



# Collapse Studies in Archaeology from 2012 to 2023

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Accepted: 2 January 2024  
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## Abstract

The study of collapse in archaeology and history has continued to grow and develop in the last decade and is a respectable target of investigation in and beyond these fields. Environmental determinism and apocalyptic narratives have become less acceptable and collapsology has matured into a more nuanced, self-critical, and sophisticated field. This review explores recent work on collapse in archaeology between 2012 and 2023. It demonstrates how collapse, and associated concepts such as resilience, fragility, and vulnerability, are studied in the light of present-day threats, how collapse studies are increasingly recognized to have application in the present day, where they can contribute to discourses of resilience and sustainable development, and shows the diversity present in collapse studies. It also discusses the language and concepts of collapse. I explore these areas with reference to general works on collapse and to six specific historical episodes of collapse: Old World collapse, eastern Mediterranean collapse, the Western and Eastern Roman Empires, the Classic Maya, Tiwanaku, and Rapa Nui.

**Keywords** Collapse · Resilience · Fragility · Vulnerability · States · Climate change

## Introduction

Since my last review of archaeological work on collapse appeared in this journal just over ten years ago (Middleton 2012), interest in the topic and related areas, such as resilience, has continued to increase. In the last five years alone, five major volumes have been published (e.g., Bárta and Kovář 2019; Centeno et al. 2023a; Erdkamp et al. 2021a; Gehler et al. 2022a; Izdebski et al. 2022a). Not only have more studies appeared on specific collapses, but also there has been a broadening and deepening of thought on collapse, which has mostly eclipsed the very visible deterministic and apocalyptic strands of the collapse discourse identified in my previous review (e.g.,

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Sharratt 2024). Resilience has an increased presence as a co-concept with collapse, and an interest in fragility and vulnerability has come more to the fore. There is a greater desire to open archaeology and history to interdisciplinary work on collapse and resilience and to produce work that can have a tangible impact on contemporary thinking and policy (Darlington 2023; Haldon et al. 2018d; Izdebski et al. 2016). The time is ripe, then, to revisit the topic and offer a framing of the field.

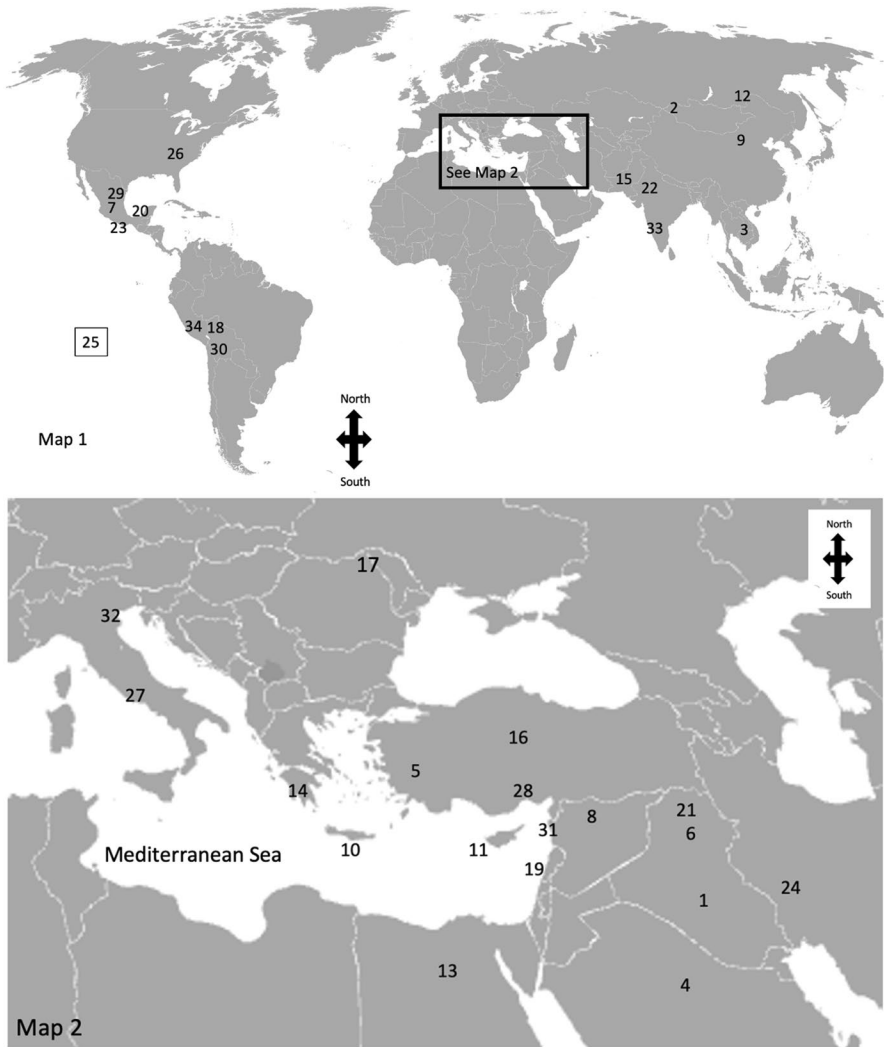
This article seeks to introduce and critically discuss work on collapse in archaeology from 2012 to 2023. It builds on my previous work published in this journal (Middleton 2012) and elsewhere (especially Middleton 2017a, b). Here I aim to avoid repetition and self-citation as much as possible in order to focus on the work of others. Inevitably, the review has my slant; I acknowledge that others may see the field and interpret evidence differently. I hope to have been reasonably inclusive, though, that the reader can follow up ideas and trends of interest.

I avoid citing works earlier than 2012 to maintain an up-to-date focus, though occasionally it is necessary to cite foundational works to provide additional context (Renfrew 1984; Tainter 1988; Yoffee and Cowgill 1988; also McAnany and Yoffee 2010; Schwartz and Nichols 2006). Those contributions are cited by most later studies and they continue to inspire new work and drive forward new understandings of past collapse and transformation.

It is impossible, however, to be aware of or discuss every relevant publication in what is an ever-expanding literature. In this review, then, I have chosen to give shape to the discussion on collapse in the first part, picking up the threads according to three themes that emerge from the literature. There I present recent work on collapse, mainly of state-level societies, in the context of current threats, as an applied field, and in terms of the diversity present in collapse studies. In the second part, I revisit the language and concepts of collapse and some of the related terms and ideas that form part of collapsology. In the third part, I present six episodes of collapse, chosen to update my earlier review (Middleton 2012): the 4.2 ka event and global collapse, collapse in the eastern Mediterranean c. 1200 BC, the Western and Eastern Roman Empires, the Classic Maya, Tiwanaku, and Rapa Nui (see Fig. 1 for locations mentioned in the text). The article ends with some final thoughts.

## Picking up the Threads

Collapse, as the end (in some sense) of ancient societies, has remained in the news since 2012 and continues to be a research focus in archaeology, history, and beyond (Brozović 2023). Popular articles about the Maya and Roman collapses still appear regularly (e.g., Fallows 2019; García Barrios 2023; Jarus 2021; RNZ 2020; Roos 2023; Serafin 2022; Sessa 2019). Others look at past, present, and future collapse (e.g., Hutt 2016; Kemp 2019; McMillan 2021; Spektor 2021; Turchin 2023b). Scholars expose and explore the ongoing omnipresent fascination, expressed across cultural genres, with environmental collapse throughout modern popular culture (Vogelaar et al. 2018; see also Darlington 2023). Interviews with collapse scholars such as Cline (Frank 2014), Demarest (Nation 2014), Turchin (Wood 2020),



**Fig. 1.** Maps showing locations mentioned in text (underlined locations are on Map 2): *1* Akkadian Empire (Mesopotamia), *2* Altai Mountains, *3* Angkor and Khmer; *4* Arabia; *5*, Arzawa, *6* Assyrian Empire, *7* Aztec; *8* Carchemish, *9* China, *10* Crete, *11* Cyprus (Alashiya), *12* Eastern Turkic Empire, *13* Egypt, *14* Greece, *15* Harappan/Indus Valley, *16* The Hittites, *17* The Huns, *18* Inka, *19* The Levant, *20* Maya, *21* Mittani, *22* Mughal Empire; *23* Oaxaca, *24* Persia, *25* Rapa Nui (Easter Island), *26* South Appalachian Mississippian, *27* Roman Empire (Rome), *28* Tarhuntašša; *29* Teotihuacan, *30* Tiwanaku, *31* Ugarit; *32* Venetian Republic, *33* Vijayanagara, *34* Wari. Maps prepared by the author. Base map from [https://commons.wikimedia.org/wiki/File:World\\_blank\\_map\\_countries.PNG](https://commons.wikimedia.org/wiki/File:World_blank_map_countries.PNG)

and Middleton (Wyman 2022) also help communicate and share ideas on collapse through society.

Begley (2021) takes a novel approach to weave together archaeological perspectives on past collapses with an examination of practical strategies to help people

survive crises on the ground. He stresses that what we term past collapses took time, decades or more, to play out, during which people and communities adapted in various ways, which suggests we can and must be flexible in facing our own future. Others muse on living through ecological collapse (Servigne and Stevens 2020; Servigne et al. 2021), as we as a species are perhaps already doing (Dasgupta and Ehrlich 2019; Dearing et al. 2023; Willcock et al. 2023).

In view of a continuing focus on the environment, studies of collapse have become even more bound up with formal or informal notions of resilience, with which it forms a conceptual duality rather than a simple an opposition (Butzer 2012; Strunz et al. 2019). A range of key terms and concepts intersect in collapse studies, giving collapsology a distinct linguistic identity and ontology of its own.

I divide this part of the paper into three sections. First, I discuss collapse in the context of contemporary environmental threats to societies; second, I present a vigorous strand of applied collapsology; and third, a survey indicates the diversity in scale and approaches to collapse and resilience.

## Past Collapse and Current Threats

Archaeologists and other scholars interested in collapse are inevitably affected by contemporary circumstances, and some of the interest in past collapse and resilience is undoubtedly driven by the threats posed by climate change, environmental crises, and fears of reaching a tipping point (Heinrich and Hansen 2021; Lenton 2023; Middleton 2018a; Redman 2012). At any rate, climate catastrophism and determinism have not disappeared from the discussion of past collapse, and many studies since 2012 repeat, continue, or develop themes of collapse and the environment, especially citing climate change and drought as a primary causal factor in collapse.

This is not surprising since new palaeoclimatic data appear regularly, and at every turn there is the temptation to blame a given collapse on climate change (or to strongly imply this, despite caveats) and thus solve big historical conundrums. The identification of apparent coincidences of climate change and sociopolitical or demographic change is often accepted as evidence for a cause-and-effect relationship from the environment to human society. In some cases, it is clear that researchers “focus on the occasions in which a correspondence is observed ..., but neglect the times when there is an environmental calamity and no transition, and those in which there is a cultural transition but no accompanying environmental disaster” (Kintigh and Ingram 2018, p. 29).

A number of books privilege the role of climate change in collapse and historical change, though not all fall foul of simplistic climatic determinism. Brook (2023) examines the relation of climate and the Little Ice Age to the collapse of the Ming dynasty (see also Zheng et al. 2014). Parker (2013) also links climate and the Little Ice Age to the global history of the 16th century AD as a cause of various disasters and difficulties. Blom (2020) gives a different perspective on the period as do Degroot et al. (2021), who describe how the Dutch Republic not only coped but thrived at this time. Harper (2017) argues that climate and plague are key to the history of the Eastern Roman, or Byzantine Empire, and the unfolding of the sixth

century AD and after. Cable (2020) focuses on the role of megadrought in demographic changes in the Mississippi and South Carolina region in the 15th century AD. Rather than collapse, Van de Noort (2013) studies four episodes of past resilience to climate change in wetland areas.

Weiss's (2017a; reviewed in Middleton 2018b) edited volume ostensibly focuses on megadrought; in the introduction, it claims that "megadroughts, impossible to predict and impossible to withstand, may have cause political [and societal] collapse, regional abandonment, and habitat tracking to still productive regions" (Weiss 2017c, p. 1). Other views are present in the volume, though. Fletcher et al. (2017), for example, note the collapse of the city of Angkor, but also describe the flexibility and resilience of the Khmer state, which continued to exist (see also Stark 2019).

The chapters in Erdkamp et al. (2021a) also focus on climate, collapse, and resilience, but the volume as a whole is critical of simple climate-collapse narratives (Erdkamp et al. 2021b). Contributions examine specific features of human-environment relations such as climate and agricultural risk (Kelly 2021) and climate and disease (McDonald 2021). The presence of environmental determinism is discussed by a number of the authors (e.g., Heinrich and Hansen 2021, p. 29), some drawing on the discussion of Arponen et al. (2019 – with responses in *Archaeological Dialogues* 26, June 2021).

Rapa Nui, Easter Island, is one of the most well-known stories of the self-induced ecological collapse of a society, with the hapless or ignorant locals to blame for their own demise in an object lesson for modern society. However, its prominence has led to a sustained critique and closer consideration of evidence and the way in which it is interpreted and presented. Boersema (2015a, b) now puts together a substantially different view, with the major themes being survival and cultural resilience. In this view, there was no apocalyptic pre-contact collapse but "if indeed Easter Island can be said to have experienced a collapse, it did not occur until the nineteenth century and for reasons completely different from those hitherto put forward" (Boersema 2015a, p. 7).

In addition to climate and environmental matters, there has also been a continued interest in other cataclysmic or catastrophic events, disasters, and their impacts on human societies. Van Bavel et al. (2020) delve deep into the nature of hazards and how they become disasters and explore human responses to them. They emphasize the preconditions of a disaster scenario and also set out responses and interventions made to cope with them and extend their discussion into the contemporary world.

