160).

"There used to be a saying as the sun was setting, 'Oh! It is going to be devoured by cannibals', for the impression was that cannibals lived to the west" (Baleni ka Silwana, 34).

"These cannibals had splendid supplies of food, good crops. They had huge goats with large ears and udders as large as those of a cow. They had no cattle. The cannibals were said to be the people of Lupalule – that was their isibongo. The cannibals were also called amaBele" (Lunguza, 302).

"There used to be cannibals formerly, viz. the people of Mbambo. These people are to be found in our and various other tribes. It is said that formerly the people here died of famine. There was a shortage of food. Wild figs were eaten, and also unomkizwana, a black creeping plant which exudes milky sap. The people of Mbambo had no livestock, such as cattle, they were cannibals, and ate people. Some of them admit it, others do not, saying they are being insulted" (Dabula, 88).

"Dingana chased the cannibals away from our part of the country. The great cannibal chief was Mahlapahlapa ka Mnjoli of the Radbele [Bheli] people. There was no cannibalism in Bungane's day, nor Mtimkulu's, but when Mtimkulu was murdered the tribe became dispersed, and as a drought set in, people, having nothing to eat, began to live on one another" (Mahungane, 111).

"Cannibals came into existence because of famine, no food, no cattle" (Mbovu ka Mtshumayela, 27).

Despite multiple indications of moisture stress in the mid- to late-1820s from the documentary reconstructions, evidence of drought by the European traders at this time is not immediately explicit. In the case of Fynn, this is easily explained by the dearth of daily weather descriptions as his original notes were buried with his brother, hence making precise dates and daily weather difficult to recall. Nevertheless, aside from widespread famine, several lines of evidence within these sources give reason to believe that drought was experienced at this time. Of the more direct evidence, Isaacs reported on December 1st 1830 that "the rainy season had set in much earlier than usual. It fell also much heavier, and was of longer duration at its intervals, than had been known for several years past" (Isaacs 1836, Vol. II, 116). It is significant that Isaacs' claim of an early onset of the rainy season, which followed on to be a very wet year, is also reconstructed from the logbook wind data to be a wet year at the two SRZ stations. Given that Isaacs had been intermittently in KwaZulu-Natal for four years at the time of writing, it is reasonable to suggest that at least the years 1826-1829 were considerably drier. That these years were not pointed out at the time by Isaacs may well be because they were not judged to be exceptional. Though this may also relate to the fact that Isaacs, and indeed other diarists at this time were still relatively unfamiliar with the climatic norms of the region, or were simply not concerned with them. This latter point perhaps carries weight as it was only towards 1830 that Isaacs began to partake in crop cultivation at his Natal homestead. Whatever the precise reasons, though, it appears to be the case that 1830 was considerably wetter than previous years, and unlike previous years this in part prompted Isaacs to write of the agricultural potential of KwaZulu-Natal:

> "We had to pursue our way through another of those fine grazing districts which abound in the interior of the Zoola country. A fine savanna, rich in corn-fields and pasturage, that would have been a sight for a Buckinghamshire grazier, lay on each side of our line of march. I could at once perceive that no part through which we had travelled could produce corn so fine as in this district: it was growing in all the luxuriance of vegetation, and had reached a surprising height, so that on passing along the fields we found it several feet above our heads, and throwing out the ear exceedingly full and productive" (Isaacs 1836, Vol. II, 193).

Despite the absence of daily weather descriptions in Fynn's diary, he did make reference to rainmaking, and reported its application in the event of drought, excess rain, and the appearance of comets. Fynn wrote that "Chaka placed little or no belief in them [rainmakers], but dreaded thunder in which case he was surrounded and covered by his girls till the storm was over" (Fynn 1836, 282). When combined with oral evidence, Fynn's claims may suggest that rainmakers fell out of favour with Shaka sometime in his later reign, for Stephen Mini told Stuart that:

> "The amaZolo were the owners of the sky; they were the rain-makers; they were addressed as 'Zulu! Dhlangamandhla! Gasa was the last rain-maker – he was killed on account of it; he was killed by Tshaka. Tshaka said to him, when he had been summoned to make rain, 'Bring rain, not thunder, only rain.' But thunder sounded. Tshaka said, 'You see; you have troubled me by bringing thunder. Do not do this again'. But on another occasion when he wanted Gasa to make rain the thunder

> sounded. This time Tshaka sent a force to kill him. He was killed near his mountain, Quedeni" (Stephen Mini, 134-136).

According to the later diary of Robert Garden, recorded while travelling with Fynn in the early-1850s, rainmakers were used when:

> "It is a whole country that is suffering under the disadvantages arising from drought which is to a pastoral people is one of the heaviest calamities that can befall them. An application to a rainmaker originated in all cases with the chief or principal men of the tribe and the rain-doctor knowing that the whole tribe or country requires his aid to obtain rain, he calls upon the chief to order every Kraal to send him cattle, and I have known cases says Mr Fynn, in which from 5 to 600 head have been collected for this purpose" (Garden 1853, 142).

Combined with independent documentary climatic evidence, then, the indirect evidence for drought suggests that widespread dry conditions were experienced in Shaka's later reign. Yet drought itself does not always result in famine in well-organised food systems, and its impacts would have varied across KwaZulu-Natal. Thus, the differences in food system vulnerability reported in Section 6.3.1 translated into differential impacts, where famine was prevalent in the outer reaches of the Zulu kingdom and adjacent areas like Natal. In particular, loss of cattle as a source of food, growing inequality, centralised *umkosi* rituals, amplified conflict and changes in the socio-political structure of small chiefdoms in these areas in the early-1820s brought new meanings to food insecurity, whereupon vulnerability to climate variability was raised, and consecutive years of drought exacerbated an already fragile situation causing dislocating famine. This re-consideration of the interaction of dynamics in KwaZulu-Natal at this time therefore further shifts the emphasis away from the view that a purely destructive influence of Zulu consolidation caused famine across its broad area of influence. Rather, the process of Zulu growth did impact on its neighbours, but in complex and often less dramatic ways than the sources suggest. If the central Zulu kingdom was more resilient to these droughts, it did undergo a period of heightened instability between 1826-1828, which is considered next.

6.3.2.1 Food security and internal instability: Shaka's last years c. 1826-1828

In 1826, the Zulu defeated the Ndwandwe polity, causing its eventual breakup, and resulted in its population either joining the Gaza polity in southern Mozambique, giving allegiance to Shaka, or joining Mzilikazi's Ndebele (Figure 6.4). This left the Zulu the dominant polity south of the Phongolo and subject to less immediate political pressures. Despite the removal of the long-standing rival Ndwandwe polity from political life in KwaZulu-Natal, the two years from 1826-1828 were a time of heightened internal instability and opposition to Shaka's rule. At the same time, the slave trade through Delagoa Bay was growing significantly, Griqua and Kora were raiding widely on the southern Highveld, while Shaka became increasingly aware of European weaponry and the expanding Cape Colony (Eldredge 2014). Shaka also moved his capital from Bulawayo to Dukuza in 1827, which brought it closer to the

British traders established at Port Natal. In addition to the elaboration of institutions and ideologies, the previous closer proximity of threats from rival polities had aided Shaka's hold on power. The removal of the Ndwandwe from the scene, however, brought domestic grievances to the fore in the Zulu kingdom. Eldredge (2014) has convincingly shown that Shaka's arbitrary violence and capricious decision-making led to a loss of support, disaffection and alienation of many of the aristocracy. In the last three years of his reign, these unpopular aspects of his rule increased, first with the death of Shaka's mother, Nandi. This event was well-remembered in the oral traditions, each of which recalled the violence and hunger that followed as Shaka proclaimed that no cultivation was allowed for three months, and no milk could be used but milk was to be poured onto the ground (Eldredge 2014). Fynn's diary reflects this, though claims that cultivation was initially ordered to halt for a year:

> "Speeches were made by the chief urging the following resolutions strictly to be observed, that, as the great female elephant, or rather the overruling spirit of vegetation had died, it was not improbable that heaven and earth would unite, and, to appease the spirits, no cultivation should be allowed that year, the cattle to be milked on the ground and not to be used for food, while any female found enceinte during the next year should, with their husbands, be put to death. The first resolution was adhered to for three months, when the chief Chaka was appeased" (Fynn 1836, 136).

According to oral evidence these policies caused food shortages across the Zulu kingdom and its subordinates, reflected by Ngidi's evidence which states that the country was destroyed by lack of food, as well as Lunguza's testimony:

> "Nandi died sometime after I was born, for I recollect the kind of food we ate after her death. Those who ate amabele [sorghum] were killed; it was said only milk and curds could be taken. There were people who used to go about inspecting, and if they saw faeces at any kraal, as they would do after a grass fire by their continuing to smoke, they would know that they had had amabele. The people of such kraal would be put to death, for Tshaka said, "So he is living in a state of contentment, whereas I am lamenting because of my mother's death!" (Lunguza, 307).

Wright (2010) suggests that these actions were attempts by Shaka to rid himself of opponents and to rouse feeling against his rivals. This is also perhaps evidenced in Fynn's diary, where it is claimed that Shaka was dismayed by the:

> "Indifference with which all the different tribes had evinced by not coming forward to express their regret at the death of so important a personage… when it was decreed that they should be attacked, Faku, Hintze, and Makomo bordering on the colony and Sochangarn west of Delagoa Bay, whose cattle taken should thus be considered as tears which they should shed on so important an occasion" (Fynn 1836, 139).

Although the reasons for the eventual attacks on Faku's Mpondo and the chiefdoms around Delagoa Bay (Figure 6.4) are ultimately unverifiable, in April 1828 two large, long-distance raids, accompanied by some of the European traders, were sent out to these locations by Shaka. The raid on the Mpondo resulted in the seizure of large numbers of cattle, but within only days of returning, the force was ordered to march to the Delagoa Bay area. To launch a second long-distance raid so soon after the other apparently augmented opposition to Shaka's rule in the Zulu kingdom, and there exists little consensus on why these decisions were taken. Want of cattle due to ongoing drought is one option, but given that significant numbers had just been gathered from the Mpondo, it is unlikely that this was the sole reason. Perhaps, as Wright (2010) suggest, Shaka became aware of the plot to kill him and acted to send his conspirators a considerable distance. Whatever the case, the Delagoa Bay campaign was a disaster, and discontent with Shaka's rule had reached such levels that he was stabbed to death by his brothers Dingane and Mhlangana at Dukuza in 1828. According to Dinya, Shaka's last words were:

> "'Is it the sons of my father who are killing me? How is this, seeing I never put to death any of my brothers ever since I became king? You are killing me, but the land will see locusts and white people come.' He then fell. True enough locusts and Europeans subsequently came. This is evidence of Shaka being a prophet" (Dinya, 95).

