1 Introduction

The impacts of natural hazards on human societies can be acute, far reaching and at times surprising. As much as the products of hazards arising entirely by natural means, however, the disastrous circumstances created by such events are socially-created phenomena. Not only are natural hazards themselves the product of a complex web of Earth-system processes, their effect on human society is the result of a constellation of inter-related and unpredictable variables. The impact of any given hazard on a particular human society, therefore, can be estimated but never predicted with absolute certainty. We are frequently reminded of this when natural hazards strike human populations today – though it is usually only the short-term ‘moment of disaster’ that captures the attention of the media rather than the multitude of processes that caused the event to occur and influence its longer-term consequences. By turning to the ‘laboratory’ of the past, however, it is possible to investigate the impact of extreme natural events, both during these tumultuous moments and across longer timespans. Additionally, the different ways in which human societies have responded to these types of event – and whether measures that were adopted ameliorated or exacerbated the situation – may be explored. The subject of this book, therefore, is the relationship between later medieval society (AD 1000–1550) and natural hazards. What follows explores meteorological disasters – a subset of natural disaster – focussing on their impact in Britain, though with a comparative eye to the medieval world more generally. The aims of this study, therefore, are:

- To reconstruct, in detail, a number of case studies to explore the impact of extreme natural events on medieval society
- To characterise how medieval society responded to these types of event (both physically and through religiously motivated and superstitious practices)
- To assess to what extent exposure to recurrent hazards affected the resilience and/or vulnerability of medieval society (either positively or negatively)
- To place the role of disasters as drivers of cultural change within a wider historical and archaeological context.

In order to accomplish these objectives a variety of historical and archaeological sources of evidence are investigated in order to explore different aspects of these interactions between nature and culture. Disasters as a subject of academic enquiry are highly interdisciplinary¹ combining elements from the physical sciences, such as physical geography and climatology, with the humanities and social sciences. The investigation of disasters in the past, therefore, requires the integration of many disparate fields including studies of historical documents, archaeological sites and standing buildings, which preserve evidence of the occurrence of disasters, as well as material culture

related to how contemporaries reacted to these events. The range of different types of hazard, their varying impacts in different locales, and their occurrence within varying historical contexts, necessarily means that there can be no ‘one size fits all’ approach to analyse the occurrence and impact of historical natural hazards. Rather, the approach adopted must be tailored to the available sources of evidence. These must be analysed creatively in order to tease out as much information as possible relating to the occurrence of the hazard, and its impact on contemporary society. The later medieval period is especially conducive to this type of research due to the significant quantity of extant documentary source material, which in most areas of Europe is orders of magnitude richer than from any preceding period. From an archaeological perspective, some types of natural hazard can be ephemeral, meaning that historical evidence is invaluable as a record of the occurrence and impact of these events. In addition, the documentary record assists in interpreting evidence for the responses these events provoked as well as their less tangible impacts on society.

Geographically, this volume focuses on Britain – in particular exploring a number of disasters that struck the east coast of England. While Britain is not widely considered to be a zone which is especially affected by natural hazards – with no significant exposure to seismic or volcanic hazards – meteorological, or weather-related, hazards occur with some regularity. Furthermore, the documentary evidence which survives from the medieval period in Britain is amongst the most complete in Europe. However, where appropriate, archaeological and historical evidence and research is brought in from many other regions, including Scandinavia, Germany, the Low Countries, Italy and France, to contextualise the experience of disasters in medieval Britain.

The format of this book is arranged around the ‘disaster cycle’, a conceptual framework which describes the ‘lifecycle’ of a disaster and is applicable to any event. This framework encompasses the physical damage caused in the moment(s) of disaster, phases of repair and reconstruction in the immediate aftermath and the periods of quiescence in the, sometimes lengthy, gaps between the occurrence of hazards. Following the Braudelian model of historical time, the effects of natural disasters can be envisaged over multiple overlapping timescales. In his first layer of historical time, Braudel generally viewed environmental systems as gradual and cyclical and judged them to be ‘almost imperceptible in nature’. With respect to rapid-onset natural hazards, however, although it is possible to conceive of many as occurring cyclically over the longue durée, the short-term effects unleashed by these events on the individuals and communities they affected were not just extremely noticeable but could be decisive in determining the fates of these communities during and immediately after

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2 ALEXANDER 2002: 6; see Fig. 1.1.
3 In which historical time is envisaged over three layers encompassing relatively gradual changes in environmental systems, more rapid changes in political and social systems and the more immediate history of the individuals which populated these overarching systems.
Fig. 1.1: The disaster cycle. Although each event will play out differently to its predecessors, the effects of a given disaster on a given society can be classified into the same fundamental stages. Redrawn by the author after Alexander 2002: 6.

their occurrence. While Braudel’s model is not well suited to the immediate impact of environmental hazards, therefore, as the remainder of this volume demonstrates, conceiving of the impacts of these events on the different spheres of life encompassed by Braudel’s layers – individuals, society more generally and the wider environment in which medieval people lived – remains a valuable approach which offers a holistic understanding of the impacts generated by these events over different timescales.