Mordechai (2018) describes "short term cataclysmic events," such as tsunamis, earthquakes, floods, epidemics, and so on. He argues that investigating societies through these events can be a fruitful avenue for research and can help identify a "society's adaptive mechanisms and resilience over time" (Mordechai 2018, p. 331). He identifies earthquakes as the most common of these events in the ancient eastern Mediterranean and argues that, on a state level, societies were resilient in the face of seismic events (Mordechai and Pickett 2018).

The COVID pandemic has inevitably raised questions about the impacts of disease on human society, including models of apocalyptic collapse (Hulme and Horner 2021, p. 184), although there was already interest in this area in collapse studies. Drawing on past epidemics to inform current policy and preparedness,

scholars note resilience in the face of plague rather than collapse. DeWitte et al. (2017) discuss the successful response and adaptation to the Black Death in Europe, which nevertheless came at a catastrophic cost. Kelmelis and DeWitte (2021) argue that survivorship increased after the Black Death mortalities in Denmark. Streeter et al. (2012) argue that plague was not a cause of collapse in medieval Iceland, but rather that the society and the adaptations people made indicate resilience in the face of demographic shock. The reality and impacts of the Justinianic plague have also been discussed and disputed by Mordechai and Eisenberg (2019), who convincingly reject a maximalist, apocalyptic plague narrative. Garcia et al. (2021) discuss the impact of European diseases on the Americas and the Black Death in Europe with a focus on the built environment, set in the context of the COVID-19 pandemic.

Collapse studies have made some progress in, by and large, rejecting simplistic, deterministic explanations of collapse. Most now acknowledge the complexity of collapse, the variety of historical realities, and the difficulties of assigning causality to processes such as collapse. Resilience is proving to be a useful foil, in a general sense. It is possible to identify catastrophe without collapse—and collapse without catastrophe.

## Applied Collapsology

Archaeology and ancient history are valuable and deep sources of data on human adaptations and responses to the environment. It is widely recognized that research in these fields can, despite differences between past and present (Jackson et al. 2022), inform contemporary discussions, policies, and practices of development and sustainability, and there is a belief that it should (Abegão 2022; Centeno et al. 2023a; Guttman-Bond 2010; Kintigh et al. 2014; LeFebvre et al. 2022; Sabloff 2008). Guttman-Bond (2019), for example, provides positive practical examples for increasing societal resilience and sustainability, drawing explicitly from archaeological examples. She describes how ancient inhabitants of the Negev Desert were able to manage water supplies to support farming and urbanism in an arid environment (Guttman-Bond 2019, pp. 46–54). Turner et al. (2020) argue that landscape archaeology can be “future facing” and contribute to better and more sustainable future landscapes, providing three examples from China, the Mediterranean, and the UK. Chase et al. (2023) studied urban trajectories in ancient Mesoamerica, proposing that studies of ancient urbanism, in particular in the context of adaptation, resilience, persistence, and collapse, can contribute to modern day issues or urban adaptation (see also Feinman et al. 2023 on urban persistence).

It is possible to recognize in the collapse and resilience literature a prominent strand of applied collapsology. Darlington (2023, p. 7) notes “a cacophony of voices warning about how important it is to learn from the past” and himself offers nine lessons. Turchin (2023b) makes five suggestions to avert Western collapse. Storey and Storey (2017, pp. 219–228) spell out explicitly what can be learned from the collapse of the Western Roman Empire and the Classic Maya, noting increasing inequalities in wealth prior to collapse. Unsurprisingly, many contributions in this vein are environmentally focused, particularly on climate change. Van de Noort

(2013, p. 2), studying wetland archaeology, presents archaeological research “as a repository of adaptive pathways” from which ideas that “help build the resilience of communities in the face of rapid climate change can be gathered.” He writes of a climate change archaeology that works in tandem with high-resolution palaeoclimatic records to help us explore in what ways past societies experienced and coped with past climate change. A chapter by Rosen (2022) examines what can be learned from the Traditional Ecological Knowledge of small-scale and foraging societies, to generate ideas with potential application in suburban contexts such as neighborhoods and urban gardens and water management.

Wide-ranging contributions to this strand of the collapse discourse, which address many themes and examples, are found in several edited volumes, including Izdebski et al. (2022a), Centeno et al. (2023a) and a recent special issue of *The Holocene* (Dawson et al. 2022). Izdebski et al. (2022b, p. 2) state that “by analyzing historical societies as complex adaptive systems, we contribute to contemporary thinking about societal-environmental interactions in policy and planning and consider how environmental and climatic changes, whether sudden high impact events or more subtle gradual changes, impacted human responses in the past.” Haldon (2022) suggests we need critical history and interdisciplinarity to understand past adaptations to climate and environmental change.

Two edited volumes, Cooper and Sheets (2012) and Riede and Sheets (2020) aim explicitly at adding archaeology into the discourse of disaster, hazards and sudden environmental change and providing practical lessons for stakeholders outside of archaeology, with the studies all situated within broader discussions of change and vulnerability, resilience, and sustainability. Each chapter has a message from the author to the reader; in Cooper and Sheets (2012) this is in the form of a box section at the end of each chapter directed to policy makers and the disaster management community and in Riede and Sheets (2020) an opening summary for stakeholders. The volumes’ concluding chapters, by Kohler (2012) and Redman (2012), and by Schuller (2020) offer critical discussions of the contributions in the context of global sustainability.

On the ground, a Museum of London (MOLA) blog presents a number of projects in which archaeology can contribute on a practical level to discussions on climate change and its impacts (Newton 2021). The National Park Service (2022) of the United States displays a similar interest, stating that “climate stories told through archeology can help us anticipate the pressures we will face in the modern world and the decisions we may make.”

Burke et al. (2021) point to the long history of interdisciplinarity in archaeology, a long interest in the environment of human communities, but they stress that cultural diversity is also a key part of resilience. Demarest and Victor (2022) adopt an institutional theory perspective and, drawing from analysis of transformations in Maya polities over time, identify democracy and capitalism as areas of fragility and weakness that need to be addressed to avoid disruption and a failure in legitimacy in present-day Western society. Blanton et al. (2020) similarly point to the effects of poor government on collapse and state the necessity for good government and a “reaffirmation of the core moral values and institutions” of the US in order to avoid collapse.

The archaeology and history of collapse and resilience clearly have much to offer outside the disciplines themselves, and putting it out there is a positive stance, which must be maintained. Overtures have been made to build closer and deeper ties between humanities and sciences in approaching historical change and the climate, and the situation has improved (Haldon et al. 2018d). Gogou et al. (2016) present a deliberately multidisciplinary set of articles on Mediterranean climate, environment, and human societies in the Holocene.

At the same time, there is a risk in presenting archaeology too much as a tool or database, or, as some would have it, a source of anecdotes, rather than as a valid end in itself (however much that may be seen as an indulgence in the 21st century). Spinney (2020) is illustrative of the instrumentalist view of archaeology and history from the outside. She asks whether they have anything useful to share, but the question is an unfair one to ask, as unlike many of the contributions noted above, the books were not written with the specific purpose of informing behavior or policy in a particular way. They have a lot that is useful to share but have very different aims, audiences, and views on collapse. Researchers outside archaeology and history who make use of the data and interpretations generated need to approach these dynamic fields aware of how their knowledge is constructed and contested, and is not simply a litany of facts. Applied collapsology is self-aware and critical, demonstrating that the collapse discourse has moved on since the early 21st century.

### **Diversity in Scale and Approaches**

Researchers identify, approach, and discuss collapse in different ways, depending on their purposes and their own considerations of what is appropriate and meaningful. Boersema (2015a), for example, looks solely at Rapa Nui. He strongly critiques the popular ecocidal collapse narrative of the island that has long been prominent, in which its inhabitants caused their own apocalyptic pre-contact collapse. Middleton's (2020a) volume on collapse and transformation in the Late Bronze Age Aegean offers regional and thematic chapters that look 50 years before and after the collapse c. 1200 BC. The chapters enable comparison of similarities and differences across the Aegean. Storey and Storey (2017; see also 2016) take an explicitly comparative approach, but study two collapses in parallel: the Western Roman Empire and the Classic Maya. Their comparison of economics and political, social, and environmental variables help them explain the two collapses. They introduce the concept of slow collapse, where collapse can take a century or more to play out.

Johnson (2017; reviewed in Middleton 2017a), on the other hand, sought a broad explanation of collapse, generated through the study of six cases: Aztecs, Egypt, Inka, Maya, Mesopotamia, and Rome, which he argued results from social hubris. In his view, hubris prevents individuals and societies from being able to perceive threats to themselves or makes them fail to take threats seriously enough. This explanation surely carries a message for contemporary society. Middleton (2017b) provided a discussion of collapse theory and took a critical approach to earlier narratives of collapse in a range of cases, including Angkor, Old Kingdom Egypt, the Hittite Empire, the Indus Valley, the Classic Maya, Mesopotamia, Minoan Crete, the



Moche, Mycenaean Greece, Rapa Nui, Teotihuacan, Tiwanaku, Wari, and the Western Roman Empire. One of my key points there is that collapse is primarily a social process driven by people rather than an apocalyptic disaster caused by an external shock.

A variety of units, politically or culturally defined, are the focus of study, and many scales are possible. Gehler et al. (2022a, b) focus solely on empires from prehistory to the modern world and the end of the British Empire (Gehler and Strich 2022) and the proposed decline of the American (Schröder 2022). Clayton (2016), Lachniet and Bernal-Uruchurtu (2017) look at the city-state of Teotihuacan. Chapters in Bárta and Kovář (2019) span prehistory, antiquity, the Middle Ages and Early Modern, and the Modern period. Svoboda (2019) deals with hunter-gathers in the Gravettian. Cílek (2019), on the other hand, discusses the looming crisis with certain raw materials in the present. Some edited volumes retain a focus on culture areas, for example the Classic Maya (Iannone 2014; Iannone et al. 2016) and the Late Bronze Age Aegean (Middleton 2020a).

In addition to case studies on empires and territorial or city-states, micro-level studies focused on much smaller units also are possible (Perego et al. 2019; reviewed in Middleton 2019). Joyce et al. (2014), at Río Viejo in Oaxaca, looked at an urban center within its local context and examined changes to the elite and post-elite core of the city and the development of neighboring centers (also Joyce 2013). Feinman and Nicholas (2016) and Meehan (2019) also study this region. Daems et al. (2021) focus on Sagalassos in Turkey in the first millennium BC, where they study the interplay of climate, landscape, and material culture. Maran (e.g., 2015) focuses even more tightly on the Late Bronze Age palace of Tiryns, Greece, taking a single site and tracing its architectural and social history before and after the collapse c. 1200 BC. Lambrugo et al. (2019) zoom in even closer, to the non-elite site of the Manfria Farm, near Gela on Sicily. Daubner (2019) traces the history of the Macedonian elite following Roman annexation. While the big picture is important, this level of detail is vital for coming closer to lived lives and experiences of people during times of crisis and collapse and helps position them as motivated actors rather than just passive victims of events. It can also help rebalance accounts of collapse that could otherwise be too general or are discussed at a much greater temporal scale.

Edited volumes on collapse sometimes take a thematic approach. Two volumes on the Classic Maya adopt specific contexts: Iannone (2014) offers a mature view of the Maya droughts, and resilience and vulnerability, while Iannone et al. (2016) look at political violence in different Maya states, putting a human face on Maya collapses. Faulseit (2016a, reviewed in Middleton 2017a) focuses on resilience and transformation. Many of its chapters question earlier narratives in the cases they explore, presenting new data and interpretations and viewing change through the lens of resilience theory and the adaptive cycle. Tainter's (2016) chapter discusses progressivism and the characterization of collapse as failure, rather than just another kind of change.

Yoffee (2019a) focuses on the fragility and vulnerability of early states. A key strand running through the volume is the notion of states as ongoing experiments, projects that are constantly in development and which may endure or collapse

depending on a range of factors (see also Wright 2006). Scott (2017, pp. 183–218) also has an important chapter on these themes. In a refreshing perspective, he asks “why deplore ‘collapse’ when the situation it depicts is most often the disaggregation of a complex, fragile, and typically oppressive state into smaller, decentralized fragments?” (Scott 2017, p. 209).

Murphy (2021a, reviewed in Middleton 2022c) takes ritual as its theme (Murphy 2021b). In Menon’s (2021) chapter, he shows the ways in which the building of temples was used to create and display the central power of the Vijayanagara state but also how local rulers also did the same in periods of instability and collapse. Feinman (2021) elaborates the role of ritual in aggregation and disaggregation, ritual both binding and separating people and groups. Ritual at times of community and identity formation and disintegration and collapse is important because of its potential for manipulation and structuring and in terms of the way it shapes people’s experience of life – it can be an instructive way of understanding change.

Blanton (2010; Blanton et al. 2020) has explored the role of collective action in state formation, resilience, and collapse. Through the initial examination of 30 example societies, Blanton (2010) proposed that hypercoherence seemed to be a factor in the magnitude of collapse. Blanton et al. (2020) focused on four examples (Ming Dynasty China, Mughal Empire; early Roman Empire; Venetian Republic) to show how moral failure played a role in collapse. In their view, the good government that had been developed, in which a reasonable balance between rulers, elites, and population spread responsibilities and benefits, helped make societies stable. Moral failure in leadership undermined this and destabilized society as people became increasingly disenchanting and disengaged. However, Blanton (2010, p. 50) also notes that “any explanation of collapse will be incomplete unless human agency is figured into its calculus of causal factors.”