Interestingly, Shaka was correct in predicting the arrival of locusts, and a number of European eyewitness accounts of locusts in KwaZulu-Natal are given in 1829-1830 (Table 3.5). Yet as locusts generally appear after droughts, of which there had been several years in KwaZulu-Natal prior to his death, this was not necessarily a difficult prediction to make (Eldredge 2014).

6.4 Summary

This chapter has investigated the complex interaction between climate variability, socio-political organisation, food security and conflict. The relatively sparse evidence that exists for the late-eighteenth century demonstrates that these linkages, along with trade, formed part of a dynamic that contributed to political transformation in the late-eighteenth and early-nineteenth centuries, although the role of climate variability in this process was more to accelerate or exacerbate changes that were already underway. In parallel to the Zambezi-Limpopo region, one outcome of these changes was that pronounced differences emerged in vulnerability and adaptive capacity with and between the various socio-political units. This was particularly evident in the 1820s, where new meanings were given to food security through changes in socio-political structures and relations, increased expropriation of cattle, and the incorporation of people by the more powerful polities. Therefore, when drought struck in the late-1820s, communities weakened by conflict and subordinate communities or polities on the outskirts of the central Zulu kingdom were the first to suffer. As the drought continued, the Zulu kingdom also itself felt its effects, and it is not beyond possibility that this in some way contributed to the internal instability in the last two years of Shaka's reign. Most significantly, then, this investigation reinforces the complexity of interactions and the imperative of studying socio-political dynamics in past societies in order to understand the plurality of drought impacts on diverse socio-ecological systems. This latter line of examination is considered more widely across southeast Africa in the next chapter.

Chapter 7. Discussion: the consequences of past climate variability

The previous chapters have investigated the nature of climate variability and climate-society interaction on a number of spatial and temporal scales. This discussion will draw comparative perspectives across the research domain in order to understand the nature of high impact climate variability, evaluate the underlying causes of societal vulnerability and response to climate variability, and assess the significance of climate variability in socio-political change. The chapter will conclude by pointing to areas for further research on related themes.

7.1 The nature of climatic stress

The majority of written and oral reference to climate variability relates to drought, locust plagues and direct impacts on food systems, or 'climatic stress', which subsequently had varying significance for socio-political dynamics. As these sources, as well as proxy-documentary records, are of variable quality and resolution, and have numerous uncertainties, it is difficult to tie inferred inter-annual precipitation variability to written references of climatic stress prior to the nineteenth century. Nevertheless, as outlined in Section 3.2.4, written observations of climatic stress display correspondence with the precipitation inferences of SRZ palaeoclimate data on a number of scales. This coherence of very different sources is important, and permits broad discussion on the magnitude, frequency and spatial scales of climate variability that were of high importance for food systems. The most striking finding based on the above data over this *c*. 425-year analysis period is that the most widespread, severe and extended periods of documented climatic stress occurred at times of regional (Figure 7.1), and in most cases, global climatic change. These were:

- Drought, locust plagues, food shortages and famine in the Zambezi-Limpopo region between *c*. 1560-1575 and *c*. 1585-1600, which represented highly variable conditions during the relatively abrupt shift from the wet decades of the early-sixteenth century to seventeenth century LIA dry conditions
- Drought, locust plagues and famine on the Zambezi and in parts of northern Zimbabwe from *c*. 1710-1770, corresponding with LIA dry conditions, and;
- Drought, food scarcity and famine across the region between *c*. 1795-1802 and 1823-1830, and locust plagues in the Zambezi and Delagoa Bay areas between 1828-1830, which occurred amidst an abrupt shift from the dry LIA towards wetter conditions, but was marked by highly variable precipitation and the above two periods of extended dry spells.

The first and third of the periods stated above occurred at times of high variability and abrupt shifts in precipitation (Figures 3.9 and 7.1). This variability had regional impacts, evidenced by the wide spatial extent of recorded drought and food shortages, including in areas which receive higher and more reliable rainfall like Manyika and the Mozambique coast (Figure 2.2). By contrast, the cluster of famines and locust plagues recorded in the early- to mid-eighteenth century occurred at a time of LIA dry conditions, which were not contemporaneous with an abrupt shift in precipitation variability. These impacts also were of a lesser spatial range, as they were only recorded in the Zambezi valley and parts of northern Zimbabwe. As these areas are considerably drier and receive a less reliable seasonal rain than the coast and the Manyika area (Figure 2.2), it is likely that their susceptibility to drought, which was amplified in the LIA, played a key role in increased accounts of climatic stress. The anomaly in this analysis, however, is the seventeenth century, when relatively drier conditions prevailed in most proxy records, yet there were just two written references to climatic stress in the entire century. While this may stem from vulnerability-related factors, it is perhaps noteworthy that unlike the other two periods mentioned, there are less explicit observations of drought and locust plagues in the Zambezi area in this century, a factor that may relate to the relative variability of rainfall. The seventeenth century, although overwhelmingly dry, experienced very low precipitation variability (Figure 3.9) relative to most other centuries. Although this variability remained relatively low in the eighteenth century in some proxy records, it increased in the T7 isotope records, when recordings of climatic stress also increased (Table 3.5). This correspondence may suggest that periods of extended drier conditions, with reductions in precipitation amounts but low overall variability, were of less direct significance than periods with more highly variable conditions, though further inter-annual records of precipitation variability are needed to clarify this proposition. Certainly, however, the reduction in mentions of climatic stress in the seventeenth century reinforces that assumptions regarding seemingly 'unfavourable' climatic conditions for society associated with generally drier conditions are not clear-cut.

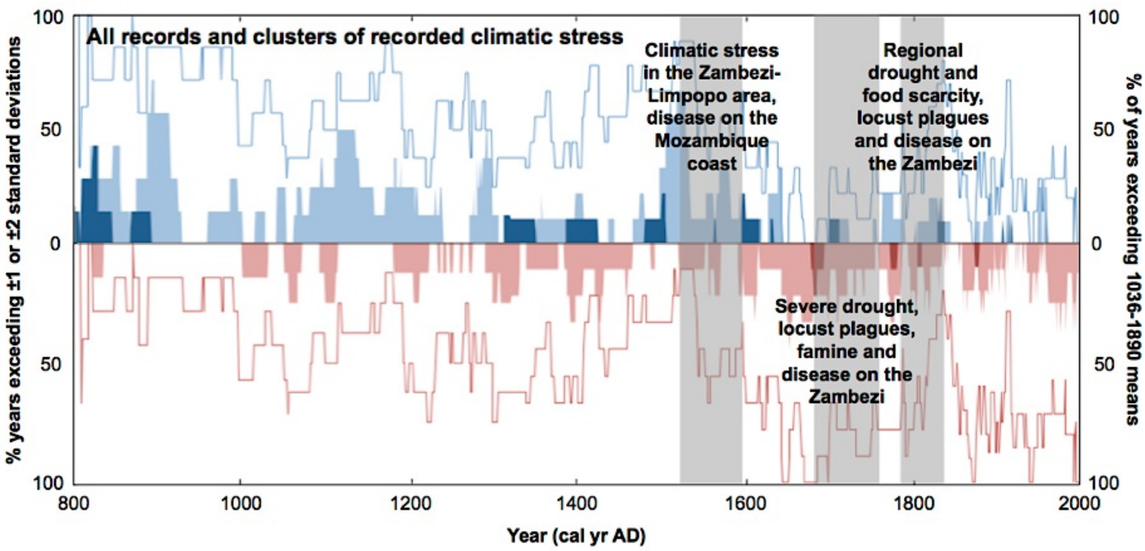

FIGURE 7.1 Proportion of years above or below the 1036-1890 record means (blue and red lines), and ±1 or ±2 standard deviations (blue and red bars) of 20-year smoothed inter-annual records and non-annually resolved records, with clusters of written reference to climatic stress.

A further reason that precludes the assumption that climatic stress was greater in the periods highlighted in Figure 7.1 may relate to the variation in and changing rationale for Portuguese written source coverage (Section 5.1.1.2). As Section 3.2.4.1 suggested, however, there exists little reason to assign any major link between climate-related observations and the spatial and temporal variability of Portuguese written records. Indeed, after 1530, the Zambezi valley from Tete to Sena, and Quelimane, produced a relatively consistent record of documents. Furthermore, coverage of the situation in the Mutapa state at Mukaranga was good from around 1560-1693, after which its move to the Zambezi lowlands brought it closer to Portuguese settlement at Tete and Zumbo, while the polities of Manyika and Teve were also covered throughout the timeframe. On a similar note, that Portuguese commercial and expansionist interest fluctuated between mining, trade, the conquest of the Mutapa state, and *prazo* society seems unlikely to have strongly influenced or deterred recording of climate-related factors. The possible exception to this is the expansion of *prazo*-society and food production around Portuguese settlements in the seventeenth century, when detailed reference to food production does increase. Yet as just two references to climate variability were found in this century, including from summaries of the sources only available in Portuguese (Mudenge 1988; Newitt 1995), it does not follow that reports of climatic stress are simply a factor of either the variability in or purpose of recording.

Consideration of the above aspects over this extended timeframe, then, reveals that the highest concentration and quantity of written reference to climatic stress is reflective of climatic conditions with high inter-annual to multi-decadal variability, magnitude and abruptness of change over wide spatial extent, though the impact of generally drier conditions varied. This relationship between climatic stress and periods of global climatic change was noted on a wider scale for southern and eastern Africa by Nicholson (1996), but more comprehensive consideration of this longer timeframe adds further weight and new dimensions to this association. This is not to suggest that more localised dry years of a lesser magnitude did not impact society, as these were recorded on several occasions (Table 3.5), but simply that the quantity of accounts in the periods noted above reinforce the idea that these were periods of heightened climate-induced stress. It is also important to note that many direct and shorter-duration climatic events or impacts are simply beyond the resolution of the available data, and more annually-resolved proxies and reconstructions are needed to further this investigation. Similarly, examination of the Portuguese documents that are yet to be translated may improve this picture further, especially those relating to food rations, prices and production on the Zambezi *prazos* and coastal towns.