Thus, following an introduction of key concepts and an overview of existing research in the remainder of this chapter, Chapter 2 approaches how medieval populations perceived anomalous natural events during periods of relative quiescence, particularly how their beliefs about disasters were informed by, on the one hand, religious instruction, and on the other, practical experience. Chapter 3 presents a number of detailed case studies to explore what actually happened, both physically and socially, during the occurrence of rapid-onset natural hazards during the medieval period. This includes a variety of types of hazard which affected society in different ways and at different scales. Turning to the aftermath of these events, Chapter 4 analyses the physical responses adopted by society in order to understand what ‘real world’ steps were
taken to mitigate and protect against disastrous events during the period under consideration. Chapter 5 augments this evidence by examining how people sought protection from these events through spiritual means, guided by both the Christian world-view and traditional, sometimes superstitious, beliefs. Next, Chapter 6 considers to what extent disastrous events lived on in the memories of individuals and communities long after their occurrence, as well as whether these memories fed back into reducing vulnerability from recurrent hazards. Chapter 7 draws the evidence presented in the preceding chapters together in order to consider the broader nature of the relationship between human society and disaster during this period. This is followed by Chapter 8 which sums up the discussions presented in the preceding chapters and draws some conclusions about the nature of disasters in the medieval period, their impacts on society and how contemporaries lived through and understood these events.

1.1 What constitutes a disaster?

Natural hazards – the instigators of any ‘natural’ disaster – encompass a wide gamut of different types of event which are caused by diverse processes. Such phenomena include wildfires, earthquakes, avalanches, tsunamis, volcanic eruptions, hurricanes and meteor impacts as well as many other potential hazards. Of course, many of these types of event are rare occurrences or restricted to particular geographic zones. As Britain is the focus of this volume, the emphasis is on the types of hazard which most commonly afflict this part of the world: meteorological hazards. Compared to ‘natural hazards’, ‘meteorological hazards’ is a more restricted category; including all those hazards of which the underlying cause relates to weather systems. The main categories of event are, therefore: floods, storm surges, droughts, wind and thunderstorms but not geophysical hazards such as earthquakes or tsunamis. Non-meteorological hazards are discussed throughout what follows only to provide parallels or where a causal relationship exists with a meteorological hazard – such as a landslide caused by high precipitation (rather than seismic activity).

The occurrence of a natural hazard, however, does not automatically trigger a ‘natural’ disaster. We may imagine that, on another planet, similar to Earth but devoid of life, completely natural fluctuations in sea level, precipitation and weather patterns might lead to the inundation of areas that are usually dry, long droughts, severe rainfall or the occurrence of violent atmospheric storms. To an astronomer watching from afar, these events would, most likely, not register as disasters; only as inevitable natural processes. It is only, therefore, by introducing the presence of human society, and its interests, that such events, and their impacts, come to be considered as disastrous. This simple distinction between presence and absence is what causes the natural action of a hazard to precipitate a ‘natural’ disaster. A simplistic definition of a ‘natural’ disaster, therefore, is an unwelcome change from an accepted norm experienced by a human community as a result of the action of a natural hazard. More clinically, the most
comprehensive database of modern disasters defines a disaster as an event which either results in over 10 casualties or negatively impacts at least 100 people.⁵ Importantly then, for a natural hazard to result in a ‘natural’ disaster, an impact on human life, assets or interests is required.

The term ‘natural disaster’ can be problematic however. Although, as above, a human component is a prerequisite for any ‘natural’ disaster, in certain cases human decisions, rather than the inevitable and natural occurrence of a natural hazard, have been held almost entirely responsible. A good example is the Fukushima Daiichi incident in Japan in March 2011 in which a high magnitude earthquake caused a tsunami wave which flooded the nuclear power station at Fukushima leading to reactor meltdown, explosions and the leakage of radioactive material. As a result, over 100,000 people were evacuated and a 20km exclusion zone was enforced around the nuclear power station.⁶ Another commonly cited example is the devastating flooding and loss of life which occurred when Hurricane Katrina struck the US Gulf Coast in August 2005. The ensuing disaster was a product of poorly designed flood defences and widespread