It can be seen, then, that at bigger or smaller scales, archaeological and historical cases remain an effective and popular way of discussing and exploring collapse and resilience in a way that enables agency and motivation to be explored and accessible outputs to be generated. They have an additional benefit in that they are similar in form to scenarios generated and used in scenario analysis in terms of the future development of society, particularly but not exclusively in the field of resilience, sustainability, and transformation. Scenarios have been defined as “coherent and plausible stories, told in words and numbers, about the possible co-evolutionary pathways of combined human and environmental systems” (Swart et al. 2004) and as “plausible, coherent narratives about the future of a place or a situation for the production of anticipatory knowledge” (Millennium Ecosystem Assessment 2005, cited in Iwaniec et al 2020). Writing critical case studies of collapse is also about generating coherent and plausible narratives about the past—and increasingly about combining knowledge of human and environmental systems and their relations; this is something many would recognize as a feature of doing history (Claus and Marriott 2012, p. 7). The similarities should enable increased understanding and operationalization of history in contemporary society, though that also runs the risk that problematic interpretations get locked into the discourse (Middleton 2018a).

Mathematical and quantitative approaches to history, which often claim a greater objectivity or basis in fact, can be found in some scholars’ approaches to collapse

(Ruggles 2021). Spinney (2020, p. 357; see also Spinney 2019), for example, suggests that a big data approach to collapse could be more useful than “sparring over case studies that might not have constituted collapse at all.”

Cumming and Peterson (2017) indeed propose a science of collapse. In the first place, they require three things for a theory of collapse to be developed: empirical and quantifiable definitions of identity and collapse, an understanding of the relationship between structure and process in social–ecological systems, and consideration of a range of mechanism that can explain why a collapse happens. For the third item, they list 14 mechanisms derived from the literature: overshoot, complexity threshold, elite capture, overspecialization and inability to adapt, scale mismatch, upscaling, speculation, contagion, fragmentation, external disruption, grinding down, vulnerability threshold, leakage. In their view, “a rigorous, quantitative theory of collapse... has the potential to be an important element in the growing discipline of sustainability science. It promises to ground ideas about collapse in scientific principles and to move debates around collapse forward from arguments over whether or not an event qualifies as a collapse” (Cumming and Peterson 2017, p. 707).

Centeno et al. (2023a) incorporate archaeological and historical studies and ecological and environmental studies, as well as mathematical and quantitative perspectives. One of these is cliodynamics, a data-driven approach in which the past is quantified in order to predict future difficulties, such as political instability (Turchin 2023a; see also Goldstone and Turchin 2020). Through multipath forecasting, it is argued that scholars can predict problems and then guide society through them (Miranda and Freeman 2020; Turchin et al. 2018a, b). To this end, Turchin founded the Seshat: Global History Databank; scholars would contribute data to be analyzed to reveal patterns, laws, and truths.

Sandberg (2023) asks whether societies age and become more vulnerable over time or whether collapse is just bad luck. He concludes that “almost no matter what we do, some challenges will get through the defences” (Sandberg 2023, p. 391). He also suggests that “there has never been any real collapse” (Sandberg 2023, p. 392), which is a conclusion that will certainly meet with some disagreement. The idea that “the Bronze Age collapse is a mere footnote” that does not matter will puzzle those who study it up close and imagine it as a lived experience. Such conclusions suggest continued difficulties in conceptualizing and defining collapse.

Another mathematical exploration of collapse is based on the notion of barbarigenesis, which considers the developmental results of interactions between more and less complex societies (Jones 2021). Jones (2021) argues that complex centers are more wealthy and less powerful than barbarian, or non-state peripheries. The latter degrade the wealthier centers; they have less to lose and more to gain by fighting. Collapse of the more complex societies can follow. Jones admits that his model is a “drastic simplification of reality” and that in his case study of western Europe in the first millennium AD “a huge amount of history happened.” Such models can produce interesting ideas but fail to consider the roles of individual and group agency and historical contingency.

Kintigh and Ingram (2018) also using modeling and statistical methods to examine climate change–culture change narratives for the American Southwest. They

examined eleven transitions in five cultures and found that there was “no statistical support for a relationship between the major transitions and episodes of climatic extremes” (Kintigh and Ingram 2018, p. 29). That is, the coincidence of collapse and climate shifts was no greater than the level of chance. They rightly note, though, that droughts will still have impacted these societies, and could still have played a causal role in significant change, but they add other factors, including cultural ones, must be included in causal arguments. In principle, the latter point should apply to all cases of collapse, given that coincidence is not causality and that responses to climate change or climate or weather events is not predetermined or obvious and equally might differ at different points in time (be historically specific).

A “scientific” approach to history can have wide appeal, especially to those in the harder and natural sciences and among the public, since big data, algorithms, and number crunching can seem more objective and reliable than the subjective opinions of quibbling archaeologists and historians (Spiegelhalter 2020; Vilkins et al. 2020). However, some would question whether dynamic and complex past societies can be accurately or meaningfully quantified and whether simplified models offer very much or merely create factoids. Since Ranke, some have suggested a science of history based on the collection of facts to get to what actually happened is possible, but as Boldt (2014, p. 462) succinctly explains, “no historian can cover and thus recover the totality of past events because their “content” is virtually limitless. One cannot recount more than a fraction of what has occurred and no historian’s account ever corresponds precisely with the past: the sheer bulk of the past precludes total history.” This does not make the practice of archaeology or history pointless, for in the same way, no one can really know the present—but naturally we are all still interested in thinking and learning about it.

Butzer and Endfield (2012, pp. 3628–3629) argue that we must pay “explicit attention to social and humanistic issues, which should be more than an afterthought.” Sparring over case studies is in itself far from a waste of time, but rather is a valuable and positive discourse on how we understand, study, and characterize history. Collapse and decline are not only objective terms for something concrete that happened in the past (when used in specific ways), but also contested and dynamic terms that configure, enable, and construct the ways in which we envision history and what we value in it. When a collapse is identified and then questioned, we learn more about the case in point and about our way of studying and describing it. Spinney (2020) also rightly points out that quantifying history may be a pipe dream; big data-driven approaches may encode biases and produce problematic results and models that appear both scientific and real. Such approaches are also deeply impersonal; they overlook historical agency and contingency and the active strategies and roles of individuals and groups in driving change.

## Language and Concepts of Collapse

Despite being of such widespread interest, there is serious debate over whether the terms collapse or resilience are meaningful or useful. Vésteinsson (2013) argues that they are not, but his discussion is largely targeted at Diamond’s (2011) book

on collapse. Heitz et al. (2021, pp. 184–185) argue that collapse is “not a very fruitful concept or metaphor.” They suggest that it has unhelpful negative connotations, which is unfortunately often the case. They also note that to prove collapse, especially as site abandonment, often requires evidence of absence, not simply absence of evidence, which can make it difficult to prove positively. Soens (2018, p. 148) proposes that “in the end, labelling a society—or socio-environmental system, or ‘multispecies assemblage’—such as Portugal in 1755 vulnerable or resilient, is largely in the eye of the beholder (whether eyewitness or historian).” There are certainly some valid concerns, and certainly an interesting dialogue to be continued—the terms should not be the goal but part of the process of investigation.

Tainter’s (1988) classic and succinct definition of collapse, that it is the rapid simplification of a society of an established level of complexity, still stands up well and seems clear and helpful. Tainter himself has revisited the difficulties in defining, understanding, and explaining collapse in later works, which comes in part from lack of clarity over how the word is used. He stresses the need for those writing about collapse to at least explain what they mean by it (Tainter 2016, 2023). There are, though, many definitions (see also Middleton 2017b, pp. 11–19). Heitz et al. (2021, p. 133) collect six definitions from the literature between 1988 and 2012. The most recent is from Butzer and Endfield (2012, p. 3628), who, in response to some popular and ecologically derived understandings of collapse as primarily a demographic disaster, cast the net wider: “Societal collapse represents transformation at a large social or spatial scale, with long-term impact on combinations of interdependent variables: (i) environmental change and resilience; (ii) demography or settlement; (iii) socio-economic patterns; (iv) political or societal structures; and (v) ideology or cultural memory.”

This definition refers to collapse as transformation. Some deliberately adopt both collapse and transformation as terms in their works, but do so in different ways. Middleton (2017a, 2020a, b) nods to the potential rapidity of a political collapse and simplification and the slower change in broader culture. Cauwe and De Dapper (2015a), on the other hand, put the two terms in opposition. Faulseit (2016a) emphasizes that transformation is “beyond collapse,” suggesting that things do happen after collapse, that there is resilience and regeneration, and that there is more to consider than just ends.

Storey and Storey (2017, pp. 11–12, 2016; see also Storey and Storey 2018) address the issue, too, offering a useful analysis that underpins their own use of the terms. They give a rough set of ideas for decline, political fall, collapse and resilience, and lengthier more formal definitions. For them, collapse happens if things go so “completely to hell that the culture loses coherence and the major defining elements and dimensions of that culture disappear,” that there is a disjuncture in developmental trajectory, a failure of political integration, and the end of the complex culture of civilization’s great tradition. What happens involves “suffering on a large scale” and a reduction in population. Resilience is where complex society regenerates, usually after a gap, and forms a new cultural identity or great tradition that “is partly derivative of the old but also distinct.”

Storey and Storey (2017, pp. 11–12, 2016) propose the concept of slow collapse, which contrasts with Tainter’s definition and many researchers’ understanding that

collapse must be rapid (though what rapid means is debatable). Johnson (2017, pp. 7, 58) favors the term ‘transition,’ viewing large-scale change as slower than usually presented where collapse is mooted. He notes as an example the long period of the Classic Maya collapse. Haldon et al. (2020) also consider how to approach the lived experience of people during collapses of different durations.

These latter two definitions see collapse as something that can take centuries to play out—it is slow rather than rapid—thus they differ from most earlier ideas of collapse. However, this can be an area of confusion where it is important to make clear what is being explained, thus a political collapse could be rapid but a culture change much slower. This is evident in both the Western Roman and Classic Maya collapses. With the Classic Maya, it is also necessary to distinguish between the collapse of individual Maya states, which could be rapid, and the longer-term shift in overall Maya societal characteristics identified by archaeologists between Classic and Postclassic Maya.

Another definition by Cumming and Peterson (2017, p. 699) returns to a more tradition understanding of rapid collapse: they suggested four criteria for identifying collapse: the identity of the social-ecological system is lost, the loss is rapid—less than 25 years, there are substantial losses of social-economic capital, and the consequences of collapse are lasting. They demand that researchers who use the word collapse must prove that they are using it in accordance with these four criteria (Cumming and Peterson 2017, p. 710). One issue here is with the notion of ‘identity’; in archaeological terms a changed identity can be indicative of resilience and adaptation.

Centeno et al. (2022, p. 63, 2023b, p. 9) adopt a systems approach to collapse, in which units, including networks, systems, and complexity break down into smaller, simpler parts. The latter is reminiscent of earlier discussions in Cowgill (1988) and Yoffee (1988), and more recently Scott (2017, p. 187), all drawing on the work of Herbert Simon and his idea that systems were “nearly decomposable.” As Scott emphasizes, while the top of the sociopolitical pyramid may disappear, other parts may be left (2017, p. 186). This is the simplification referred to by Tainter (1988). For collapse, this means that while some elements of the collapsed unit will disappear, others will continue. Considering “the identity of the system”—something important in more ecological understandings of collapse—produces something of a difficulty in characterizing change either as failure and loss or successful adaptation. This all ties in with notions of resilience.

Collapse is still often seen as a negative, but Scott (2017, p. 209) offers the salient reminder that collapse, as the disaggregation of “typically oppressive states” into smaller units, might not have been a bad thing for many inhabitants, and it need not be characterized as bad by modern scholars. While violence may have played a part in some, or indeed many collapses, in some form, and instability in the aftermath may sometimes have made circumstances less stable, collapse is not apocalyptic, and population decline over time need not be characterized as traumatic. On the term ‘collapse,’ Tainter’s (1988) simple and value-free definition remains perhaps the most apposite.

There are similar issues of usage with resilience, too, which can have a range of formal or informal meanings that differ by writer and reader (Bollig 2014;

Bradtmöller et al. 2017; Cretney 2014; Løvschal 2022; Marston 2015). Haldon (2016, p. 9), suggests, in the context of the survival of the Eastern Roman Empire in the seventh/eighth centuries AD that “resilience, is in fact a much better way to think about non-collapse and collapse.” Resilience can carry meanings of adaptability and sustainability, but it can also simply imply persistence or continuity in a given area or domain, whether it be cultural, demographic, or otherwise.

Centeno et al. (2023b, pp. 17, 19, n. 5) derive their usage of robustness and resilience from engineering, whereas many archaeologists and historians follow a formal view of resilience theory as derived from population ecology. Such a definition is given by Løvschal (2022, p. 196, quoting Walker et al. (2004): “Resilience theory is the theory of how capable a system is “to absorb disturbance and reorganize while undergoing change so as to still retain essentially the same function, structure, identity, and feedbacks.” This definition brings up its own problems as applied to archaeology and history in terms of what is classed as a disturbance; the term somewhat implies some kind of external shock or perturbation. The second part of the definition suggests essentially changing to stay the same, but for some such change would mean a change in identity and therefore be collapse, and collapse can itself be considered an adaptation. It is easy to go in circles.

These two are not the only problem words. Gehler et al. (2022b) also discuss the ongoing difficulties with terminology—ideas such as downfall, decline and fall and the use of alternative and supposedly more value-neutral terms such as decentralization, disintegration, fission, fragmentation, transformation, and transition.