While the nature of climate variability discussed above had significant impacts on the climate-sensitive aspects of the socio-ecological system, differences in vulnerability meant that the socio-political significance of these climate impacts varied. In order to assess underlying sources of vulnerability, and the differences and similarities between these in various socio-political contexts, the next section examines the differences in the vulnerability and response of societies to climate variability over the spatial and temporal domain of this thesis.

7.2 Underlying sources of vulnerability

Differences in vulnerability and the inter-linked concept of resilience were key reasons why the response to and significance of climate variability varied over space and time. This was investigated in Chapters 5 and 6, and revealed differences in the sources and extent of vulnerability between and within societies, but also a number of parallels in underlying vulnerabilities and their importance for individual and community response to climate variability. This section discusses these differences and similarities across southeast Africa with respect to food production and security, livelihoods and trade, and conflict and governance. In particular, the discussion will consider long-term, structural and recurrent stresses that contributed to core sources of exposure, sensitivity and adaptive capacity. The overriding factor in this section, though, is socio-political organisation and governance, which strongly impacted upon the vulnerability and resilience of food systems and livelihoods.

7.2.1 Food production and security

The main area of vulnerability analysed in Chapters 5 and 6 relates to food systems, particularly crop cultivation and the keeping of domestic animals. Basic environmental factors had a strong influence on these climate-sensitive livelihoods, such as the drought-prone, tsetse-infested environment of the Zambezi valley compared to the well-watered coastal areas, yet socio-political organisation and human agency played an equally important role in conditioning the vulnerability of food systems.

7.2.1.1 Crop diversity

Cultivated crop diversity and dependence had a major influence in the sensitivity of the agricultural system to climate variability. Until the seventeenth century, the centralised African polities in the Zambezi-Limpopo region generally remained dependent on the 'traditional' mix of drought-resistant sorghum and pearl millet, supplemented by a range of vegetables, with the addition of rice at different times. Sometime in the seventeenth century, maize grew in importance across the Zambezi-Limpopo area, the peculiarities of which had particular significance. In the Mutapa state, for instance, maize began to spread when Mukaranga became increasingly depopulated, the state was under a high degree of Portuguese influence, and the generally dry conditions of the LIA set-in. Given these new population-climate dynamics, the shorter growing season and reduction in labour requirements for maize cultivation may have therefore given this grain an advantage over others, acting as an 'emergency crop' as observed elsewhere (Ekblom et al. 2012). The new vulnerabilities associated with increased dependence on maize cultivation, however, increased the exposure of its cultivators to the amplification of climatic stress recorded in the eighteenth century. Information on maize cultivation is patchy in KwaZulu-Natal, and the ambiguous evidence that does exist makes assessment of the extent of its vulnerability-related impacts difficult. It is possible, though, that in some of the inland areas, maize offered increased productivity and contributed to the population increase in the eighteenth century (Maggs 1982, 1989). Nevertheless, it is perhaps notable that the expanding Mthethwa and Zulu polities, as well as the Mutapa state at its height, were largely dependent on the traditional grains of sorghum and millet, supplemented by a range of vegetables, fruits, domestic animals, and wild animals and plants.

By contrast, in smaller-scale, less centralised or subordinate communities, a slightly lower diversity of cultivated crops was reported. For instance, only millet was said to be consumed in the Zambezi valley in the mid-sixteenth century, while Fynn's evidence suggests that maize became the dominant staple in the smaller polities in KwaZulu-Natal, especially after a loss of cattle herds. In the sixteenth century, Santos noted that smaller communities in the Zambezi-Limpopo area cultivated a surplus in crops such as rice to sell to traders, yet this did little to directly build resilience in the food system of these communities as these grains were not consumed by locals. In the smaller-scale communities in both the Zambezi valley and the KwaZulu-Natal area, wild plants were also used extensively to supplement cultivated crops, and is perhaps reflective of the lesser sophistication of the subsistence-based agricultural system outside of more centralised socio-political systems. More important food system vulnerability differences in these areas and periods, however, lay in stocks of domestic animals and socio-political organisation, which are discussed in the next two sections.

Significant changes to the vulnerability of the agricultural systems of decentralised socio-political units came with the incorporation of much of the Zambezi valley, as well as lands around Quelimane and Sofala, into the Portuguese jurisdiction. This began in the early-sixteenth century at Sofala with the import of locally cultivated sorghum, but the environmental and labour-related barriers to the production of a consistently high surplus were reciprocated by the vulnerability of the population of the town itself who relied on purchased grains. The initial problems of food production and security at Sofala, however, were followed by an increase in the diversity of cultivated crops and the organisation of surplus food production in the Zambezi towns and Quelimane. Indeed, as early as the mid-sixteenth century these settlements drew on surplus production of sorghum, millet, rice, vegetables and fruits in their hinterlands. At the height of Portuguese influence in the seventeenth century, the diversity of food production increased, with wheat and maize cultivation on the *prazos* (Table 5.4) and sugar mills in the Zambezi delta area. This increase in food system diversity was mirrored by the increase in the organised labour force of slaves and *colonos* around these areas, yet as Section 7.2.1.3 will show, gains from the building of food system resilience were countered by inherent problems in the organisation of the *prazo* system. Thus, while evidence suggests that agricultural diversification led to a reduction in the exposure of the food system to climate variability, the shift to new governance and production systems brought new underlying vulnerabilities in its adaptive capacity.

7.2.1.2 Domestic animals

Less detailed information is available on domestic animals in the Zambezi-Limpopo region as they had little long-distance trade value prior to the mid-eighteenth century, though were of vital socio-cultural value in this area, as well as a food source. Conversely, cattle were frequently mentioned by British traders in KwaZulu-Natal, and were of even greater social and dietary importance in this area. Individual and community cattle ownership was thus strongly tied to wealth and food system resilience in pre-colonial southeast Africa, helping to maintain class distinction, social relations and political organisation. Cattle were possessed in high numbers by the Mutapa state prior to the eighteenth century and in moderate numbers by the Manyika polity throughout the period, whereas in KwaZulu-Natal, cattle became increasingly centralised in the early-nineteenth century, and caused marked imbalances in ownership. This loss of cattle in both cases caused a considerable increase in vulnerability, most directly as a loss of a reliable food source, but perhaps more importantly in undermining social relations and the basis of wealth. In the Mutapa state at Chidima, the loss of cattle as a readily available livelihood source partially gave rise to persistent banditry in the eighteenth century, particularly in times of climatic stress. In KwaZulu-Natal, the export of cattle to Delagoa Bay had both positive and negative impacts by on the one hand increasing the complexity of socio-political organisation, and on the other reducing the availability of food sources. This was offset, however, by the growth of *amabutho* and their use in raiding. These increased inequalities thereafter resulted in loss of cattle by weaker chiefdoms through raiding, which increased the vulnerability of these societies to drought by enforcing a reliance on agriculture, hunting and gathering, and earning the name of ‘cannibals’ for some of these communities.

In a number of areas in the Zambezi-Limpopo region, such as the Zambezi valley and the Teve area, cattle ownership was always relatively low, and made these societies more vulnerable to climate variability. However, the Teve area in particular appears to have offset this exposure by conducting highly organised hunts and keeping other domestic animals such as fowls, while the Zambezi valley and coastal areas effectively used fishing and the gathering of fruit to in part counter these deficiencies. This may have been enough to survive in years of average precipitation, or even in the event of shorter-term drought, but in extended droughts of multiple years, like the 1570s and 1820s, the lack of domestic animals may have contributed to hunger and malnutrition, exacerbating the susceptibility of the population to the diseases such as smallpox, which caused extensive mortality at these times.

7.2.1.3 Socio-political organisation and adaptive capacity

Perhaps the most important influences on the vulnerability and security of food systems in southeast Africa related to socio-political organisation (Figure 7.2). This is because in well-organised food systems with social networks and the provision for storage and redistribution, the impacts of drought can be buffered, thus preventing the amplification of climatic stress into famine or wider social dislocation. This broadly appears to reflect the situation in centralised polities such as the Mutapa state and Zulu kingdom, where the organised labour of the wider population cultivated fields in the capital hinterland, and the production from which was redistributed in times of stress, although central political instability may have affected the efficacy of these systems (Section 7.2.3). This was complemented by long-term planning and coping strategies on a local scale, such as grain storage and the sharing of food in times of stress. European and oral accounts provide strong evidence of similar, more elaborate central and local practices in early-nineteenth century KwaZulu-Natal. This mainly related to the centralised 'first fruits' festival, or *umkosi*, which both helped stave off food scarcity from consumption of maturing crops and reinforced socio-political authority. This appears to have become increasingly important in the expanding Mthethwa and Zulu polities, as it was the main meeting place for the *amabutho* from across the wider territory, as well as for the clarification of diplomatic and military strategies. Similarly to the centralised polities in the Zambezi-Limpopo area, cultivation of central fields and the redistribution of grain in times of stress were practised to help buffer food scarcity. What is not explicitly clear from the documents is the impact of increased inequalities within centralised political units on the food security and adaptive capacity of the poorest communities, though reduced ownership of cattle would suggest that there were important differences in these factors within society. Overall, however, it is noteworthy that in the Mutapa state at its height, and in the central Zulu kingdom, there is virtually no evidence of widespread reliance on wild resources, as is frequently highlighted in other polities with less organised food systems.

The documents make clear that there were major differences in food system organisation between centralised and smaller-scale, decentralised communities. It does not appear to be the case, as is sometimes idealised, that smaller-scale communities or political units with less evidence for social stratification, less mineral and material wealth, and high reliance on more localised systems of exchange, were ultimately less vulnerable to climate variability. Rather, labour, resource and territorial limitations meant that a smaller quantity of crops could be cultivated on less secure and often less fertile lands, while in the absence of mineral resource wealth, a proportion of this was also sold to the Portuguese in exchange for cloth and beads. Similarly, adaptive mechanisms and coping strategies, though operational at the household level, were less advanced than in centralised polities, and a generally more limited resource-base was available to barter for food, meaning reliance on wild food resources was a coping strategy employed much sooner in times of climatic stress (Figure 7.2). In years of sustained drought, a common response across southeast Africa was for individuals to seek protection from food scarcity by pledging allegiance to larger political units or the Portuguese, and later the British in Natal in the late-1820s and 1830s. These people then lived as subordinate communities under the overlordship of the centralised units, but a number of new socio-political vulnerabilities emerged from this.