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⁵ Smith, Petley 2009: 24.
⁶ Hasegawa 2012.
poverty which increased vulnerability, with many inhabitants unable to escape to
safety. In such examples, while the conditions themselves arose naturally: the earth-
quake and tsunami which hit Fukushima and the hurricane conditions of Katrina, the
main factors which made these events ‘disasters’ were economic, social or political
issues both internal to the societies they affected and the result of human decisions.
While these two examples sit at the extreme end of the scale, and have received copious
amounts of both scholarly and popular analysis, all disasters incorporate a human
element meaning that, at a semantic level, none can truly be considered ‘natural’. Clearly
then, the risk created by a ‘natural’ disaster is composed of multiple elements.
The two most fundamental of these are: the natural hazard – encompassing the phys-
ical mechanism behind its occurrence, its magnitude and area of effect – and the
vulnerability of the human society – a product of factors such as their awareness and
understanding of the hazard, their location in relation to the hazard’s area of effect and
their resilience when the hazard strikes. This is often conceptualised as an equation,
as in Fig. 1.2, in which these two factors combined produce the risk from any given
disaster. Accepting that ‘natural’ disasters are the results of the interplay between a
natural hazard and human decisions, the term ‘natural disaster’ is used throughout
what follows in reference to these events.

1.2 Natural hazards in a British context

While meteorological hazards are the primary focus of this book, it is useful to provide
a brief overview of the main natural hazards which pose a risk in and around Britain.
The types of natural hazards which typically impact northern Europe more generally
are relatively uniform. The combination of long, exposed, coastlines and the inter-
actions between the Atlantic Ocean and climate systems strongly influence both the
weather and many of the hazards experienced across this zone. Extra-tropical cyclones
frequently track across northern Europe – indeed, the storm tracks which occupy this
zone are among the most active in the northern hemisphere. These events cause high
magnitude windstorms and/or precipitation and most commonly occur during the
autumn and winter months. At a continental scale, westward coastal areas between
latitudes of 50° and 70°, which are exposed to the full force of cyclonic systems from the
Atlantic, Ocean are worst affected. Strong storm winds can also produce other hazards
such as aeolian sand, when sand deposits become mobilised, and storm surges, dur-
ing which high wind speeds drive bodies of water against coastlines causing the water

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7 Comfort 2006: 503.
8 Wisner et al. 1994: 49.
9 Lamb, Frydendahl 1991: 3.
10 Bartholy et al. 2006; see Fig. 1.3, B.
11 Clarke, Rendell 2009.
to ‘pile-up’ bringing about a localised rise in sea-level. The low pressures associated with storm systems also precipitate a rise in sea-level amplifying the flood risk posed by storm surge events. The North Sea basin, and adjoining coasts, are particularly vulnerable to this effect (see Fig. 1.3, A) due to the basin’s relatively shallow bathymetry, funnel-like shape and the ‘bottleneck’ of the English Channel which slows the escape of water driven from the north. The risk to surrounding coastlines is epitomised by devastating modern events such as the storm surge and resulting flood which struck the UK and the Low Countries on 31st January/1st February 1953.¹²

Floods caused by other factors routinely occur throughout northern Europe. While there are many different categories of flood, including those caused by ice-jams, mass movements or the failure of levees and dams, the most common, in addition to storm surge flooding, are river floods and flash floods.¹³ River floods occur when sustained or intense precipitation, over a timespan of days to weeks, swells rivers beyond their normal bounds. These events become particularly severe when flooded soils become waterlogged or frozen as this prevents floodwaters from draining into the soil. River floods are common throughout northern Europe (see Fig. 1.3, C), especially during the winter months when atmospheric depressions cause warm fronts bearing moisture to pass over the zone from the west. Flash floods are localised extreme precipitation events which occur over a short time frame, usually under six hours. These events most commonly affect mountainous areas, although lowlands can also fall victim, and can also be caused, or exacerbated, by rapid snowmelt. Precipitation supplied by moisture from the Atlantic Ocean means that an excess of precipitation is more common than a deficit. Drought, however, does occur across the region although not to the same extent as in southern and eastern Europe.¹⁴

Turning to geo-tectonic hazards, active volcanoes within northern Europe are limited entirely to Iceland¹⁵ which is somewhat anomalous for the zone in geological terms. Risk from earthquakes across the majority of northern Europe is low, with a slightly elevated probability of seismicity in parts of Belgium, northern France, western Norway and Wales, as documented by the 2013 European Seismic Hazard Map produced by the SHARE project.¹⁶ Again the exception is Iceland which sits atop the Mid-Atlantic Ridge, a major fault line between two tectonic plates. In spite of the relatively low seismic risk across northern Europe, damaging earthquakes do occur; modern examples include the magnitude 4.4 17th February 2018 Cwmlynfell earthquake which affected Wales and England¹⁷ while medieval cases include the tremors of 21st May 1381, the epicentre of