Vulnerability and fragility have also become important concepts relating to collapse and resilience in archaeology. Vulnerability has long been a key idea in disaster studies (Bankoff 2019). Van Bavel et al. (2020, pp. 33–35) identify three aspects of vulnerability: a risk of exposure to hazards, a risk of inadequate capacities to cope with hazards, and the attendant risks connected to poverty. These can relate to individuals, communities, groups, and societies; Soens (2018) presents a good example of an application of vulnerability, on a human level, and resilience on a societal level. Van Bavel et al. (2020) also point out how a consideration of vulnerability adds a deeper time dimension to disaster research, which must necessarily examine conditions before the disaster event (see also Williamson and Courtney 2018). There is some clear crossover with collapse studies here, where it is equally important to consider how prior conditions can make a society vulnerable to shocks of some kind.

In an archaeological discussion based on Andean states, Dillehay and Wernke (2019, pp. 9–10) take vulnerability to mean “the relative susceptibility of the ideological, political, economic, or military apparatuses of the state to physical trauma (e.g., earthquakes, floods) and social stress (e.g., war, famine, class conflict),” therefore extending its use beyond the impact of natural disasters or hazards. This, they argue, can be a precursor to fragility, which “refers to weakened, disintegrating, or collapsing state apparatuses.” However, they also suggest that “neither vulnerability nor fragility necessarily implies imminent failure and collapse of the state and, in some cases, these conditions can lead to a more effective and efficient political apparatus.” This may sound contradictory, but a vulnerable society may remain vulnerable and not experience any trauma, while a collapsing state may recover and stave off total failure. The Roman third century crisis and the Classic Maya hiatus come to

mind as possible examples of collapsing states that recovered. Beyond structure and stress, they also note that there were “unique outcomes from contingent chains of events and interactions” (Dillehay and Wernke 2019, p. 21).

Yoffee (2019b) argues for fragility to be considered a property of early states, which were experimental and not necessarily stable, even when they might be enduring. In collapse studies, we must consider early states to possess properties of both resilience and fragility, as well as areas of potential vulnerability, all of which are present in dynamic political and socioenvironmental settings.

Discussing terms, like debating case studies, is important and goes beyond pedantry. Language matters and concepts arise and take form, then shape meaning and thought and the construction of knowledge, that should be contested in turn. Bankoff (2019) has demonstrated how the concepts of vulnerability, resilience, and adaptation appeared in specific western political and cultural contexts; collapse in archaeology too has arisen in a later 20th and early 21st century contexts with resilience in archaeology following soon after (Heitz et al. 2021, p. 130, fig. 5.1). As Tainter suggested, people should at least define how they are using a term, it cannot be assumed that all terms in the collapse domain are used in a single way. These discussions and debates are part of the process of doing collapsology, and they enable creative discovery and drive research. There is no final definitive answer or silver bullet.

## Episodes of Collapse

Here I focus on cases of collapse that continue the discussion in Middleton (2012). The first two are regional-scale collapses of several states, though it is open for question whether they are, at least in part, modern constructs that wrap up a number of separate events and processes. These are the 4.2 ka BP event and the eastern Mediterranean collapse c. 1200 BC. Both have been associated with climate change, and so discussions begin there. Following those two examples is brief discussion of the Western and Eastern Roman Empires, imperial states, and the Classic Maya, a culture zone comprising many states, then Tiwanaku and Rapa Nui. Many other examples could be discussed, but space is limited.

### The 4.2 ka BP Event and Global Collapse

The 4.2 ka BP event is hypothesized as a climate change event, a three-centuries long megadrought (2200–1900 BC), which caused the collapse of a number of Early Bronze Age cultures, states, and societies, including the Akkadian Empire, Levantine cities, the Egyptian Old Kingdom, the Aegean Early Bronze Age II period, Harappan society, and Neolithic polities in China (Cookson et al. 2019; Liu and Chen 2012, p. 39; Liu and Feng 2012; Middleton 2018c; Ran and Chen 2019; Weiss 2016, 2017b, p. 115, 2017c, p. 13; Younes and Bakry 2022). It seems widely accepted that there were some kinds of climatic changes around the end of the third millennium BC, at least in some places (Rousseau et al. 2019). Other recent evidence for the event comes from coral samples off the coast of Oman (Watanabe



et al. 2019), from central Asia (Li et al. 2021), the eastern Mediterranean (Bini et al. 2019; Triantaphyllou et al. 2014), and a lake core from China (Xiao et al. 2019).

Evidence from the northern hemisphere, however, is mixed; Bradley and Bakke (2019) found “no compelling evidence for a significant and widespread climatic anomaly at ~4.2 ka BP (i.e., an event) in most areas.” Likewise, evidence from the British Isles does not show a 4.2 ka BP climate event (Roland et al. 2014). While some evidence from the Mediterranean does show a 4.2 ka BP event, other evidence does not, suggesting regional variations (Bini et al. 2019). Caution is necessary in the identification of a single uniform climate event, a megadrought, spread across a large area or even global in scale; regional, local, and microregional differences could still be present (Manning 2017). Bini et al. (2019), writing of the eastern Mediterranean, accept the reality of climate change from 2200 BC, but also note regional differences.

Recent interpretations of the Indus Valley collapse vary from abrupt collapse caused by rapid climate shift, based on evidence from Dholavira (Sengupta et al. 2020), to gradually weakening monsoons and drying river courses encouraging population to move eastward (Giosan et al. 2012). Dutt et al. (2019, p. 21) agree with the last point, even pushing back the start of eastward tracking; they argue that “the growth and displacement of the Indus Civilization (IC) was primarily controlled by the precipitation changes due to Indian monsoon variability indicating that the climate played an important role in the course of human history.” Petrie (2019) has been more cautious about the role of climate, stressing the potential different impacts in different regions. Nevertheless, the Indus collapse remains closely tied to discussion of its natural environment, in one form or another. Pokharia et al. (2017) identify a change in crops from barley to more drought-resistant millet at Khirsara, enabling adaptation to a drier climate, though the site was abandoned later.

Given that even a global climate event will present with regional and local differences, it becomes difficult to assign climate change as a single or primary cause in multiple collapses around the world. Weather in an event of three centuries would also have varied on shorter scales within any period, with possible local impacts. Too great a focus on the climate evidence runs the risk of fossilizing particular and sometimes outdated or questionable historical narratives as truths to be explained by climate change. It is always necessary to consider first what is being explained—what the archaeology and history tell us—and understand how this can be contested and subject to revision. For example, with the Aegean, c. 2200 BC, changes on the mainland once thought dramatic and sudden no longer appear so, and certain parts of Crete buck the trend in that cultural development is uninterrupted (Schoep and Tomkins 2012; Manning 2017; Middleton 2018c, pp. 275–276; Wiener 2013, p. 585). Weiberg (2017) explores these divergent trajectories, which counter any simplistic view of climate-driven collapse. A review of recent developments in the archaeology of early Minoan Crete does not mention climate change at all, suggesting it is not considered as a driving factor (Legarra Herrero 2019), but this can be contrasted with Wiener (2013).

In China, recent work has emphasized that while there may have been climatic and environmental changes (Xiao et al. 2019) these did not always coincide with the degree of sociopolitical complexity, the rise and fall of societies (Liu et al. 2019).

Liu et al. (2019) note that the late Longshan complex chiefdom developed during the 4.2 ka BP event, and the Zhou dynasty also developed during a climatic downturn. Li et al. (2021) and Li and Gao (2021) also point out the Longshan development at this time, although they note that it was an exception. Liu et al. (2019, p. 4) stress that “it is the human responses to external challenges in various ways that ultimately determined the trajectories of social evolution”—that is, neither climate nor the 4.2 ka BP event were determining factors in fluctuating sociopolitical complexity even if they contributed to change. Jaffe et al. (2021) critique the widespread, though not universal, acceptance of a climate-collapse model in Chinese archaeology.

In the case of the de-urbanization of northern Mesopotamia, often associated with the collapse of the Akkadian Empire, Cookson et al. (2019) have approached the matter through climate modeling and simulations. They suggest that a combination of reduced rainfall and mismanagement of land could have led to the progressive abandonment of northern urban sites, though they note continued habitation at Tell Brak and Tell Mozan, where particular agricultural strategies might have enabled continuity. In this line of argument, the impact of climate change depends on the agricultural regime and the capacity for adaptation of a given city, region, or society (Ur 2015). Yoffee and Seri (2019) remind us of the fragility of hegemonic states in Mesopotamia contrasted with the resilience of city-states.

Lawrence et al. (2021) have proposed a mismatch between urban growth, in which population in northern Mesopotamia grew high over the third millennium, and the carrying capacity of the land. In this scenario, the urbanization was fragile and collapse by overshoot would have become an increasing risk. In their view, a collapse, de-urbanization, could have happened without drought for internal reasons or been exacerbated by drought. They further caution that the “datasets... presented here do not provide sufficient temporal precision or cultural attribution to comment on the question of the Akkadian Empire itself” (Lawrence et al. 2021, pp. 15, 20). They are less sweeping in their conclusions than other megadrought-collapse proponents and more sensitive to the variations in settlement change over 4.2 ka BP. They also highlight the question of whether drought, if present, was just background noise or a causal factor in change.

Focusing on northern Mesopotamia and the Levant, Wilkinson et al. (2014) identify a boom-and-bust pattern of urban development and collapse in the mid-to-late third millennium BC. Urbanism, they argue, was something of an aberration rather than a long-term feature (Wilkinson et al. 2014, p. 94). Rainfall levels may have influenced settlement patterns with increased urbanization in some areas, but other areas increased in size without this, and even in times of declining rainfall. They conclude that “the relationship between climate and settlement growth was not necessarily linear” (Wilkinson et al. 2014, p. 97).

Other views focus on the historical situation, questioning the problem that climate change and megadrought is supposed to solve. For example, McMahon (2012) has addressed the questions of what the Akkadian Empire was—whether it was an over-grown city-state, a hegemonic state, or a nation-state and whether we have been taken in by the Akkadian’s own grandiose propaganda (see also Liverani 2014, p. 137). Perhaps the Akkadian dynasty was a particularly aggressive and successful force in the short term, but little more than that. Repeated military action across

the region by successive kings to rein in subject areas suggests a real lack of stable imperial integration and continued pro-independence tendencies in these regions, which were still able to levy their own forces (McMahon 2012, pp. 666–667; Middleton 2018a, pp. 277–278).

The significance of the Akkadian collapse for Mesopotamian history may also have been overstated; subject cities again became independent and later, during the proposed three-century megadrought, the new hegemonic Ur III Dynasty appeared (Liverani 2014, pp. 155–160; on its collapse see Lang 2022). Thus “from the wider perspective of Mesopotamian history, Akkadian political collapse was a minor blip in a long-term cycle of growth, contraction, and movements of peoples, a minor setback greatly overwhelmed by cultural continuities” (McMahon 2012, p. 667).

As for the cities in the Levant, it now seems clear that sites across the region had a varied trajectory. Genz (2015) observes different regional patterns, with urbanism in northern Lebanon continuing and in southern Lebanon reducing and even, as in the southern Levant, disappearing. Greenberg (2017) and Hofmayer (2015) note that Levantine de-urbanization happened over centuries, not suddenly in a collapse at 4.2 ka BP. It may have been completed three centuries before the 4.2 ka BP megadrought (Wilkinson et al. 2014, p. 90). Lawrence et al. (2021) also note a lack of evidence for simultaneous de-urbanization in western Syria and northern Mesopotamia.

The interpretation of the situation in Egypt around 2200 BC is perhaps most of all one of terminology and characterization. The First Intermediate Period has been seen by some as a dark age of famine and death, at least in some apocalyptic views of climate change and environmental collapse that have reached a wide audience (Middleton 2017b, pp. 55–58). Some have found more evidence for a low Nile at 4.2 ka BP, such as Zaky et al. (2020), analyzing pollen evidence from Lake Hamra, and Hamdan et al. (2019), working on mineralogical samples from Saqqara. Welc and Marks (2014) also found evidence from Saqqara for aridification but also heavy rainfall c. 2200 BC. Younes and Bakry (2022) review multiple strands of evidence, including textual, iconographic, archaeological, geoarchaeological, and bioarchaeological evidence, to argue that climate change and famine played a key role in the end of the Old Kingdom and that successful adaptation to the problems of the First Intermediate Period is evident in the form of the Middle Kingdom reunification.

Bárta (2019) has contributed an engaging and up-to-date study of the Egyptian Old Kingdom and its eventual collapse and transition into the First Intermediate Period. He makes clear that the process of fragmentation of the centralized Egyptian state was a long and complex one that was embedded in the dynamic and ongoing development of the state, not a sudden catastrophic event caused by climatic or some other external cause (Bárta 2019, p. 179). Climate is given a role, but rather than a sudden drought and famine Bárta (2019, p. 195) suggests that decreased Nile floods over time, along with periodic torrential rains, may have added pressure to internal processes of change, which led to the emergence of the independent local statelets of the First Intermediate Period (see also Bárta 2015).

Morris (2019, pp. 79–81) has reviewed some of the evidence, both scientific and from more recent Egyptian history, which suggests that low Nile floods and heavy rainfall could have created the conditions for collapse. But what was this collapse?

Bárta (2019) is somewhat ambivalent about the use of the word ‘collapse’ for the ending of the Old Kingdom, preferring to emphasize the decline or simplification of a complex system. He notes the ebbing of power from the center to local territories, increased poverty, and a “leveling of the vertical structure of society” (Bárta 2019, p. 23). At the same time, Moreno Garcia (2015, p. 14) concludes that “no sudden collapse is apparent, nor any signs of catastrophic environmental events leading to political and economic chaos” (see also Moreno Garcia 2021).