In the Zambezi-Limpopo area, people who sought protection from the Portuguese were first incorporated into the jurisdiction around the towns of Sofala, Sena, Tete and Quelimane, and later on the *prazos* that developed with Portuguese expansion in the seventeenth century. The *prazo* system in particular led to the emergence of new vulnerabilities. Portuguese *senhors* attempted to take the place of traditional chiefs, but the critical difference was that these new 'chiefs' intensified exploitation as they were driven by short-term profits. This gave rise to new inherent instabilities, such as the frequent breakdown of socio-political order, and undermined the gains in resilience from the diversification of the food system. This was particularly evident in times of drought like the 1820s, as this exacerbated pre-existing social tensions, and resulted in socio-political breakdown, including the migration of *colonos* and banditry among slave bands. Thus, despite decreases in food system vulnerability, high magnitude climatic stress on the Zambezi continued to cause a recurring nexus of prolonged drought, locusts swarms, famine and sometimes epidemic disease because of socio-political changes.

In KwaZulu-Natal, smaller-scale political units subject to the overlordship of the Zulu kingdom or other polities followed various trajectories of vulnerability. Those who '*konza'd*' the Mthethwa or Zulu kingdoms were not subjugated into a state of poverty despite the increased demands for tribute to the central authority, as this process generally involved the incorporation of people, land and resources rather than their destruction or extortion. However, the food system of these subordinate chiefdoms became more vulnerable in a number of ways. Sub-chiefs were no longer permitted to conduct their own food-related rituals such as the *umkosi* as this was seen as undermining centralised Zulu political authority. The more centralised *umkosi* over a wider area therefore lacked sensitivity to local biophysical and climatic requirements regarding the planting and harvesting of different crops, and thereby increased the direct vulnerability of food production in parts of the composite structure of the Zulu kingdom. Similar processes occurred with occasional unreasonable demands for tribute by the central Zulu authority in Shaka's later reign, while where smaller chiefdoms were less inclined to submit, cattle were removed altogether. However, as with the Portuguese jurisdiction, one benefit of incorporation into central authority was security of land-holdings and the provision of agricultural and grazing land, which was less secure under small, segmentary political units. In both cases of incorporation, though, any resilience built by the diversification of the food system and more advanced social security mechanisms was generally undermined by new instabilities and vulnerabilities that went with being subordinate to the unstable authority of the Portuguese or Shaka's Zulu kingdom. Reliance on wild food resources, as well as banditry and migration consequently continued to be a common response in times of social breakdown and drought, the latter two of which led to more widespread competition over resources and socio-political instability. This distinction between socio-political organisation and structure is thus an important one, and demonstrates the plurality of responses to climatic stress across southeast Africa.

7.2.2 Livelihoods and trade

Trade-based livelihoods such as gold mining and elephant hunting had limited direct relevance for exposure or sensitivity to climate variability, as low numbers were involved in these livelihoods. However, these activities were of high importance to political leaders and thus state security. This had been the case since early trade connections from *c*. AD 900, through Mapungubwe and Great Zimbabwe, the Torwa and Rozvi states and the Mutapa state in Mukaranga. Mining exports and trade imports of cloth and beads played a self-reinforcing role in political centralisation and social stratification, which was strongly linked to the financing of elaborate stone structures. The trajectory of change in the relative importance, profitability and security of gold and other precious metals involved the working out of deposits, increasingly unfavourable terms of trade, the shift of labour conditions towards exploitation, and eventually the loss of control over gold resources altogether in the Mutapa state. Alongside this came a decline in political prestige, increased leadership instability, and reduced sovereignty. Indeed, it is notable that the construction of stone-built *zimbabwe* came to a halt in the mid- to late-sixteenth century Mutapa state (Pikirayi 1993), which commenced the gradual impoverishment of the area. Manyika, on the other hand, managed to retain a greater degree of control over its gold resources, aided by the Rozvi state who kept the Portuguese at a distance in the eighteenth century, and in turn had a slightly greater degree of political stability. The control of these resources was therefore of importance as political stability aided the efficacy of governance and probably centralised adaptive mechanisms such as the redistribution of grain. A partial parallel can be drawn between this and the control of cattle in the Zulu kingdom, where the reciprocity of social networks were reinforced by control of important resources. Nonetheless, the fostering of socio-economic inequality within chiefdoms that came with the expansion of trade meant that poorer people had fewer entitlements to cattle ownership and the redistribution of food, which made them more vulnerable to climatic stress.

The hunting and export of ivory offered an alternative livelihood to mining across much of southeast Africa, particularly in mineral-poor areas like Teve, where it was a useful source of income for both the leadership and wider population. In the Teve area, the ivory trade with the nearby settlement of Sofala had specific advantages, as cattle were less numerous, and the ivory obtained was a by-product of the extensive hunting that took place. Rapid response to the growing trade in ivory and cattle was also linked to state formation in KwaZulu-Natal. Importantly, though, the relative importance of trade to both the population and the leadership seems to have been low in the Zulu kingdom under Shaka. This perhaps reflects the unchanging primacy of cattle in KwaZulu-Natal, in comparison to the long-standing relationships between mineral resources, ivory and trade in the Zambezi-Limpopo area. Trade-related livelihood instability, which became increasingly prevalent when the Portuguese began to penetrate the southeast African interior in the 1570s, was thus indirectly important for response to climate variability by way of its role in political rule, but these livelihoods were clearly not as important as food production.

A key role of these livelihoods, as well as others such as the procurement of salt, ambergris, fish and cotton (Appendix B) was their use as 'convertible assets' and livelihoods that could be intensified, as they were in Manyika, to barter for food (Figure 7.2). In the Manyika area, this appears to have taken place to the extent that trade-based livelihoods became increasingly popular, forcing the ruler to authorise a change of policy to increase the degree of concentration on agriculture, which would reduce both external exposure to economic shocks and risk of food scarcity. However, in mineral-poor areas such as the Zambezi valley, where non-food based livelihoods were more limited, and there was a general absence of centralised political authority, a more direct option for individuals in times of climatic stress was to seek protection with the Portuguese. Alternative livelihoods appear to have played less of a role in response to climate variability in KwaZulu-Natal, where there were limited precious metals, and cattle was dominant in socio-cultural and political relations.

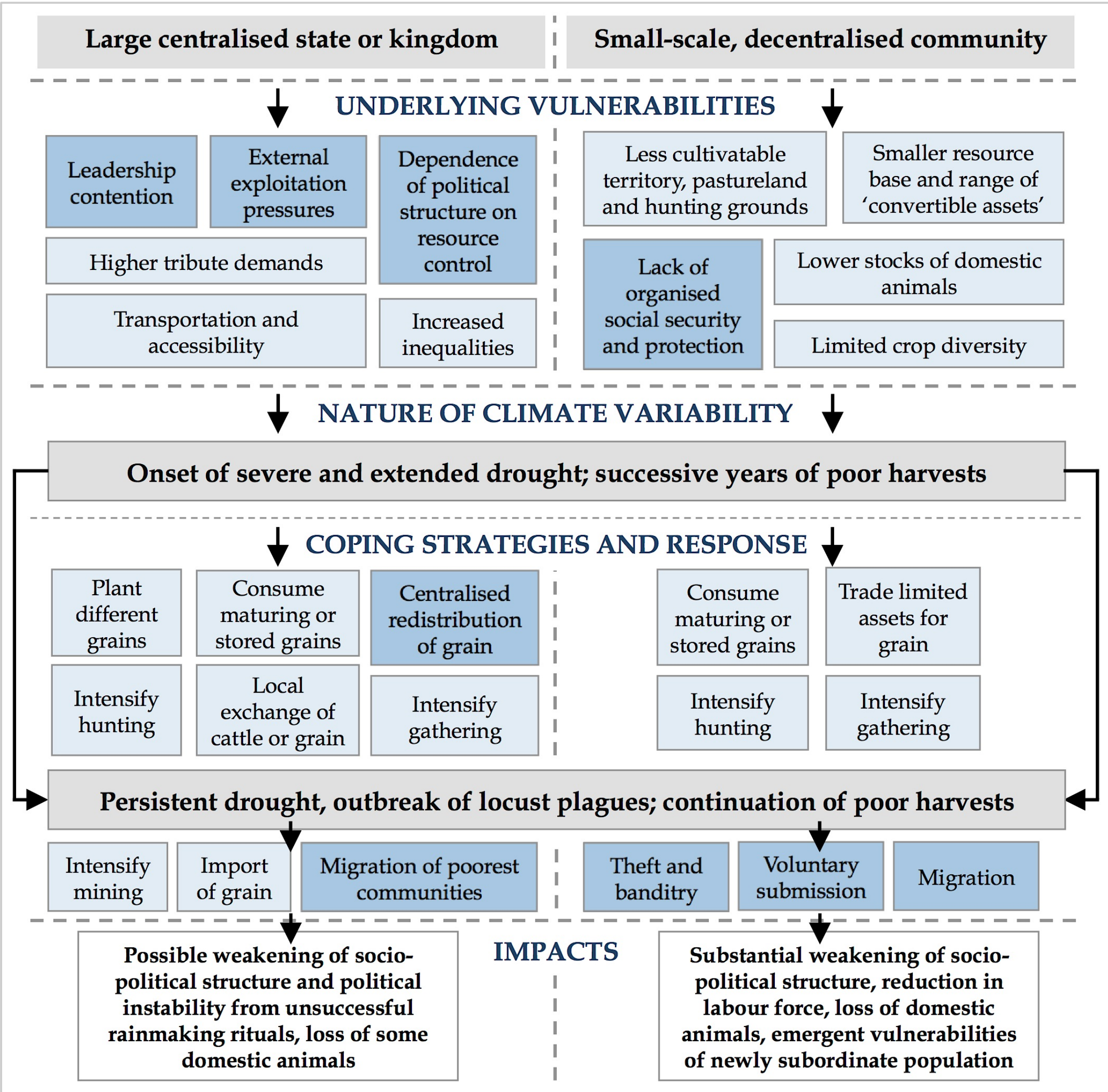

FIGURE 7.2 Sources underlying of vulnerability and response to climatic stress. Light blue shading – food system and livelihood factors; dark blue shading – socio-political factors.

7.2.3 Conflict and political stability

The final area of vulnerability discussed in the thesis relates to conflict and political stability. The nature of conflict was very different between the two sub-regions. In the Zambezi-Limpopo area, this generally took the form of long, drawn-out civil war arising from leadership disputes, or limited-scale inter-polity conflict, both of which had varying impacts but limited mortality. The main documented impacts of conflict relate to the disruption of trade and localised systems of exchange, yet evidence does not suggest that conflict had major impacts on the agricultural cycle. Rather, Rezende's account implies the opposite was the case, and that if a campaign encroached on planting and harvesting periods, it was not uncommon that warriors would desert the field and return to their gardens. This concurs with Beach's (1980, 1998) arguments regarding the generally limited impacts of conflict in this area. Indeed, evidence in Section 5.4 showed that even the capture of a ruler's *zimbabwe* and the installation of 'puppet' rulers for an extended period of time did not undermine the functioning of social relations and food production to a critical degree, which is reaffirmed by Conceição's (1696) evidence of tribute cultivation at the capital. Still, it is probable that with the reduction in political scale in the eighteenth century came a weakening of the efficacy of these systems, while issues such as transportation and disruption by more severe conflict would have also been problematic at times. This therefore demonstrates the resilience of the wider society and food production in the face of persistent civil conflict, although it is reasonable to assume that persistent instability did impact on social networks and security, and thus coping strategies, to some degree. The exception to this rule was in periods of 'total war', such as in the 1590s, the mortality resulting from which was a partial cause of the depopulation of Mukaranga.

Conflict was of a very different nature in KwaZulu-Natal, as it predominantly took the form of short-duration, high-intensity cattle raiding. The loss or gain of cattle as a source of food and socio-cultural wealth had significant impacts on vulnerability, as outlined in Section 7.2.1.2. Raiding and counter-raiding had been long-practised in the area, but the growth of *amabutho* and cattle herds brought new dimensions to these practices, which intensified conflict and in turn the vulnerability of polities with less cattle. Although these new resource imbalances increased inequalities, the mortality from conflict in KwaZulu-Natal was highly exaggerated by contemporary observers, and was perhaps only high in major campaigns (Eldredge 2014). Perhaps the best illustration of the difference in conflict between the two regions, however, is exemplified by the arrival of Nguni-speaking communities and their raiding activities north of the Limpopo. The impacts of this short-term, higher intensity conflict involved the expropriation of high numbers of cattle from polities such as the Rozvi and consequently undermined both the food system and socio-political dynamics. Political instability in the Zulu kingdom again took a different form to that in the Mutapa state. The increasingly despotic nature of Shaka's rule was held together by external pressures, yet when these subsided after the breakup of the Ndwandwe polity, Shaka's unpredictable policies and arbitrary violence had greater impacts on internal socio-political instability. The aftermath of Nandi's death is a prime example, when the harvesting of crops and the milking of cows were prohibited for three months at a time of drought, the year after which Shaka was murdered. Nonetheless, the transition of power that followed this, unlike in the Mutapa state, was relatively smooth, and made little obvious difference to food system stability. Another important aspect which influenced political stability in both Shona- and Nguni-speaking communities was rainmaking. Evidence over much of the analysis period attests to a continued importance of this practice in spite of missionary influence, but offers little insight into if and when political rule was challenged by drought and climatic stress, and thus it is only possible to speculate on these factors from written evidence alone.

These differences and similarities between underlying sources of vulnerability in southeast Africa had profound importance for the contextual significance of climate variability in socio-political formation and security, which the next section summarises.

7.3 The significance of climate variability in socio-political change

Although this thesis has shown climate variability to be an important element in various processes of socio-political transformation in southeast Africa, evaluation of its contextual significance in Chapters 5 and 6 revealed very few instances where climate was a lone driver of societal change. Instead, and as observed elsewhere (for instance, Dugmore et al. 2012; Endfield 2012), climate variability formed part of a suite of complex, multi-causal processes that impacted upon shifting vulnerability contexts. This may also be a partial reflection of the more gradual nature of socio-political change in southeast Africa as the role of climate variability itself, for excluding the decline of Great Zimbabwe and the Rozvi state, there was no 'collapse' or abrupt end to state structures. Thus, the role of climate variability was more often than not to accelerate, aggravate or even dampen this change rather than drive it. Table 7.1 assesses the significance of climate variability by assigning a weighted significance in the cases of societal change discussed at length in the earlier chapters, and ascribes confidence levels to these judgements. 'Low' significance is shown when climate variability was likely not a significant factor relative to others, 'moderate' is assigned where climate variability played a role in accelerating or exacerbating societal change, but other factors were more important, while 'high' proposes that climate variability was a principal causal contributor to the documented socio-political change. The confidence levels operate on the same scale, and denote the quantity and robustness of evidence that supports or refutes the corresponding level of significance.

High significance and high confidence were ascribed together in only two instances, in both of which there is explicit evidence of shorter-term, high-magnitude climate impacts on relatively decentralised political units and populations with low adaptive capacity in the Zambezi valley. The first of these involved the weakening of socio-political structure in the 1560s-1570s, when highly variable climatic conditions acted on a vulnerable food system in a relatively dry environment, causing famine and people to seek the protection of centralised political authority. The consequent weakening of small-scale socio-political structure undermined the capacity of local communities and chiefdoms to respond effectively to heightened external threats from the Portuguese on the one hand and the Mutapa state on the other, resulting in the assimilation of much of the Zambezi valley into the expanding Portuguese jurisdiction. The second of these events occurred in the eighteenth century, when extended drought and locust plagues impacted food systems that were less vulnerable than in the sixteenth century, but the severity of this climatic stress, and the proximity to expanding Portuguese settlement and food production, meant that food scarcity was by this point the principal reason why individuals sought the protection of the Portuguese. This pattern of response to high-magnitude climate variability was recurrent in the Zambezi valley, and therefore climatic stress was a factor of high importance in socio-political change. Climatic stress on short-term scales may well have been of high significance to socio-political dynamics elsewhere, as the model in Figure 7.2 demonstrates for the cumulative impacts of sustained drought weakening political and ritual authority, but specific cases of this process are simply beyond the resolution of the available data.

TABLE 7.1 Confidence and weighting of the contextual significance of climate variability in southeast African socio-political change *c.* 1450-1830.

Societal event or change	Timeframe	Climatic conditions	Significance	Confidence
Decline of Great Zimbabwe	c. 1450-1500	Relatively dry 1420-1450, trending towards wetter	Low	Low
Rationale: Scant evidence to make direct climate-related links. Economic and political change appears to have been highly significant, but re-assessment and inclusion of evidence means that climate-induced internal stress cannot be ruled out as a contributory factor.				
Mutapa-Danda civil wars	1516-1528	Trending from relatively wet to drier	Low	Moderate
Rationale: Political and trade-related aspects of high importance, though there is a possible but unverifiable link between drought and extreme climatic events causing food shortages at Sofala and subsequent meddling in African politics.				
Weakening of Tonga political structure	1560s-1570s	Highly variable, trending towards drier	High	High
Rationale: Highly variable climatic conditions led to widespread food shortages in the dry Zambezi valley, Tonga-speaking chiefdoms were subdued by the Portuguese.				
Slaves seeking protection on the Mozambique coast	1580s	Highly variable, trending towards drier	Moderate	Moderate
Rationale: Famine was one of several reasons causing people to seek protection and security in times of food scarcity. Low food system resilience may be equally responsible.				
Weakening of Mutapa state structure	1560s-1620s	Highly variable, trending towards drier	Moderate	High
Rationale: The Mutapa state recovered from food shortages in the 1560s and 1570s, but famine reduced the ability of the state to respond to external military threats.				

Mortality in and migration from Mukaranga	1590s-1670s	Relatively dry	Low	Moderate
Rationale: Locust plagues and famine were linked as a causal factor by Portuguese writers, but mortality from previous conflict and the conduct of the Portuguese were of greater significance.				
Impoverishment and reduction in scale of Mutapa state	1710s-1830	Trending from very dry to relatively dry, highly variable between 1800-1830	Moderate	Moderate
Rationale: Droughts and locust plagues were more prevalent in the Mutapa state at Chidima, but the economic decline through loss of cattle and mineral resources, and political instability through persistent civil war and state fragmentation were more significant.				
Increase in numbers of slaves seeking protection	1730s-1760s	Relatively dry	High	High
Rationale: Explicit evidence that food scarcity was now the principal reason people sold themselves as slaves in the Zambezi valley.				
Political centralisation in KwaZulu-Natal	1750s-1810s	Trending towards wetter, with severe drought around 1800	Moderate	Low
Rationale: Sparse evidence on the role of wetter conditions or extended drought contributing to political centralisation, evidence suggests that trade and coercion were important.				
Decline of Sena	1800-1830	Highly variable, drought 1823-1830	Moderate	High
Rationale: High climatic stress but the breakdown in food production and social relations had already begun, while the decline in economic importance of Sena was of prime importance.				
Weakening of autonomous political units in KwaZulu-Natal	1824-1830	Persistent drought	Moderate	High
Rationale: Widespread evidence for famine, and multiple strands of evidence to suggest climate had a role in this, but other factors such as loss of cattle were of high significance.				
Political instability in the Zulu kingdom	1826-1828	Persistent drought	Low	Moderate
Rationale: Social policy and mode of governance was of greater significance in political instability, despite the reduction political stability at a time of growing climatic stress.				
Increase in Zambezi slave exports	1827-1830	Persistent drought	Low	Moderate
Rationale: The last intensification of slave exports through Mozambique to Brazil was largely a result of the terms of the Portuguese-British treaty which prohibited slave exports to Brazil after 1830. Zambezi slave exports earlier may have been encouraged by a breakdown in socio-political order around Sena, where climate variability played a moderate role.				

Despite the lack of evidence for high significance elsewhere, a higher number of events or periods of change in Table 7.1 revealed a moderate significance of climate variability in socio-political transformation. This change was of variable nature, but in each case denotes complex interaction with other factors resulting in a gradual change in the socio-ecological system. This was evidenced in the sixteenth century, where climatic stress was stated as one of a number of reasons why individuals sought protection as slaves on the Mozambique coast. Similarly, evidence indicates that a number of factors coalesced to stimulate political centralisation in KwaZulu-Natal in the late-eighteenth to early-nineteenth century. Climate variability, particularly in the severe *mahlatule* famine, then had important impacts in exacerbating pre-existing inequalities and fostering the voluntary incorporation of people into expanding chiefdoms. Moderate significance was also assigned to some climate-society links despite contemporaneous high precipitation variability or recurrent climatic stress on the basis of the differences in vulnerability discussed in Section 7.2. A prime example of this was the weakening of the Mutapa state structure in the late-sixteenth and early-seventeenth century, where the lower vulnerability of the Mutapa food system enabled a recovery from climatic stress in the 1560s and 1570s. However, the impacts of climate variability in the late-1580s and early-1590s probably served to weaken the state to external threats, such as Maravi invasions and Portuguese exploitation, which were of greater significance in the weakening of political structure. Similarly, although the extended drought of the 1820s played a significant role in the eventual decline of Sena, the area was already highly vulnerable in the early-nineteenth century due to a decline in trade with the interior and the breakdown of social relations in *prazo* society.