There is no dispute over the continuation of Egyptian culture after c. 2200 BC, nor that the centralized Old Kingdom Egyptian state broke down into smaller regional polities with local leaders. But the terminology suggests an anomaly, a worsening rather than just a difference, and can easily be misinterpreted or misrepresented. As Schneider (2017) has explained, the First Intermediate Period has enjoyed a variety of characterizations, as a period of social fluidity, innovation, and the democratization of material and spiritual culture, and as a period of dismal proletarianism in which the commoners forgot their place. The impact of political fragmentation differed, good for some, bad for others; some will have worked toward it, others against, some seized new opportunities while others suffered.

The fragmentation of Egypt without decline has led one scholar to rename the First Intermediate Period ‘the era of regions’ (Morenz 2010, quoted in Schneider 2017, p. 316). The contemporary texts of regional rulers such as Ankhafy do laud their ability to solve real problems—to feed their own people and neighbors, and to fight and win in conflicts; increased conflict might be represented in several categories of evidence (Morris 2019, p. 82). But this does not imply a wholly negative (or post-apocalyptic) situation in daily life, especially when the increase in non-elite wealth and development of new cultural forms are considered (Schneider 2017, p. 315).

Toward the end of the Old Kingdom, increasing urbanization and the building of city walls could be interpreted several ways—as reflecting increased conflict or a display of civic pride, but the fact of it is evidence of continued settled and organized civic life. One study on urbanization at the end of the Old Kingdom concludes that “It is evident that the end of the third millennium BCE in Egypt is not characterized by a wide-spread political and economic collapse but by major changes that seem to have had positive effects on the population, such as creating a dynamic environment for the development of regional traditions” (Moeller 2016, p. 246). Morris reminds us that there can be feasts even during famines, and “it is no doubt as erroneous to envision a time of unremitting misery and peril as it is to ignore attestations that life during this period could be particularly challenging” (Morris 2019, p. 83). If there were real environmental problems, collapse of central power in favor of local power may have been a positive and successful adaptation.

Thus, whether or not there was a three-century megadrought from 2200 and 1900 BC, the situation on the ground, across the wide region from the eastern Mediterranean through western, southern, and eastern Asia was not one of straightforward global collapse, despite the many and various changes through that long period. It seems at least worth questioning whether the many and various historically specific changes should be rolled into one event with a main cause as opposed to disconnected regional and historically specific developments.

## Collapse in the Eastern Mediterranean c. 1200 BC

The collapse c. 1200 BC roughly marks the end of the Late Bronze Age in the eastern Mediterranean; it continues to be an area of discussion and debate, with climate, famine, and migration playing prominent roles in explanations (Middleton 2018c). The collapse, painted often as a regional disaster, saw the end of the Hittite Empire in Anatolia and the palace states of the Aegean, the kingdom of Ugarit as well as destructions and changes on Cyprus and in the Levant and the end of an integrated regional state system (Cline 2021, p. 170). Many have also addressed the period before and after collapse, with reference to both geographical regions and particular themes: for Anatolia there is de Martino and Devecchi (2022), for the Aegean, Middleton (2020a, b, c), and for Greece and the wider Mediterranean, Lemos and Kotsonas (2020). Iacono et al. (2022) present a wide-ranging review of the Late Bronze Age Mediterranean, which deals also with collapse, in which human agency is seen as key.

Climate change—drought—is the most loudly proposed cause of specific parts of the eastern Mediterranean collapse c. 1200 BC (e.g., Drake 2012; Kaniewski and Van Campo 2017; Kaniewski et al. 2011, 2013, 2015, 2019a, b; Langgut et al. 2013; see also Molloy 2023). In this view, everything that happened in the eastern Mediterranean over three centuries from 1200 BC or slightly before was connected and part of the same event. Cline, who had argued that a perfect storm of factors brought about the collapse of the eastern Mediterranean world has come to place a much greater weight on climate change, megadrought, as “the principal driving force behind many of the problems that Late Bronze Age societies faced” (Cline 2021, p. 164, 2022, 2023). Critical responses to Cline (2022) come from different perspectives (Greenberg 2022; Hitchcock 2022; Maeir 2022; Middleton 2022a; Yoffee 2022).

While palaeoclimatic proxies are drawn from many locations around the eastern Mediterranean, different conclusions are drawn from their study, such as different onset dates and durations (Knapp and Manning 2016; Middleton 2018c, pp. 280–281). These are significant at a historical level, where decades make a difference; glossing over such issues is inappropriate. The spread of evidence, often from core samples, is wide but very thin. As with the 4.2 ka BP event, great regional variation is likely across the complex eastern Mediterranean landscape, and cultural engagement with the environment and landscape would have produced different responses to climate and weather issues. A recent review of the highest resolution palaeoclimatic data for the eastern Mediterranean c. 1200 BC also casts doubt on the simplistic climate-collapse hypothesis (Hazell et al. 2022).

The evidence for Anatolia has been carefully critiqued by Kuzucuoğlu (2015, p. 57), who concluded that “the drought at the end of the second millennium BC started at least 100 years if not 200 years before the Hittite Empire disappeared.” The evidence of the massive grain storage silos and water management systems at Hattusa, as de Martino (2018, pp. 28–29) observes, also demonstrates knowledge in place to manage variations in supply and buffer against bad years.

Not much is known about the end of the Hittite Empire c. 1200 BC. In the words of Schachner, there is a “silence that veils the end of the Hittite state”

(quoted in Kuzucuoğlu 2015, p. 32). Many views on the Hittite collapse have been proposed, usefully brought together by Alaura (2020). Recent opinions on the causes of the Hittite collapse consider both internal political and external factors, though there is still disagreement about what happened, never mind why. De Martino (2018, p. 23) summarizes what is meant by collapse in this case, thus: “The fall of the Hittite kingdom was a complex process that involved the abandonment of the capital Ḫattuša, the fragmentation of the Hittite kingdom into smaller polities, the breakdown of a centralized system of control over the Anatolian territory, and the disappearance of cuneiform writing as well as the Hittite language.”

Miller (2020) has examined the Hittite texts from Ḫattuša and concludes that there is no indication of decline and nothing that would suggest any impending catastrophe. In addition, he points to the last king, Suppiluliuma II’s continued international correspondence and his monument building and renovation at the capital (Miller 2020, pp. 248–249). According to inscriptions and texts from Hattuša, the king was victorious in campaigns on land in parts of western Anatolia, including the Lukka Lands, and at sea against Alashiya (Cyprus) (Bemporad 2014). The lack of documentary clues to the latter part of his reign may be due to the relocation of king and court—the city was abandoned in an organized way, and the court and its archive probably moved elsewhere (de Martino 2018, p. 25; Glatz 2020, p. 269; Miller 2020, p. 249). It is not certain that this should be connected with the collapse (the capital had been relocated before). Suppiluliuma’s reign saw him able to raise armies and win battles, even far to the west and at sea, which demonstrate Hittite clout c. 1200 BC. Nevertheless, it is possible he was defeated and possibly killed and the empire consequently fragmented (as it could have done at many points before) (de Martino 2022b, p. 259). Suppiluliuma II had a son, but it is not certain whether he ever ruled as king; other members of the extended royal family did survive, including at Carchemish; the title of Great King passed to (or was taken by) them. One of these, Ir-Teššob, may later have reconquered some of the eastern Hittite areas from his base at Carchemish (de Martino 2018, p. 27).

Like Cline, Schachner (2020, p. 1112) opts for a perfect storm argument in which a “unique combination of negative political, social, ideological, economic, geographical, and climatic developments at the turn of the 13th–12th centuries brought about the collapse.” He admits the Hittites had faced similar issues before and had overcome them, but it could be argued that each such episode was a historically unique set of circumstances. De Martino (2018, 2022a, b) argues for a weakening of the Hittite core, alongside new claims to high status by rulers of surrounding and even vassal states—Mašḫuitta of Mira claimed Great King status and another Great King may have ruled in Tarḫuntašša. The weakness may have been caused by a lack of new wealth and manpower, because conquered areas had now been absorbed and from the conquest of now absorbed areas, as well as possibly a significant defeat by the Assyrians at Nihraya, which may have led to mass deportations (de Martino 2022b, pp. 256–275; Reculeau 2022, pp. 760–761). The Assyrians made overtures to Hittite vassal Ugarit, and certainly one vassal failed to support the Hittites at Nihraya, again suggesting potential weakness, although this was decades before the collapse.

Although disputing a simplistic climate collapse model, some do give a role to climate (de Martino 2022b; Kuzucuoğlu 2015). It may be that looking to weather could be more relevant. A recent study of tree ring data from central Anatolia indicates that a three-year drought occurred between 1198 and 1196 BC ( $\pm 3$  years), which Manning et al. (2023) suggest “contributed to, but did not solely cause, the collapse and break-up of the Empire.” A specific drought event, on the scale of a few years, could certainly have caused subsistence problems and had consequences in other areas of society, potentially exacerbating already present tensions; these problems may have had longer term impacts; these were probably not uncommon, though. At any rate, the megadrought > famine > collapse > migration narrative is something of a modern myth.

It is not clear who destroyed the old state of Ugarit either, a Hittite vassal state, though a violent mass migration of “the Sea Peoples” is usually blamed (Kaniewski et al. 2013). A famine or grain shortage is also suggested by some (Cohen and Torrecilla 2023). The Sea Peoples migration hypothesis is heavily influenced by the Medinet Habu text of Ramesses III, which describes a pattern of destruction blamed on various peoples of the sea. While it does mention the destruction of the Hittites, it does not mention Ugarit, which was well known to the Egyptians. It does mention the destruction of Carchemish, which was not destroyed. Unnamed enemies at sea and to the north were mentioned in Ugaritic texts, but Millek (2020b), while acknowledging the good evidence for destruction in conflict, demonstrates the difficulties with this theory, from the textual and archaeological perspectives. Knapp (2021), Knapp and Manning (2016) and Middleton (2015, 2018d, e) also point out the many problems. An alternative construction of the Sea Peoples as pirates that developed in the context of collapse is proposed by Hitchcock and Maeir (2014).

The collapse of palace societies in Greece continues to be swept up in accounts of Sea Peoples, migration, and collapse, though it is unclear in these narratives what, beyond drought and famine, happened there. The only palaeoclimatic evidence from near a Mycenaean palace site, Pylos in Messenia, which is derived from speleothems, indicates no aridification prior to the palace’s destruction, though the climate may have become drier and more variable afterward (Finné et al. 2017). Dibble and Finné (2021) have argued that changes in agriculture and diet may have been adaptations to increased aridification as well as the end of palatial influence on ways of life. The Linear B evidence from the last days of Pylos suggest no food production problems and mention numerous types of foodstuffs disbursed by the palace to dependents or used for commensality and ritual purposes (e.g., Weilharter 2017). Weiberg and Finné (2021) and Timonen and Brysbaert (2021) also suggest that Mycenaean societies appear to have been resilient to climate changes. State-organized banquets, one of the key functions of palaces, were the products of “long administrative chains linking local communities, regional elites, and palatial elites” (Nakassis 2012, p. 2); these chains were evidently still intact on the eve of collapse.

The collapse primarily impacted the state societies of the Aegean and their elites, with non-state and peripheral areas unscathed, which seems an unlikely coincidence if the climate was involved (Eder and Lemos 2020, p. 136; Middleton 2020b). Sometimes the latter benefited from new access to exotic materials to use in their own cultures of display (Arena 2020, pp. 38–39; Maran and Wright 2020, p. 119).

Maran (2022) has suggested that Mycenaean societies might long have been characterized by friction within and between elites. He notes that longer-term pressures such as intra-elite competition, large-scale construction projects, and the development of warlordism that eventually resulted in the actual conflict and violence of collapse. Some element of popular uprising might have played a part, and it is also quite possible that the palatial way of doing things was actively rejected. Eder and Lemos (2020) discuss the interruption to elite social memory. Middleton (2020b) suggests that ongoing competition between Mycenaean states and regions may have become a hegemonic struggle, which ultimately led to the collapse of both leading and competing states and the rejection of the palace system.

The Mycenaean kingdoms, with their palaces and Linear B administrations (at least in some places) collapsed, but not all simultaneously (Bennet 2013, p. 253). The destructions conventionally labeled c.1200 BC may have happened over decades, and there were many earlier and later destructions around the Aegean world (see Jung and Kardamaki 2022a, b). Three palaces seem to have fallen quite some time before 1200 BC, Knossos in the 14th century, and then in the mid-13th century BC Iklaina (Cosmopoulos 2019), and Ayios Vasileios (Vasilogamvrou et al. 2022), amid other destructions. Presumably these key centers were destroyed by rival Mycenaean states or powers. The 13th century has been seen as a period of decline and increasing instability, but this is only one possible reading of the evidence, which can equally imply business as usual (Middleton 2017c).

The Mycenaean collapse(s) should be placed in a broader Aegean context, which shows the dynamism of the region over time and the development and unraveling of different political landscapes. Minoan Crete was home, over time, to a shifting number of communities and polities of varying sizes and degrees of power and influence (D'Agata and Girella 2022; Driessen and Langohr 2015; Watrous 2021; Whitelaw 2022). While Watrous (2021, p. 201) concludes that "Minoan palatial culture had effectively come to an end" by 1200 BC, identifying a Minoan collapse is not straightforward. Another date could be the final destruction of the palace at Knossos around 1330 BC (LM IIIA2) (Bennet 2013, p. 244; Driessen and Langohr 2015, p. 96; Watrous 2021, p. 188). But that last palace was a Linear-B-using administrative center, which has often been taken to indicate it was a Mycenaean palace, run by intrusive Greek-speaking mainlanders rather than native non-Greek-speaking Cretan Minoans. Watrous (2021, p. 189) sees the Mycenaean as invading and taking over the island around 1400 BC (LM II). Driessen and Langohr (2015, p. 95) agree that significant changes took place in LM II, bringing a more mainland flavor to Crete, though they suggest that immigration from the mainland may have been limited. If it was a Mycenaean kingdom of Knossos, surely any Minoan collapse must have predated it and have happened long before 1200 BC. After the end of Knossos, there is the probable Chania palace with its own Linear B to consider (Jung and Kardamaki 2022b, pp. 12–13).

The periodic destructions on Crete and the Minoan collapse have been associated with natural catastrophe, especially earthquakes and the Thera volcanic eruption (Driessen 2017, 2019; Jusseret and Sintubin 2017a, b; Macdonald 2017; Middleton 2022b). Thus Watrous (2021, p. 113) observes that "the massive eruption of Thera late in LM IA brought the era of Minoan prosperity to an end. Following that, some



150 years later in LM IB the mainland Greeks invaded Crete, destroying many sites across the island and bringing the Second Palace Period to an end.” Natural catastrophes are supposed to have weakened Minoan society, with earthquakes, tsunamis, ash fall, pumice all contributing to a physical and spiritual crisis, which precipitated the violent destruction of the Minoan palaces and allowed the Mycenaeans entry to the island; though it is unclear in this view why the Mycenaeans arrived such a long time after.

It does seem clear that many destructions in LM IB were caused by human agents, and that, in many cases, elite culture was deliberately targeted; this is perhaps where the start of the Minoan palatial collapse can be best situated (Callender 2019; Driessen 2019, pp. 197–198). LM IB was a period of more than one generation, and destructions across Crete, including repeated destructions at some sites, may therefore have taken place over some time (Driessen and Langohr 2015, p. 95). Driessen (2019, p. 198) maintains the view that the Thera eruption had significant impacts on Minoan society, the economic impacts of which led to decentralization and increased localism, with power shifting away from palace centers and their elites and increased social tension and internal conflict. Other regional powers—perhaps mainland Mycenaeans—may have stepped in, but it might not have been a simple takeover.

It is worth remembering that since Minoan and Mycenaean are modern designations for material culture and should not be considered contemporary ethnic terms, and some argue for their abandonment (see D’Agata and Girella 2022, p. 13). Could it be that the last Knossos palace was run by Cretans (Greek-speaking Minoans?) adopting some mainland Mycenaean cultural elements? Mycenaean culture did not simply take over or eclipse Minoan culture, and there were continuities from each tradition even after c. 1200 BC. In addition, Chania, which had Linear B and may have been a palace site in its own right, continued to 1200 BC and possibly after (Driessen and Langohr 2015, p. 96). Thus, what happened on Crete in the second half of the second millennium BC was not a simple or sudden catastrophe and collapse.

Other collapses in the eastern Mediterranean happened before 1200 BC. For example, the Hittites carved up Arzawa, which had had its own Great King (Cooper 2012; Oreshko 2019), and Mittani in the mid-14th century (von Dassow 2022). Notable for not collapsing c. 1200 BC is Egypt, though some situate the diminution of its power in the Levant and its eventual fragmentation in the Third Intermediate Period c. 1069 BC as part of the collapse story (see Cooney 2022, pp. 316–341). Carchemish, a Hittite kingdom, also did not collapse; it survived until the eighth century BC (Brown and Smith 2016). The Assyrian Empire also did not collapse, despite a troubled 12th century; efforts to attach its apparent instability at that time to climate have not been successful (Frahm 2023, pp. 343–344; Reculeau 2022, pp. 782–783). Despite destruction, some urban centers on Cyprus also continued, with apparent cultural continuity and innovation over the 12th century (Georgiou and Iacovou 2020, pp. 1142–1144; Knapp 2013, p. 451; Knapp and Meyer 2020). What this tells us is that collapse and transformation in the eastern Mediterranean was not restricted to a single c. 1200 BC event; sociopolitical change was happening without climate change and before and after 1200 BC.

Applicable to the eastern Mediterranean region as a whole is the important work of Millek (2020a, b, 2021, 2023). He has questioned the widely accepted characterizations of widespread catastrophic destructions c. 1200 BC by returning to and reexamining the primary archaeological data. He concludes that of the 153 identified destructions in the Aegean, Anatolia, Cyprus, and the Levant, 94 are false destructions, either misdated, assumed, or mis-cited; he raises the issue of how destructions have often become artifacts of the literature. The destructions that did happen c. 1200 BC (i.e., perhaps c. 1225–1175 BC) could have happened in unrelated events with different actors, and as the net is cast to include a wider spread of destructions before and after (e.g., c. 1250–1150 or 1100 BC), there is perhaps even less likelihood of the collapse being a single event with one main cause.

This brief review of the collapse c. 1200 BC shows that constructs such as the 3.2 ka BP collapse or the collapse c. 1200 BC may roll together what are in all likelihood separate and local events that had multiple causes within unique historical contexts (see also Nakassis 2020, p. 668). It also tends to ignore the fate of non-state peoples and regions and the elements of survival and continuity (Middleton 2020c). Should the abandonment of a site in a Mycenaean kingdom be associated with the end of the Anatolian Hittite dynasty, the burning of Ugarit, or Egypt's retreat from the Levant? Maran (2022) reminds us that it is probably wrong to look for simple prime movers, such as climate and drought, but it may also be wrong, or at least distorting, to think of a single collapse as opposed to multiple collapses. In the study of any collapse, the problem to be explained needs to be correctly identified in the first place, or at least critically considered.

## The Roman Empires—Western and Eastern

The collapse of the Western Roman Empire in the fifth century BC remains an object of interest, discussion, and debate. There remains a mixture of more traditional accounts focused on barbarian migrations and others based on climate. Bang (2013) takes a fairly traditional political and historical approach, explaining how groups of Germanic soldiers came to settle in Roman territory, given land in return for military service. The process drew in more migrants, who sought their gifts of land, but also fractured the relationship between army and emperor/state. In alliance with local elites, or sometimes in spite of them, they were then able to establish larger independent political units: “in that situation, the western emperor was gradually abandoned” (Bang 2013, p. 459; also Börm 2022; Pohl 2015). Lee (2013, p. 101) in addition gives a contributory role in the breakup of the west to the politics of the western court itself. This complex situation is discussed by Kulikowski (2018, p. 260), who emphasizes that there was not a single point of collapse, but rather decades of instability and change; this fits with Storey and Storey's (2017, p. 205) notion of slow collapse. He also notes that not everything can be explained simply by barbarian invasions (Kulikowski 2013a; see also Kulikowski 2018).

Heather (2015) places much of the above in a wider context by arguing again for the role of the Huns and the rise and collapse of their empire as part of the reasons behind some of the barbarian migrations or movements. In a further addition to the

Hunnic context, de la Vaissière (2015, pp. 190–191) suggests that the Huns departed the Altai region due to “major climatic change,” although this in itself does not explain their journey west or make the fall of the Western Roman Empire inevitable. Brosseder (2018) has discussed the climate-migration argument and the identification of the Huns with the Xiongnu.

Esmonde Cleary (2013, pp. 341–348) privileges the archaeological evidence, pointing to changes in identity visible in the Roman army in the northern and western borders, where from the early fifth century Roman soldiers, in a sense, became barbarians—or individuals could be either or both. The Roman army in the west, the key feature and instrument of the state, may have become neither Roman nor, in the end, an army. The situation, which may have come about in part due to the long settlement of men in particular border zones, was exacerbated by the inability to pay the armies in coin (Esmonde Cleary 2013, pp. 349–350), and the progressive eroding of manpower and tax bases as immigrant groups took increasing amounts of land from the state. Although there were Roman armies in the fifth century, and sometimes successful ones, they followed charismatic leaders rather than being state-operated (Esmonde Cleary 2013, p. 351). Both Roman and barbarian armies were made up of people of mixed ethnicities, most of whom were from Roman territory, first, second, or third-generation inhabitants (Kulikowski 2013a, p. 685). Local aristocracies, materially poorer, also adapted to the new sociopolitical realities, including adopting a more militaristic attitude, role, and display culture that was relevant to the new world in which they operated (Esmonde Cleary 2013, p. 438; Kulikowski 2013a, p. 692). Provinces and their aristocracies became more independent and the empire less integrated as a result (Drinkwater 2013; Kulikowski 2013b). The fall of Rome may have been an unintended consequence of the actions of all involved over a prolonged period (Esmonde Cleary 2013, p. 341).

Elsewhere, climate is given a much more central role in the end of the Western Roman Empire, an idea that goes back to Huntington’s 1917 paper, in which he used tree rings and lake levels to map past climates (cited in McCormick et al. 2012, n.2; Hu et al. 2022). With increasing sophistication over the years, more scholars have reconstructed palaeoclimatic patterns across the Roman Empire and have suggested that climate played a causal role in some of the bigger historical processes. McCormick et al. (2012), who marshal a range of palaeoclimatic proxy data, note that the ups and downs of Roman history tend to mirror climate change—reduced climate stability and political instability from AD 150–200, climate improvement from about AD 300, and more instability from AD 400. The east then seems to have enjoyed better conditions, and McCormick et al. (2012, p. 205) note that “such regionally advantageous climatic developments might help to explain the success of the eastern Roman Empire as the western Empire dissolved into new polities.”

However, McCormick et al. (2012) rightly note that trying to make linkages between climate and history can be controversial. The Roman Empire was constituted of many structural and moving parts, located in very different regions and locations, responding to all kinds of stimuli, all feeding back on each other. They thus view their own work as provisional, a starting point rather than a conclusive history, although their tone clearly implies they do see a relation. They observe that a step in the “right direction will be the development of focused regional and microregional

case studies that can use highly resolved climate data” (McCormick et al. 2012, p. 206)— this certainly applies in other episodes of collapse too, not least those mentioned above. But coincidence does not equal causality, and broad-brush strokes that ignore the regionally and historically contingent specifics are not convincing.

The debate about the role of climate in western Roman collapse is eclipsed by its supposed part in the history of the east, where the causes and effects of the AD 536 event continues to be the subject of debate. This climate event is argued by some to have had significant impact on societies around the world, causing widespread crop failures, famine, plague, death, and driving historical change on a grand scale (Moreland 2018, pp. 94–97). Büntgen et al. (2016) identify a Late Antique Little Ice Age, spanning AD 536–660, caused by volcanic eruptions in AD 536, 540 and 547 and associate it with a range of historical events and processes: the advent of the Justinianic plague and the transformation of the Eastern Roman Empire, the collapse of Sassanid Persia and Eastern Turkic Empire, the Arab expansion, and various population movements. With a vivid graphic, they map these historical events and processes onto graphs of fluctuating summer temperatures in the Altai mountains and the Alps, although they also sound a note of caution in simply associating historical change with climate change and voice caveats against reductionist and determinist thinking. The cause of the cooling is proposed to be one or more major volcanic eruptions or comet impact(s), which caused a dust veil that blocked sunlight and resulted in cooler temperatures over several years (Dull et al. 2019; Sigl et al. 2015).

As is usual, there are strong proponents of both that view and the contrasting view that climate had little to do with overarching historical events and processes, as well as moderates occupying the middle ground (Moreland 2018, p. 106). Evidence for the cooling is found in multiple proxies from various parts of the world, including polar ice cores and tree rings, suggesting that the cooling was real and likely global (Newfield 2018). It is recorded in textual sources from Late Antiquity, East Asia, and possibly also in the Viking stories of Fimbulwinter and Ragnarök and the Finnish stories collected in the Kalevala (Gräslund and Price 2012; Newfield 2018, pp. 449–452; Price and Gräslund 2015). Newfield (2018, p. 449) argues that what was perhaps a 15-year cooler period was nevertheless “a discontinuous complex of phenomena whose effects were extreme but varied across space and time.” Harper (2017, p. 254) acknowledges the event but sees “a decline in solar output” from AD 500 to AD 680 as much more important.

Harper’s *Fate of Rome* is one of the most notable contributions to the discussion of the sixth century and after (2017; also Harper 2016 and Harper and McCormick 2018). Despite its catchy subtitle, “the end of an empire,” the book is not really about the end of either the Western or Eastern Roman Empire, but rather concerns the impacts of climate and plague on the empire over time. The history of Rome is set into the context of three climatic periods, the Roman Climatic Optimum (c. 200 BC–AD 150), the Roman Transitional Period (c. AD 150–450), and the Late Antique Little Ice Age (c. AD 450–700) (Harper 2017, p. 15). In the early days, Harper (2017, pp. 14–15) argues, the Roman Climatic Optimum helped the lucky Romans build an empire. Climate and plague then challenged the empire at its height; resilient at first, it plunged into near collapse. As climate improved, so did the stability of the empire. The end of the Western

Roman Empire across the fifth century does not really fit into the thesis of the book; while eschewing a monocausal explanation, the Huns are again seen as a major factor in this (Harper 2017, p. 163). The east was saved by “the blunt determinism of physical geography... safe behind its natural barricades” (Harper 2017, p. 198). Harper connects the fate of the west and east thus: “if the environment had receded for a little while and let human actions take center stage, nature was about to reassume the protagonist’s role” (2017, p. 198)., p. 198).

The narrative moves on to the combined effects of plague and climate change, the Late Antique Little Ice Age, in Justinian’s reign (AD 527–565) and after in the east. Presenting a case of widespread catastrophe, Harper (2017, p. 260) also notes that these did not cause the Roman Empire to collapse “in a clean blow,” nor even “topple the regime of Justinian,” but rather “environmental degradation sapped the vitality of the empire.” Indeed, the Eastern Roman Empire did not collapse in the sixth or the seventh century, though, as discussed by Haldon (2016, 2023), in the face of environmental and other challenges, it simplified and transformed to become more resilient—partly through an increased reliance on local rather than long-distance production, exchange, and supply. Another reason for the survival of the Eastern Roman Empire may be the ideological unity of many stakeholders, political, religious, and military across the east that was vested in the survival of the state (Haldon 2016, pp. 289–291). Haldon et al. (2022, p. 244) write of a virtuous circle: “a self-reinforcing social-ecological system whereby the surviving state and its elites and infrastructure enabled the survival of landscapes which in turn provided the resources necessary for the state’s continued existence.”