A high number of events were also assigned low significance, including the decline of Great Zimbabwe, the Mutapa-Danda civil wars and the increase in slave exports from Mozambique in the late-1820s. This classification generally denotes the lack of an explicit link between climate variability and societal change, or the much greater importance of other causal factors despite previous hypotheses regarding the coincidence of societal change with 'unfavourable' climatic conditions.

This broad-scale summary of Chapters 5 and 6, although partially as a result of evidence limitations, proposes only limited straightforward correspondence between the severity of climate variability and its immediate socio-political consequences, contrary to common assumptions in the literature. However, this section illuminates a number of cases where climate variability interacted with other factors to play a more subtle role over longer-term scales through its impacts on underlying and structural vulnerabilities, thereby influencing socio-political transformation. The outcomes of this investigation therefore reflect and follow the conclusions of McCann (1999), who asserted the value of longer-term evaluations of historical environment-society interactions in Africa.

7.4 Future historical climate-society research in southeast Africa

The scope of this thesis was purposely relatively broad, and thus the main suggestions for future research in this spatial and temporal domain relate to the addition of further depth and texture in a number of areas. In the area of climate reconstruction, the sourcing of further high-resolution palaeoclimate proxy data, and reanalysis of existing sources using state-of-the-art age models would be highly beneficial for reducing the uncertainties and ambiguities in knowledge of past precipitation variability, particularly regarding the spatial dynamics of this change. Although this investigation has reduced uncertainties in some places, the dominant signals that were used to inform the majority of Chapter 5 can only be related to societal change to a generic degree. Furthermore, an integrated study of the relationship between precipitation variability and climate modes such as ENSO over the last millennium would increase understanding of the nature of southeast African precipitation variability on a number of spatial and temporal scales, though there are numerous uncertainties with the wide type of existing proxy ENSO datasets (Neukom *pers. comm.*).

Despite the growing body of climate reconstructions from documentary sources in southern Africa (Kelso 2007; Nash and Grab 2008; Neukom et al. 2014; Hannaford et al. 2015), there remains considerable scope for additional work. Extraction and digitisation of wind data and weather descriptions in the remaining 3000 EEIC logbooks in the British Library, as well as any additional data in the Lisbon archives, would not only enhance the resolution of the precipitation reconstructions in Chapter 4, but would most likely enable the reconstruction to be extended back to the beginning of the eighteenth century. The methodology applied in Chapter 4 could also be applied to the higher number post-1850 wind records in the ICOADS database, extending the logbook reconstructions to the beginning of instrumental records. Likewise, acquiring meteorological data from other national weather services, such as Zimbabwe, Lesotho and Mozambique, would enable further station-based reconstructions with the addition of these other logbook data.

In order to develop further semi-quantitative documentary reconstructions of past precipitation variability, a feasibility study is needed to assess the large amount of nineteenth century and pre-nineteenth century written material relating to southeast Africa. In this thesis, the majority of source material consulted related to African society, yet a considerable number of Portuguese records stored in Lisbon, Goa and Maputo will inevitably reveal further climate-related evidence for the Mozambique coast and Zambezi valley areas. Where this evidence is continuous or semi-continuous, this may well reveal further tropical cyclones, extreme weather events and storm surges on the Mozambique coast, as was found in the document from 1516 at Sofala, which could potentially provide a highly unique record of tropical cyclone occurrence, frequency and magnitude on the Mozambique coast using the methods pioneered by Nash et al. (2014) for Madagascar. Similarly, there is further potential for mid- to late-nineteenth century documentary reconstructions in the nineteenth century from British and Portuguese colonial and missionary archival records relating to Zimbabwe, Mozambique, and adjacent areas of Zambia, which would provide much-needed coverage of precipitation variability to extend the relatively short instrumental record.

The consultation of an extensive range of written and oral sources in this thesis has covered substantial ground on the vulnerability-related aspects of African communities. However, there remains scope for more detailed studies of pre-nineteenth century climate-society interactions in the Portuguese jurisdiction, particularly on the Zambezi *prazos* and in the coastal towns, where semi-continuous records of food prices and rations are available. Certainly, incorporating such records for the Sub-Saharan African interior is a worthwhile task given the paucity of high-resolution climate records prior to 1820. What may be of far greater value, however, is research of a similar approach and methodology to that adopted here from the period after 1830, through the imposition of colonial rule in 1890, and into the twentieth century colonial period. In this timeframe, the increased quantity of written and oral sources, and later instrumental climatic data and comprehensive documentary records, could be used to conduct a series of detailed, sub-regional studies of how changes in food system- and livelihood-related vulnerabilities interacted with climate variability on much higher-resolution scales than the more deep-rooted, longer-term perspectives examined here. Indeed, as precipitation and its variability remains vital to human livelihoods in rural southeast Africa, a detailed understanding of the social dynamics of adaptation to climate variability and extremes would be of increased relevance to policy-making and current climate-development discourses. This is not to suggest that the pre-1830 focus of this study is not of relevance, but the 1830s and the 1890s were transformative decades in southern Africa for a number of reasons, the former because of the migration and settlement of Nguni-speaking communities in Zimbabwe and Mozambique, the treks of Dutch stock-farmers across South Africa, and the increasing role of the British, and the 1890s as of the region-wide establishment of colonial rule. These events profoundly altered vulnerabilities across most of the region, but rather than 'reset' these completely, this resulted in the development of a complex mix of food system, livelihood and socio-political vulnerabilities in the post-colonial nation state. Thus, the development of sub-regional, integrated historical climate-society studies over the last 150 years in southeast Africa would offer considerable insight into the physical and socio-cultural origins, emergence and temporalities of vulnerability that are present today. Studies on these themes can be structured around three aims:

1. Reconstruction of sub-regional climate variability between 1830 and the beginning of the instrumental record;
2. Investigation of how changing socio-economic and political systems and adaptation policies shaped the nature of vulnerability and response of individuals and communities to such climate variability and extremes, and;
3. Evaluation of the critical social, political and economic vulnerabilities to climate change that remain key to the resilience of the twenty-first century nation state.

Taking up this task in Africa is by far the most valuable contribution that this cross-disciplinary research focus on historical climate-society interactions can make to the reduction of research gaps and uncertainties, as highlighted with high confidence in the IPCC Fifth Assessment Report, that "constrain decision-making in processes to reduce vulnerability, build resilience, and plan and implement adaptation strategies at different levels in Africa" (Niang et al. 2014, 1204). The following concluding assessment builds upon this discussion by evaluating the outcomes of this research in relation to its original aims, and ends with an evaluation of its wider significance.

Chapter 8. Conclusion

The starting point for this thesis was the divergent and often over-simplified debate over the role of climate variability in southeast African socio-political change, which is a discussion situated more broadly amongst global historiographical perspectives on nature-culture interaction. The main aims and research questions of the thesis were therefore theoretical, methodological and practical (Section 1.3). Arguably the most important of these aims was the initial challenge of advancing, both theoretically and methodologically, how to make connections between the range of disciplines and data sources required to engage with this debate, especially given the variable quantity and quality of these sources over a wide timeframe and spatial domain of analysis. To undertake this task, climate history, vulnerability and resilience were situated as 'bridging concepts' for the integration of traditions and sources in African and colonial history, environmental science, palaeoclimatology, historical climatology, development studies and to a lesser extent, oral history and archaeology.

Before putting these concepts into action, however, Chapter 2 critically analysed the environmental, economic and socio-political background and history of southeast Africa over the wider timeframe of *c*. AD 900-1830. This comprehensive assessment was crucial for the later chapters, as without prior understanding of these aspects, as well as acknowledgement of the disagreement and uncertainties that exists within and between the disciplines of palaeoclimatology, history and archaeology, any subsequent analysis of the interaction of climate and society would be fundamentally flawed. This also meant engaging with a number of underlying historiographical and epistemological 'currents' that have dominated previous discussion on this research area, including the agency of climate versus that of humans, the weighting of internal African innovation against external influence, and the function of 'worldview' against complexity. Rather than adopting one or the other position, this thesis was attentive to each of these viewpoints in their intersection with climate-society interaction. This analysis consequently allowed the identification of specific research gaps on climate-society interaction to which the following four analysis chapters could attune.

The first of these, analysed in Chapter 3, related to the uncertainty of precipitation variability over the last millennium, particularly between *c*. AD 1450-1820. This chapter took the form of an analytical review of SRZ precipitation inferences from a wide range of proxy-documentary sources, which were first assessed by correlation analysis to identify the proxies that were more representative of palaeoprecipitation. Using these sources, a decrease in precipitation was found in the SRZ over the last 1200 years, with relatively clear evidence for the MCA between *c*. AD 800-1200, and strong evidence for the LIA between *c*. AD 1600-1800, although it is less clear whether the latter period extended further back than this. Uncertainties were also highlighted in relation to early-nineteenth century precipitation variability, particularly between proxy records and the precipitation classifications of the Nicholson et al. (2012) database. A key part of the assessment in Chapter 3 was the identification of periods of climatic stress from written sources, which were of prime importance for the later climate-society analysis in Chapters 5 and 6. Comparison of this written evidence with proxy precipitation inferences revealed that evidence for climatic stress was found in clusters in periods of high and abrupt precipitation variability, such as *c.* AD 1430-1590 and *c.* AD 1780-1830, as opposed to longer periods of generally drier conditions such as the LIA in the seventeenth century.

The uncertainties in precipitation variability in the early-nineteenth century were examined in greater depth in Chapter 4 using wind observations within ships' logbooks. To reconstruct precipitation from these variables, an original method was developed which related reanalysis u-wind to station precipitation over a twentieth century calibration period of 1979-2008, and used principal component regression to apply these relationships to the u-wind variables recorded in ships' logbooks. The reconstructions at the three stations where relationships were strongest, Mthatha, Royal National Park and Cape Town, showed some correspondence with other inter-annual records from the region. In the SRZ stations, the reconstructions revealed evidence of dry conditions between 1796-1802, coincident with the *mahlatule* famine or the 'great Mozambique drought', and evidence of successive years of drought from 1824-1829, both of which appear to have been regional dry spells. Some coherence was also found with documentary-reconstructed El Niño events, but this was variable.