Strong critiques of Harper and the climate-disease catastrophe narrative, which focus on both methodological areas and matters of fact and interpretation, are given by Bresson (2020), Erdkamp (2019), Haldon et al. (2018a, b, c), Sarris (2018), and Sessa (2019); these should be read along with it. Those reviewers note a range of problems with climate evidence, historical evidence, and argumentation, which undermine Harper’s thesis and his presentation of Roman history. One issue is that, since the empire spanned many climatically diverse regions, it is difficult to speak of a single beneficial or disadvantageous climate. Additionally, assigning the climate of the Roman Empire into simple chronologically bounded periods is problematic; what reality do they have and how do specific historical events fit into these? Writing history over the top of these periods, assuming a causal relationship, without considering the impact of other factors, is questionable. Why was it that the Climatic Optimum helped the Romans but not the Etruscans, the incipient state of Italia, the Greeks, or Celts? Harper’s work is nevertheless important because it will continue to prod researchers toward ever more careful reconstructions.

The fall of Rome, Late Antiquity, and the varied trajectories of the western and eastern empires are challenging to understand and write about because of the amount of evidence, archaeological, climatic and environmental, and textual. Weaving these together and assigning causality is not straightforward; this problem highlights just how much there is to consider in any case of collapse, but perhaps especially those (essentially) prehistoric ones where evidence is much more limited. As such, it remains a crucible for ideas about collapse and historical thinking.

## The Classic Maya

The Classic Maya collapse became a prime example of an apocalyptic climate-induced collapse narrative, with a megadrought bringing about universal demographic, political, and cultural collapse. This view was found in some scholarly literature and, because of its dramatic appeal in combination with the Maya mystique, was taken up widely in the media, becoming an accepted historical truth among many in the wider public (O'Mansky 2014, p. 158; Yaeger 2020, p. 787). In the years since the initial excitement at the increasing amount of palaeoclimatic data and attempts to base sweeping explanations on it, the situation has calmed somewhat, with a rapprochement between proponents of various approaches and points of view (Iannone 2014). Multidisciplinary research continues to aid this. The challenge, as always, is how to integrate climate data with historical and archaeological data from a very wide area over a long period, of three centuries, and produce a meaningful narrative; many contributions thus focus on particular regions, e.g., Copan in the southern Maya region (Freter and Abrams, 2016) and the Puuc Hills in the northern Maya region (Smyth et al. 2017).

A recent overview by Yaeger (2020) effectively draws together the strands of Maya collapse studies. The collapse itself has to be seen not as a total end but as one of several periods of broad transformation that Maya culture experienced over the *longue durée*; it is connected to what went before in the Classic and what came after in the Postclassic. The Classic collapse had a political element, with the demise of states and the rejection of divine kingship, and a demographic element, with sometimes significant reduction and movement in population. While collapse happened rapidly at some centers, it was slow elsewhere; the picture across the Maya area is varied, and each kingdom had its own unique history. Northern centers flourished while southern centers were abandoned. Yaeger rightly emphasizes as well that collapse is also an opportunity for reorganization and regeneration, where people are able to develop and modify existing traditions with new forms; hence Postclassic society was different but also complex. Acknowledging the contribution of work on climate change and drought, Yaeger nevertheless reminds us that there are difficulties in understanding the links between climate and history—what is it that made drought a problem at one time but not another—and in assigning and weighting causality? At the same time, he also reminds us of the agency of the Classic Maya themselves, both elite and non-elite people.

Some identify climate as a player in the Late Preclassic transition, the sixth-century Maya hiatus, and the (Terminal) Classic collapse (Valdez and Scarborough 2014). Dahlin and Chase (2014), for example, discuss the possible impacts of the global AD 536 event as a possible contributing factor. The hiatus is marked by the absence of dated monuments between the Early and Late Classic, but only at some sites. Exploring the different trajectories of three cities in the Southern Maya Lowlands, Caracol, Tikal and Calakmul, they propose that “the interaction between climate and culture cannot just be reduced to a simple cause-and-effect relationship’ but depends greatly on “the key characteristics of social, political, and economic systems” (Dahlin and Chase 2014, p. 154). At Caracol, for example, where there was no break in monument erection through the hiatus, “the entire... landscape was

modified by humans and agricultural terrace systems, which would have retained water, and covered *entire* watersheds” (Dahlin and Chase 2014, p. 140). Intraregional communications and exchange also were improved through road construction. These modifications were made over time, but mostly at AD 550–650, when the population peaked. Calakmul’s response was apparently to increase warfare and conquest, and to extract resources from wetland areas. At Tikal, unlike Caracol, there was no centrally planned response, and the lack of a successful response may have destabilized the regime; the state was defeated by Caracol and came under the influence of either Caracol or Calakmul (Dahlin and Chase 2014, p. 137). If the AD 536 event was global, and did impact Mesoamerica, it did not simply cause a collapse; Dahlin and Chase give due recognition to local differences and responses.

For the Classic collapse, Douglas et al. (2015, 2016) agree that there were severe droughts in the ninth–11th centuries, but they also observe that droughts hit different regions at different times and that in some cases the processes of collapse, which also varied across the Maya region, preceded these. They suggest an inherent fragility of the Classic Maya state system, with the divine kingship and its conspicuous resource use (cities, monuments, rituals, warfare) at its heart. Competition within and between states was an inevitable cause of fracture points. Nevertheless, they argue that while successfully adapting to earlier droughts (c. AD 200–500), many states failed to adapt to those of the Terminal Classic and thus assign droughts an important role. Kennett and Hodell (2017) also examine the impacts of drought in different Maya regions.

Martin (2020, p. 279) observes that a high population may have made the Maya states particularly vulnerable to changes in precipitation in the Late/Terminal Classic. This may be supported by Hoggarth et al. (2017), who used historical period population and climate data to show a connection between drought, famine, and population mortality and increased migration. This, they suggest, provides a model for understanding the impact of droughts in ancient Maya times.

Medina-Elizalde and Rohling (2012) observe that even a modest reduction in rainfall could have had profound effects, a conclusion also reached by Kuil et al. (2016), who argue that a modest reduction could have resulted in an 80% population collapse. Braun et al. (2023) note the difficulties with previous drought-collapse hypotheses and through an analysis of a speleothem from Yok Balum cave, Belize, suggest that unpredictable variability in rainfall in combination with droughts was key in the Classic Maya collapse. This variability challenged already vulnerable societies both internally and possibly resulted in increased intersite conflict.

Some of the evidence presents a picture of collapse without drought. O’Mansky (2014, p. 176) argues that “the process of collapse in the Petexbatun and greater Pasión River region can be and has been explained based on internal and structural problems of Maya civilization, and this explanation correlates to the archaeological record.” With the aid of inscriptions, a political narrative of competition and conflict between cities and states can be reconstructed, and the archaeology shows a landscape of fortified settlements. Warfare may have become endemic in the region and affected elites and non-elites. This happened against a stable environmental background. Demarest (2014) similarly argues for a political explanation for collapse in the Peten, “*before and without drought.*”

Scherer and Golden (2014) also argue against a drought-collapse explanation for the western lowlands, instead noting the difficulties of ruling quite disparate populations; success may have led to disintegration. None of this is to dismiss the potential role and impacts of droughts in specific areas, in specific contexts, at specific times, but few would see drought alone as the cause of global collapse, as authors in Iannone (2014) agree.

An exploration of collapse at Ceibal also focuses more on politics than climate. Investigations into Group D at Ceibal in Guatemala has revealed several episodes of “political disruption” (Bazy and Inomata 2017; Inomata et al. 2017). In AD 735 Ceibal suffered a defeat by Dos Pilas (both in the Southern Maya Lowlands, Pasión River region); later, after Dos Pilas hegemony ended around AD 761, Ceibal was taken over by Ajaw Bot, an “illegitimate” ruler, who did not use Ceibal’s established emblem glyph. His palace was in the defensive Group D area. Ajaw Bot’s reign ended around AD 810 and some elite buildings were ritually destroyed. The previous dynasty regained some control with king Wat’ul K’atel in AD 829 using the emblem glyph once again. The last dated monument is from some 60 years later, but most of Ceibal was abandoned by AD 900. It is the period around AD 810 when various states seem to have had problems, and Bazy and Inomata et al. suggest that the collapse c. AD 810 and that of AD 900 may have had different causes. This study also raises the question of when we date the Classic Maya collapse. Rather than a long or gradual collapse, they suggest it might be better characterized, in different places, as several episodes of rapid disruption.

At Nakum, a center in the Southern Maya Lowlands east of Tikal, Żrałka and Hermes (2012) note that the site experienced development during the Terminal Classic and only later experienced collapse. This was possibly due to its location and function as a port city, and the opportunism (and luck) of its elites in light of weakened neighbors.

Masson (2021) remarks on how resilient the Maya were in Postclassic times, especially Mayapan in the northern Yucatan. Kennett et al. (2022a, b) do observe a correlation between drought c. AD 1400–1450, increased civil conflict, and the collapse of the Mayapan polity in northern Yucatan. However, far from a simplistic apocalyptic drought-driven collapse narrative, the authors carefully integrate historical, archaeological, and scientific evidence to give a more nuanced picture of collapse and resilience. They argue that drought exacerbated tensions between elite factions, which had already periodically resulted in outbreaks of violence, resulting eventually in the killing of the ruling Cocoms and the dissolution of the state. Here we can recognize that historically specific events and their results took place (and that other outcomes were possible), which were influenced, at least in part, by climate pressure.

The Maya region is a rich area for collapse studies, given that the Maya culture area contained many different states, each with their own environmental setting and adaptations, and their own individual history (Martin and Grube 2000). These interacted with each other and adapted to their changing environment in different ways. It is one area where progress is being made in integrating climate and archaeology. But as with other cases of collapse discussed above, perhaps the Classic Maya collapse should be more accurately described as the Classic Maya collapses; many



individual state collapses dotted around chronologically and an overall cultural and demographic transformation into the Postclassic.

## Tiwanaku

The question of what Tiwanaku was is still under discussion (Vranich and Stanish 2013), and the answers to the question naturally impinge on how we frame and understand the Tiwanaku collapse. There does, however, seem to be some general agreement that there was a Tiwanaku state, with a large urban capital with monumental building, and perhaps 20,000 residents at its height. Precise reconstructions vary, ranging from Stanish's (2013, pp. 153, 164) view of a large hierarchical state on a par with "classical non-imperial" old world civilizations, with a capital "comparable in size and complexity to medieval London and Bronze Age Knossos..." to Janusek's (2013, pp. 198–199) Tiwanaku as "an ongoing project of cultural production" that formed a long-lived and "coherent political community" or "pan-regional community." It also seems agreed that elite-sponsored public ritual at the monumental heart of Tiwanaku, and its peripheries, played a key role in bolstering or constructing political power, and thus in state formation and maintenance (Seddon 2013; see also Isbell 2013). Janusek (2013, p. 198) writes of the appeal of Tiwanaku culture, "something evocative, seductive, and powerful," in which "the power of ritual encounters and spiritual experiences" people bought into, along with the attraction of feasting and hospitality culture (Bandy 2013). That there were ruling elites seems undisputed.

The Tiwanaku area stretched across the south-central Andes but was based around Lake Titicaca, where the city of Tiwanaku lay to the south. Around AD 950–1100 the state collapsed (Vranich 2013), marked by the cessation of monumental construction at Tiwanaku and the abandonment of its core area (Sharratt 2016a). The Putuni, a palace or very high-status building, was burned and razed and similarly at Tiwanaku towns in the Moquega Valley, "violence was wrought on symbols of state authority and religious ideology" (Sharratt 2016a, p. 150). Some habitation continued at Tiwanaku, but populations at Tiwanaku centers also dispersed and new small settlements, sometimes with defensive characteristics, appeared (Sharratt 2016a, p. 151; Thompson and Kolata 2017, pp. 241–242).

Climate change—drought—remains one of the proposed causes of Tiwanaku collapse. One of the main sources of palaeoclimatic data applied to Tiwanaku are the ice cores from the Quelccaya ice cap (Thompson 2017; Thompson and Davis 2014; Thompson and Kolata 2017). Two ice cores were drilled in 1983, with two more in 2003 providing more and higher resolution data than the earlier two cores. Thompson and Kolata (2017, pp. 237–238) identify from the cores a period from c. AD 500–1150 of "overall, though highly variable, warm and relatively wet conditions." From c. AD 950, precipitation declined steadily, reaching a low c. AD 1200. Aridification is also inferred from a palaeoclimatic proxy from the Laguna Pallacocha, which is "broadly synchronous" with a reduction in snow accumulation on Quelccaya. Thompson and Kolata (2017, p. 240) add sediment records from Lake Titicaca, which also suggest aridification. In another study, Arnold et al. (2021a), using

sediment data from Lake Orurillo, between Quelccaya and Lake Titicaca, identify a phase of reduced precipitation and high aridity between AD 950 and 1025. After that, precipitation increased again, but aridity continued to the 13th century.

Thus, in these views, the collapse of Tiwanaku was contemporaneous with climate change, which is assigned a probable (Thompson and Davis 2014; Thompson and Kolata 2017) or a definite causal role (Arnold et al. 2021a). As for the mechanism of collapse, Thompson and Kolata (2017, p. 240) suggested that lake levels dropped significantly, causing the state-managed raised field agriculture to fail, which in turn caused “sociopolitical fragmentation.”