Chapters 5 and 6 analysed the role of changing vulnerability contexts of food systems, livelihoods and socio-political organisation in shaping the impacts of and response to the climate variability examined in the previous two chapters. Chapter 5 developed an indicator-based approach to quantify this vulnerability for a number of socio-political units and communities in the Zambezi-Limpopo region. This approach revealed a general trajectory towards increased vulnerability over the analysis period, consistent with the gradual impoverishment and socio-political breakdown of state structures in the Zambezi-Limpopo region. In the Zambezi valley in particular, this reflected an increase in the recorded impacts and response to climate variability, and it was thus a significant factor in socio-political change in this area. Nonetheless, qualitative analysis of written sources revealed that the plurality of vulnerabilities and responses to climate variability were highly dependent on socio-political organisation. Moreover, the magnitude of climate variability itself was of high importance in areas like the Zambezi valley, where high-magnitude rainfall variability was a predominant factor in recurrent disruption to socio-political order in the 1570s, 1730s and 1820s.

Chapter 6 used written and oral sources to assess the interaction between climate, conflict and food security and its importance for socio-political dynamics in the KwaZulu-Natal area between *c.* 1750-1828. Although this analysis did not use a semi-quantitative indicator-based approach, it did assess comparative perspectives on vulnerability between political units, and illuminated important interactions between agropastoral livelihoods, food security, social organisation, conflict, governance, trade and rainfall variability in both the growth of centralised political structures in the late-eighteenth and early-nineteenth century and the heightened instability in the area in the 1820s. Climate variability was judged to be of moderate significance in both of these periods (Table 7.1), but the pre-conditions of increased inequalities and social organisation, and later the mode of governance and its impacts on food security, were of high importance in shaping the impacts of climate variability.

Chapter 7 drew parallels and contrasts in the nature of and responses to climatic stress across the region. This discussion reinforced the earlier suggestion that periods of increased climatic stress occurred at times of regional and global change, including the high variability of precipitation in the transition towards the dry LIA in the sixteenth century and its last intensification in the late-eighteenth and early-nineteenth century. Examination of underlying sources of food system and livelihood vulnerability across the region enabled the identification of how these were shaped, in which socio-political organisation, governance and its stability were all key. This discussion therefore allowed a level of characterisation on how African society experienced and responded to environmental risk, as well as the identification of factors that conditioned the effectiveness of coping strategies and adaptations.

Consideration of these outcomes in relation to the original aims and research questions makes clear that these were successfully achieved and answered. While the studies in each of the analysis chapters are relevant as standalone research, the major value of this thesis is the cross-disciplinary approach which ties these seemingly disparate sources, disciplines and methodologies together, providing original insights into the interaction between the complex physical and cultural determinants of past climate impacts. This emphasis on interaction is important, as it is in contrast to much previous research, some of which continues to emphasise the agency of climate over humans (for example Burke et al. 2009; Hsiang et al. 2013), or vice versa. The sooner the notion of interaction gains full acceptance in both historical and contemporary studies, the sooner a fuller understanding of these complex processes can be achieved.

Perhaps the most significant outcome of this research, though, is the potential application of its approaches and methods to other spatial and temporal contexts, whether this relates individually to ships' logbook-based climate reconstructions, or analysis of the influence of changing livelihoods and political systems on vulnerability to climate variability, or collectively in the integration of datasets and disciplines. The focus prior to the twentieth century represents a relatively young but highly rich area of research, especially in developing regions, which are arguably where such studies are most valuable given present and future climate-development challenges. This line of investigation and reasoning is certainly distinct from the conventional justification for past climate-society research, which has often viewed the past as a source of cautionary tales of maladaptation. The proliferation of sub-regional level climate-society assessments that are sensitive to cultural and historical conditions can therefore make an important contribution to future, global assessments on the nature of climate change, underlying vulnerabilities and the design of adaptation strategies.

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Appendix

Appendix A

Evidence of climate variability not mentioned in the main text

Event and possible climatic inference: September 1511: Scarce provisions at Sofala, drought?
Evidence: "You shall pay each person as set down under his item – namely – to each of the first nine, five alqueires of *milho* and one of kaffir-corn because there was a shortage of *milho*." Perestrello (1511, 135).
Confidence rating: 1 (low)
Rationale: Supply and demand problems were due to a range of causes at this time (see Section 5.3.1).

Event and possible climatic inference: 1554: scarce provisions around Maputo bay, drought?
Evidence: "There he [the king of Inhaca] gave to each person about a peck of grain like canary seed, which is the best provision in the country, and is esteemed by them like relics." Perestrello (1554, 271).
Confidence rating: 1 (low)
Rationale: As Perestrello also notes that "the people of these parts are bred in the wilds… having no notion of cultivating the earth" (Perestrello 1554, 272), any possible scarcity of provisions appears to relate to the lack of local agricultural production rather than the potential adverse impacts of a drought event.

Event and possible climatic inference: 1560: floods in the Mozambique coastal plain – very wet year.
Evidence: "As these lands are all flat, when it rains heavily in the Winter the streams along the way fill, leave their beds and cover the whole land like a deluge. This year the Portuguese were caught in one of these floods and most of them abandoned their goods and others remained, either upon a tree or near one." Fernandes (1560, 475).
Confidence rating: 2 (moderate)
Rationale: Explicit evidence of flooding, but unclear whether this is representative of an extreme weather event or anomalously wet year.

Event and possible climatic inference: June 1593: scarce provisions in KwaZulu-Natal, drought?.
Evidence: "Nothing was brought for sale except a cow belonging to the lord of the country, because provisions were scarce that year, owing to want of rain" Lavanha (1593, 327).
Confidence rating: 3 (high)
Rationale: Explicit evidence of lack of rain in 1593.

Event and possible climatic inference: 1861: famine in KwaZulu-Natal, drought?

Evidence: "Ilanga li ka Mbete – this is the name of a great famine which occurred in Zululand about the year 1861. It got its name because of people leaving their homes and going to pick and feed on figs etc. In Swaziland the same famine was known as indhlala ka ngongoni" Falaza (129).

"There was a great drought; it was called the drought of Mbete. The land was destroyed. The king ordered the people to be sent to ask for rain from Langalibalele ka Mtimkulu. Indeed they crossed the Tukela with the rain following close behind them" (Magolwana, 111).

Confidence rating: 2 (moderate)

Rationale: Explicit evidence of drought and severe impacts, though date uncertain.

Event and possible climatic inference: Seventeenth century cold LIA conditions.

Evidence: "In these lands, especially in Matuca and Manica, it can get very cold in June and July, almost everyday the waters are frozen and the fields covered in frost" Macedo (1633, 15).

"In the Mocranga… sometimes the water freezes and, in the highest mountains, the bodies too" (Sousa 1697, 237)

Confidence rating: 1 (low)

Rationale: Lack of continuous records on temperature for comparison.

Appendix B

Vulnerability indicator assessment

1505-1560: Food, trade and conflict in the early-sixteenth century.

Indicator	Mutapa	Manyika	Sofala
Crop diversity	0	0	0
Domestic animals	-1	0	1
Animals hunted	-1	-	0
Wild resources	-1	-1	-1
Cultivatable territory	-1	0	1
Quantity of minerals controlled and mined	0	-1	1
Prices of and demand for minerals	0	0	0
Quantity of ivory hunted	-1	0	0
Prices of and demand for ivory	0	0	0
Alternative livelihood options	0	0	-1
Access to and participation in inter-continental trade network	0	0	0
Access to local trade network	-1	-1	0
Leadership contention and stability	-1	-1	-
Sovereignty	-1	-1	1
Presence of local conflict or raiding	0	0	1
Presence of external conflict	-1	-1	0
Presence of slavery	-1	-1	1
Inferred fertility of land	-1	-1	-1
Hazard prevalence	0	0	1
Occurrence of epidemic, disease, plague or pests	-	-	-
Total	**-11**	**-8**	**4**

Sources:

Food system: Alcáçova (1506), Goes (unknown year), Barros (1552) and Frois (1561) on Mutapa state, Almada (1516) and Barbosa (1518) on Sofala.

Livelihoods and trade: Alcáçova (1506) and Barros (1552) on mining, Barbosa (1518), Velho (1547) and Botelho (1552) on ivory, Almada (1516), Barbosa (1518), Bhila (1982) and Beach (1994) on access to trade, Phimister (1976), Mudenge (1988) and Newitt (1995) on prices.

Socio-political: Veloso (1512) on Mutapa political dynamics, Sepúlveda (1542), Velho (1547), Bhila (1982) and Mudenge (1988) on conflict, Barbosa (1518) on socio-political situation of Sofala area.

Biophysical: Almada (1516), Barros (1552) and Fernandes (1560) on fertility and hazards.

1561-1624: Climatic stress, violence and Portuguese penetration.

Indicator	Mutapa	Manyika	Teve	Zambezi valley	Inhambane	Sofala	Sena	Quelimane
Crop diversity	0	0	1	1	1	-1	-1	-1
Domestic animals	-1	-1	0	0	0	0	0	0
Animals hunted	-1	0	-1	0	0	1	1	-1
Wild resources	-1	-1	-1	-1	0	-1	-1	-1
Cultivatable territory	-1	0	-1	0	0	1	1	0
Quantity of minerals controlled and mined	-1	-1	1	1	1	1	1	1
Prices of and demand for minerals	1	1	1	1	1	1	1	1
Quantity of ivory hunted	-1	0	-1	0	-1	0	1	1
Prices of and demand for ivory	-1	-1	-1	-1	-1	-1	-1	-1
Alternative livelihood options	-1	-1	0	-1	0	0	0	0
Access to and participation in inter-continental trade network	-1	-1	-1	0	0	-1	-1	0
Access to local trade network	0	-1	0	0	0	0	-1	0
Leadership contention and stability	1	0	0	0	-	-	-	-
Sovereignty	0	0	0	1	1	1	1	1
Presence of local conflict or raiding	1	1	1	1	0	0	1	1
Presence of external conflict	1	1	1	1	0	0	1	1
Presence of slavery	-1	-1	-1	1	0	1	1	1
Inferred fertility of land	1	1	0	0	-1	-1	0	-1
Hazard prevalence	1	0	0	1	1	1	1	1
Occurrence of epidemic, disease, plague or pests	1	-1	1	1	1	1	1	1
Total	**-3**	**-3**	**-1**	**6**	**3**	**3**	**6**	**4**

Sources:

Food system: Azevedo (unknown year), Monclaro (1573), Santos (1609), Castelbranco (1618) and Fernandes (1562) on food system.

Livelihoods and trade: Santos (1609), Anonymous (1573), Monclaro (1573) and Couto (1616) on minerals and ivory, Bhila (1982), Mudenge (1988) and Newitt (1995) on trade.

Socio-political: Santos (1609), Castelbranco (1618), Beach (1980, 1994), Mudenge (1988) and Newitt (1995) on socio-political situation.

Biophysical: Carneiro (1573), Monclaro (1573) and Santos (1609) on fertility, Monclaro (1573) and Santos (1609) on locust plagues, Santos (1609) on epidemics.

1625-1692: Livelihoods and vulnerability under the Portuguese.

Indicator	Mutapa	Manyika	Teve	Zambezi valley	Sofala	Sena	Quelimane
Crop diversity	0	0	0	-1	-1	-1	-1
Domestic animals	-1	-1	0	0	-1	0	0
Animals hunted	-1	0	-1	-1	1	1	-1
Wild resources	-1	-1	-1	-1	-1	-1	-1
Cultivatable territory	-1	0	0	0	1	0	0
Quantity of minerals controlled and mined	1	0	1	1	1	1	1
Prices of and demand for minerals	1	1	1	1	1	1	1
Quantity of ivory hunted	0	0	-1	0	0	1	1
Prices of and demand for ivory	-1	-1	-1	-1	-1	-1	-1
Alternative livelihood options	-1	-1	0	-1	0	0	0
Access to and participation in inter-continental trade network	1	-1	-1	1	-1	-1	-1
Access to local trade network	-1	-1	-1	-1	-1	-1	-1
Leadership contention and stability	1	1	0	-	-	-	-
Sovereignty	1	0	1	1	1	1	1
Presence of local conflict or raiding	1	0	0	1	-1	1	1
Presence of external conflict	1	1	0	1	1	1	1
Presence of slavery	1	0	-1	1	1	1	1
Inferred fertility of land	-1	-1	-1	-1	-1	-1	-1
Hazard prevalence	0	0	0	1	1	1	1
Occurrence of epidemic, disease, plague or pests	-1	-1	-1	0	0	0	0
Total	**-1**	**-5**	**-6**	**1**	**0**	**3**	**1**

Sources:

Food system: Bocarro (1631-49), Macedo (1633), Gomes (1648), Barreto (1667), Anonymous (1683) and Rezende (1634).

Livelihoods and trade: Bocarro (1631-49), Macedo (1633) and Anonymous (1683) on minerals and ivory. Phimister (1976) and Newitt (1995) on prices and demand.

Socio-political: Bocarro (1631-49), Rezende (1633) and Newitt (1973, 1995).

Biophysical: Bocarro (1631-49), Macedo (1633), Pereira (1663) and Anonymous (1683).

1693-1760: The rise of the Rozvi and climatic stress on the Zambezi.

Indicator	Mutapa	Manyika	Teve	Zambezi valley	Sofala	Sena	Quelimane
Crop diversity	-1	0	0	-1	-1	-1	-1
Domestic animals	1	-1	0	0	0	0	0
Animals hunted	0	0	-1	0	1	1	-1
Wild resources	-1	-1	-1	-1	-1	-1	-1
Cultivatable territory	0	0	0	0	1	0	0
Quantity of minerals controlled and mined	1	0	1	1	1	1	1
Prices of and demand for minerals	1	1	1	1	1	1	1
Quantity of ivory hunted	0	0	-1	0	0	1	1
Prices of and demand for ivory	-1	-1	-1	-1	-1	-1	-1
Alternative livelihood options	0	-1	0	-1	0	0	0
Access to and participation in inter-continental trade network	0	0	-1	0	0	0	-1
Access to local trade network	-1	-1	-1	-1	1	0	-1
Leadership contention and stability	1	1	1	-	-	-	-
Sovereignty	0	0	0	1	1	1	1
Presence of local conflict or raiding	1	1	1	1	1	1	-1
Presence of external conflict	-1	-1	0	1	1	1	-1
Presence of slavery	0	0	1	1	1	1	1
Inferred fertility of land	-1	-1	-1	-1	-1	-1	-1
Hazard prevalence	0	0	0	1	1	1	1
Occurrence of epidemic, disease, plague or pests	1	1	1	1	1	1	-
Total	**0**	**-3**	**-1**	**2**	**7**	**6**	**-3**

Source:

Food system: Conceição (1696), Sousa (1697) and Xavier (1758).

Livelihoods and trade: Conceição (1696), Sousa (1697) and Xavier (1758) on minerals, ivory and trade access, Phimister (1976) and Newitt (1995) on prices and demand.

Socio-political: Conceição (1696), Ribeiro (1698), Mudenge (1988), Beach (1980, 1994) and Newitt (1995).

Biophysical: Conceição (1696) and Xavier (1758) on fertility, Miranda (1766) on hazards and locust plagues.

1761-1830: Climate and socio-political breakdown in Zambezia.

Indicator	Mutapa	Manyika	Zambezi valley	Sena	Quelimane
Crop diversity	-1	0	-1	-1	-1
Domestic animals	1	1	0	0	-1
Animals hunted	0	0	0	1	-1
Wild resources	-1	-1	-1	-1	-1
Cultivatable territory	0	0	0	1	0
Quantity of minerals controlled and mined	1	0	1	1	1
Prices of and demand for minerals	1	1	1	1	1
Quantity of ivory hunted	0	0	0	1	1
Prices of and demand for ivory	-1	-1	-1	-1	-1
Alternative livelihood options	0	-1	-1	0	0
Access to and participation in inter-continental trade network	0	0	0	0	-1
Access to local trade network	0	-1	-1	0	0
Leadership contention and stability	1	0	-	-	-
Sovereignty	-1	0	1	1	1
Presence of local conflict or raiding	1	1	1	1	-1
Presence of external conflict	1	1	1	1	1
Presence of slavery	0	0	1	1	1
Inferred fertility of land	-	-1	-1	-1	-1
Hazard prevalence	1	0	1	1	1
Occurrence of epidemic, disease, plague or pests	1	0	1	1	0
Total	**4**	**-1**	**2**	**7**	**-1**

Sources:

Food system: Castro (1763), Anonymous (1780),

Livelihoods and trade: Castro (1763), Anonymous (1780), Bhila (1982), Newitt (1995).

Socio-political: Castro (1763), Miranda (1766) Anonymous (1780), Bhila (1982), Mudenge (1988) and Beach (1994) on political stability and conflict, Alpers (1975) and Newitt (1995) on slavery.

Biophysical: Miranda (1766), Ferrão (1810), Newitt (1988) and Silva (1830, 1831) on hazards.

Alternative livelihoods

Documentary evidence of alternative livelihoods.

Alternative livelihoods	Mutapa	Manyika	Teve	Zambezi valley	Sofala	Sena	Quelimane
Iron	x	x	x	x			
Copper	x	x					
Quartz	x	x					
Metal-working	x	x	x	x			
Salt	x				x		x
Weaving	x	x	x	x	x	x	x
Cotton				x	x	x	x
Timber crafts				x		x	x
Sugar				x	x	x	x
Ambergris			x		x		x

Appendix C

'Foods used by the natives when in distress'. Quotes taken from Fynn (1836, 305), except for *izinongwe* (Mmemi ka Nguluzane, 238) and *armatingoola* (Isaacs 1836, Vol. I, 87).

Name of plant	Description
Imbecca	Water lily: stalk as flour and leaves as spinach. The roots are boiled for 24 hours without which it would be bitter.
Ingonolla	A creeper round trees with leaves resembling a French bean. When about 6 feet high eatable. The roots are peeled, cut in pieces and parboiled, it is then cut in slices as thin as a wafer and planted in a running stream for 36 hours. It is then again boiled and affords excellent food. Without undergoing the above process it causes temporary insanity.
Umguambaler	Spreading root which is divided and boiled in four waters. The first is thrown away and the fourth remains 24 hours. One person eats on trial before a number will be allowed to partake. Belching of wind from the stomach decides its safety, otherwise it causes madness for a short period.
Esondu	Part of the wild date. The lower part above the ground is eaten raw or boiled and is much like nuts. The fruit has the flavour of gingerbread, but only the skin which covers a large nut is eaten.
Esindu	Wild coffee tree; also eaten in the same manner.
Incamanga	Wild plantain. The heart is juicy and astringent. The seeds make coffee or are eaten parched and sometimes smoked by the natives in lieu of dakka.
Imbase	Forms a small hedge of straight branches from the ground and yields roots nearly the size of a man's body. It is peeled off a thin rind of a reddish colour and ground between stones, the small fibres extracted and eaten raw; being extremely sweet it is often baked after grinding and eaten with milk. It is sometimes made into a wine by first baking the root after grinding, on which boiling water is poured and when cool it ferments without any other additions.
Isebalarn	Bulbing plant about six inches high with leaves resembling the water lily. The leaves are arrow shaped, speckled with white spots. The bulbs are the size of a potato but without it is boiled in two waters it is of a bitter taste and burns the throat.
Undongna	Plant bearing pods, the seeds of which produce oil but are frequently parched and eaten.
Untumba	Large plant with lance shaped leaves, small white blossoms and produces large globular bladders which on sudden pressure explodes with a loud noise. It is great abundance near Natal and the inside bark is used by the natives to string beads.
Ebondo	A long tuber very like a potatoe and altho' good eating does not resemble the original so much as the Amasamban which Mr Fynn believes to the potatoe in its wild state. The Umpanga grows about three feet high. It is a species of wild date or belongs to that tribe The centre of the root is dried, ground into powder and eaten with milk when corn is scarce. It bears a nut.
Moondi	Root much esteemed by all Kafirs, grows only in Faku's country and the Zulus. Much resembles stick liquorish in flavour.
Izinongwe	A fruit eaten when famine is on. The Ngema people [part of the Qwabe tribe] expressed an unwillingness to join the Qwabe's in the proposed hunt on the ground that, there being a scarcity of food, they were busy eating ingadi marrows, alias izinongwe.
Armatingoola	Plum; the natives consume with great avidity in their incursions where there are no kraals.