Arnold et al.’s (2021a) conclusions have been critiqued by Marsh et al. (2021). In particular, Marsh et al. point to problems in the chronology of the study, noting a significant error range in dating the drought and also the uncertainty over the date of the Tiwanaku collapse itself. Arnold et al. (2021b) responded in defense of their data and argument. Other studies, however, also come to different conclusions. For example, Bruno et al. (2021), working at Lake Wiñaymarka at the southern end of Lake Titicaca, conclude that there was an arid phase, but that it came after the collapse of Tiwanaku, beginning c. AD 1200. In their view, lake levels fluctuated throughout Tiwanaku times, with the polity thus showing resilience through times of drought, in part because of diverse and flexible subsistence strategies. With that in mind, they conclude that political and social factors certainly played a role in collapse, in addition to any environmental challenges.

Much work has been done on what happened after Tiwanaku collapsed. Population did not disappear but dispersed, then declining over time. The Moquega Valley, a coastal valley 300 km from Tiwanaku, had been the home of several Tiwanaku colonies or towns, including Chen Chen and Omo. After the Tiwanaku collapse, old settlements were abandoned and new smaller ones founded, including Tumulaca la Chimba (Sharratt 2016a, b). Tiwanaku traditions at Tumulaca la Chimba were selectively continued, rejected, or transformed. Pottery, for example, continued in similar styles, though it was made at household levels rather than bigger workshops, and it no longer carried symbols of Tiwanaku state ideology, such as the Staff God (Sharratt et al. 2015, p. 403). Sharratt (2016a, 2021) also suggests that Tiwanaku ritual practices continued but were now performed in common spaces rather than elite locations.

It is as yet unclear what caused the Tiwanaku collapse. It seems climate could have played a role but equally that Tiwanaku people were able to cope with climatic fluctuations and landscape changes. However, as Sharratt (2016a) argues, it is not a sufficient explanation. Political factionalism among elites is one possible arena that could have caused the abandonment of previous rituals in Tiwanaku’s urban core and peripheries and have generated a wider dissatisfaction and disengagement with the once-attractive Tiwanaku way (Janusek 2013). Collapse may have been “a violent, drawn-out process” (Sharratt et al. 2015, p. 399). Why factionalism, which surely existed in Tiwanaku’s previous five or six centuries of existence, should come to have such a profound impact at that point is not obvious. Rejection of the Tiwanaku way by the general population is part of the story, given the destruction targeted at elite culture. External factors, such as conflict with neighbors is another possible factor.

In the case of Tiwanaku, much remains unknown, but a degree of continuity through collapse, and the agency of groups after, is clear. It seems likely that a range of factors, coincident in time and mutually reinforcing, perhaps historically specific and contingent, conspired to bring about collapse, which as a process may have taken 50, 100 or 150 years to play out, punctuated by specific acts of destruction, abandonment, and change.

## Rapa Nui

Pre-contact Rapa Nui was, for a time, seen as a prime example of cultural collapse caused by anthropogenic environmental destruction and overpopulation (Cauwe and De Dapper 2015b; Ingersoll et al. 2018, pp. 194–198). As such, the island's fate at the hands of its inhabitants was held up as a lesson to learn from—Easter Island as the earth in microcosm. Discussion of the supposed collapse of pre-contact Rapa Nui has continued, and the ecocide narrative of Diamond and others seems soundly rejected by many specialists (Boersema 2015b; Mieth et al. 2022, p. 485). Haoa Cardinali et al. (2018, p. 2) comment on the continued archaeological work on the island, stating that “far from a culture of collapse and doom, a snapshot of extreme innovation and resolve has emerged.” Rapa Nui is now a prime example of the resilience of a people in a challenging, changing, and circumscribed environment. Cauwe and De Dapper (2015a) and Rull and Stevenson (2022) also present recent views on collapse, resilience, population, and environment on Rapa Nui (see also Rull et al. 2013).

Boersema (2015a; see also 2015b, 2018) offers a full and measured discussion. He explains the rise of the ecocide narrative of Rapa Nui collapse from the 1970s and after, in which the island's society was proposed to have fallen violently from its apogee of civilization in c. AD 1400, with the *moai* culture in full swing, into chaos, death, hunger, and poverty—the state it was discovered in by Europeans, Americans, and others. He argues instead, from a thorough reading of journals of early western visitors to the island, who first arrived in AD 1722, that such a premodern collapse is hard to see; “none of these sources contained any support for the collapse theory, nor any evidence of a decline caused by famine and high mortality” (Boersema 2015a, p. 5). Richards (2018, p. 179), who studied the impact of outsider visits prior to 1862, also notes that “there is no evidence of a shortage of food to trade.” From a different angle, DiNapoli et al. (2020) employed a model-based approach to understanding the development of the monumental *ahu* and *moai* cultures. They found that, rather than ending in precontact times, *moai* continued to be made. By these measures, the earlier ecocidal view of Rapa Nui collapse becomes problematic.

The deforestation of Rapa Nui, from an island of some 16 million native palms, is generally accepted, but the causes and manner of it is uncertain. Deforestation clearly happened gradually over a long period of time, some four centuries from AD 1250–1650, which suggests that on the scale of lived lives the deforestation we see in hindsight was perhaps not clearly perceived (Mieth and Bork 2018, p. 45). Each of the 15–20 generations in turn, over the years, was used to a slightly different landscape and environment from its predecessor, and adaptations were developed

alongside these changes, even to the stage where few palms were left; the islanders continued to survive, culture intact, in a deforested island.

The disaster narrative associates deforestation as ecocide with *moai* production and transportation, often suggesting wooden rollers were used to move the stones, but given the numbers of *moai* it is unlikely that this could have caused total deforestation. Some parts of the island may have been cleared for particular cultivation strategies and some to allow the construction sacred platforms, *ahu*. Mieth and Bork (2018, pp. 47–50) suggest that the wood from palms may have been, or have become, of secondary interest. Rather, palm sap may have been consumed by islanders; there were few good sources of water on the island, and access could possibly have been limited by clan boundaries, distance, and taboos. Palms have long been cultivated in many parts of the world, and palm sap can be used in various ways, including as a nutritious and tasty drink (Sarma et al. 2022). One felled palm, they calculate, could provide 400 liters of sap over a year to a year-and-a-half, with one or two trees per year enough for an individual. Stone troughs of unclear purpose found around the island may have served as receptacles.

The disaster narrative also proposes that many *moai* were abandoned during construction and transport, giving the impression of a sudden apocalyptic collapse—no more trees, no more rollers, no more *moai*, no more civilization. However, Cauwe and De Dapper (2015c) demonstrate that the roadside *moai* had been initially positioned upright, where they had remained for long enough for rain to create runnels, and then had been carefully laid down and secured into position horizontally. This was a deliberate behavior of people with *moai* and is not evidence of a sudden disaster or civil conflict.

Flas (2015) outlines the problem of interpreting the *mata'a*, which in the ecocide narrative are obsidian blades used as weapons in the wars and anarchy of collapse. He argues that they are not a single type of tool but a diverse set of object types. Use-wear studies of some *mata'a* suggest horticultural rather than combat use and they lack impact damage; they also come in a range of shapes and weights, which make most of the *mata'a* inappropriate for projectile weapons (Flas 2015). Lipo et al. (2016) support this idea of *mata'a* as “general purpose tools.”

Lemaitre (2015), who studied the petroglyphs of the island, also finds no evidence of collapse in rock art. The birdman, whose cult is often associated with a break in culture from the *moai*, is present and became more widespread over time, but it appears the same as in other Polynesian communities where it also grew in popularity.

The tenor of many recent studies is to downplay the idea of a violent collapse, an arms race and a descent into mass violence on the island. However, Bahn (2015) makes a number of arguments against this revision of the island’s history. He follows Molloy’s argument that the *moai* were toppled violently, given the damage and positioning of some stones and islanders’ own reports that this was done with ropes (Bahn 2015, pp. 139–140). He also affirms that the *mata'a* were weapons, which were seen in use by Captain Cook and others and referred to as such by islanders (Bahn 2015, pp. 145–148).

Brandt and Merico (2015) focus on population collapse and instead of a sudden drop posit a gradual decline. They suggest “a resilient society that tries to adapt in

the attempt to avert the looming ecological catastrophe” (Brandt and Merico 2015, p. 10). Boersema posits a low population, rather than an ecocidal overpopulation, that had and would have had no subsistence difficulties, varied diets, and reasonable health, confirmed by bioarchaeological research (Boersema 2015a, pp. 108–109, 115–119). Polet’s (2015) study of human remains, dentition, and food middens demonstrates that most of the diet consisted of tubers, with a third made up of sea food, then eggs, chickens, and rats. Analysis of the wear patterns on teeth did not indicate cannibalism. She also found that babies were breastfed until three, and there was no serious infant malnutrition. These results argue against the catastrophe narrative.

Successful adaptations to the environment and arid periods included the practice of lithic mulching to maintain soil quality while infanticide may have served as a deliberate control on population. Cultural adaptations to changing situations included the development of the birdman cult. Boersema sees a picture of resilience and adaptation, at least until the growing contact with outsiders of the 19th century, with spreading disease and the abduction of islanders. The true collapse, in which traditional culture and knowledge was lost and population dropped catastrophically, resulted from this contact (Boersema 2015a, pp. 142–144).

Rapa Nui can no longer be held up a simple case of apocalyptic collapse, nor of a society that chose to fail. Precontact change on the island does need to be explained, but resilience and adaptation may be a more appropriate characterization. The real cultural and demographic disjuncture came later.

## Final Comments

This review has presented work on collapse and its associated concepts published between 2012 and 2023. It demonstrates how collapse studies often reflect current perceived threats to society and how many researchers explore collapse to inform present understanding, action, and policy with regards to the environment, resilience, and sustainability. It also shows the variation in how individuals and groups go about engaging in and sharing collapse studies, whether it be in terms of the way they conceptualize collapse or dismiss it, how they seek to identify or explain it, or the reasons for studying it in the first place. Some accounts focus on culture history, site descriptions, or regional surveys through time, some offer historical narratives with characters and decisions, while others propose algorithms, laws, models, and simulations. There is an ongoing discussion, for example, over fundamental approaches—quantitative and qualitative, long *durée* or short term, macro or micro, determined or agent-driven, process or event, which determine the kind of history (the consumable output) that is produced. Collapse studies are still characterized to some extent by a tension between those who see collapse as caused by external events and others who are internalists, broadly speaking; the tension is useful, though, in providing a structure for mutual critique and the presentation of interpretations.

In truth, there is room for variety in collapse studies, which should not imply wooliness or even lack of agreement; rather, by approaching collapse from many angles, we build up our knowledge and understanding. Even disagreement can

be constructive and illuminating. Inclusivity and an appreciation of diversity that spans disciplines, rather than exclusivity, will be the most beneficial attitude.

What can we learn about the study of collapse in the past ten years? Several themes appear. The first is that simplistic grand narratives seem to have faded away somewhat, at least in academic circles, although there is still a distinct and deterministic climate-collapse discourse in some subfields. Where this is present, it does not pass without critique. A greater number of voices offer more careful analysis of cases of collapse or significant change or periods of successful adaptation. One area that requires attention is the identification of collapse events constructed from geographically and temporally disparate evidence. It is worth questioning to what extent some collapses are constructs or artifacts of scholarship. This is not pedantic, given that both descriptions and explanations may fundamentally differ according to what the collapse is that is being looked at.

Collapse also still tends to have negative overtones, seen in some of the definitions given above, but it is also now uncontroversial that in many cases collapse was something that had most impact or is at least most visible at an elite or state level. Others may have benefited or have felt little difference. The intersection of class and collapse (and resilience) might be a fruitful avenue for future research, one that could inform discussions of societal sustainability and resilience (as with vulnerability, which differs by social location, in disaster research acknowledges). It is also much clearer that researchers understanding collapse as the fragmentation of empires or states also do not imply that complex society did not continue to exist in many cases. Apocalyptic views of collapse have generally faded away; resilience in some form (population, culture, etc.) is seen as the norm, and collapse can be seen as a process of adaptation to a new normal. At the same time, the lived experience of collapse should not be forgotten in this adaptive model; collapse should be a story about people derived from archaeology.

Another major theme is that we can, as a society, learn from past collapse and resilience, and we should write (at least sometimes) helpful histories. This is no longer couched as avoiding the apocalypse, citing the disappearance of the Maya or Easter Islanders as cautionary tales, but much more focused on understanding what makes societies vulnerable and fragile, where cleavage points are located and how successful adaptations and sustainable systems work and who they work for. Knowledge of the past can indeed scaffold the development of more convincing models and scenarios of the future, despite the significant differences of modern global society from preindustrial societies around the world. The study of past collapse remains a challenge to those doing archaeology and history and a resource from which new and better understandings of human communities can come.

**Acknowledgments** I would like to thank Anna Lucia D'Agata, Elena Devecchi, Jan Driessen, Luca Girella, Calian Hazell, Stefano de Martino, Jesse Millek, and Dimitri Nakassis for kindly sending me some of their recent work. I am also grateful to Gary Feinman and Linda Nicholas and the six anonymous reviewers of the original manuscript for their supportive and very useful comments and suggestions, which have helped improve this paper in content and style. I thank Newcastle University for making it possible to publish this article Open Access. Errors that have crept through, of course, remain my own.

## Declarations

**Conflict of interest** No funding or financial support was received in the preparation of this work. The author has no competing interests, financial or non-financial interests to declare.

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