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¹³ Barredo 2007: 130.
¹⁴ Lloyd-Hughes, Saunders 2002.
¹⁵ The only exception is Beerenberg on Jan Mayen Island, Norway, located in the North Atlantic.
¹⁶ Giardini et al. 2013; see Fig. 1.3, D.
¹⁷ BGS 2018.
which is estimated to have been located in the Straits of Dover, which caused structural damage in south-east England and the Low Countries.¹⁸

Another hazard to which the entire zone is exposed are mass movements such as landslides. These can be caused by seismic activity, although, as above, excepting Iceland, there is only a low risk of such an occurrence across northern Europe. High rainfall on the other hand, can also precipitate mass movements and is a common occurrence across the zone. In the majority of areas however, such occurrences only have the potential to be low magnitude events due to the relatively flat topography of much of the zone – including most of England, much of Ireland, northern France, the Low Countries, northern Germany and eastern Scandinavia. The exception are mountainous regions including parts of Wales, the English Lake District, the Scottish Highlands and parts of Scandinavia. Jaedicke et al. identify the Scottish Highlands, two distinct areas of eastern Norway and two separate areas on the north and south coasts of Iceland as hotspots for landslides caused by precipitation within northern

Fig. 1.3: Risk from different natural hazards in northern Europe today (Red=high, Blue=low). Created by the author using data from the European Spatial Planning Network available at: http://rimap.espon.eu. Seismic hazard map from Giardini et al. 2003.

²⁸ Hoffman 2014: 308.
1.3 Approaching the study of disasters in the past

Specific disasters, both mythical and historical, have always figured prominently in the popular imagination of the past. One need only think of the Atlantis myth, the Biblical flood of Noah or, more recently, archaeological discoveries such as Roman Pompeii which seem to preserve the cataclysmic realities of a moment of disaster from long ago. Throughout the early modern period, specific disasters spurred research into their underlying causes and, in some cases, how they might be mitigated. The ‘Great’ storm of 1703, for example, inspired the writer Daniel Defoe to collate contemporary eyewitness testimony as well as trying to understand, through the literature available at the time, why such an event had occurred. Most famously, the 1755 Lisbon earthquake gave rise to early research into the causation of the disaster and what might be done to mitigate damage on the same scale occurring in the future. The Verdalen landslide

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19 Jaedicke et al. 2014: 333.
23 Haslett, Bryant 2007a; Haslett, Bryant 2007b.
24 Bailey 1991: 189; Bailey 2007a: Fig. 16.
25 Defoe 1704.
26 Araújo 2006.
in Norway in 1893 drove research into the mechanics behind landslides – including historical analysis of past events – though “as memory of the disaster faded, so did the funding for further … investigations”. As demonstrated in the latter case, these early studies were affected by an element of ‘amnesia’ – although, for a time, the occurrence of a disaster inspired research into why they happened, as well as their impacts, up until the mid 20th century, this was generally a temporary phenomenon which lapsed as memory faded of the event which had originally sparked interest.

Academic research into disasters as a discrete category of event worthy of consideration is a relatively recent phenomenon. In the United States, social scientists first began investigating disasters in detail during the post-war years, using natural disasters as proxies for plausible social responses to military emergencies such as a nuclear attack by a foreign power. During this period, natural disasters were, somewhat fatalistically, treated as unpredictable events which could not be averted. Only from about 1980 has a view emerged which, as previously described, treats disasters as events created by an interplay of natural processes and cultural decisions.

In this context, from the 1990s, but especially since the early 21st century, the sub-discipline of historical disaster studies – which seeks to approach the study of disasters, as a combination of natural and cultural concerns from the historical perspective – has emerged. Prominent scholars within this sub discipline include Gerrit Schenk, who, as well as investigating a number of detailed case studies, has also concentrated on refining concepts and methodology while promoting the value of studying disasters from a historical perspective and Christian Rohr, whose research especially focusses on hydrological and seismic disasters in central Europe as well as methodological questions. Others include Christian Pfister, who has particularly focussed on reconstructing climate related hazards as well as looking at risk culture in historical societies more generally, Franz Mauelshagen, who has investigated cultural responses to disaster during the post-medieval period, and Greg Bankoff who has studied the cultural component of disaster and risk in both the present-day Philip-

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29 Juneja, Mauelshagen 2007; Schenk 2007a.
30 Quarantelli 1987.
31 Oliver-Smith 1996: 304.
33 Schenk 2007a.
34 Schenk 2015.
36 Rohr 2007.
38 Pfister 2011.
39 Mauelshagen 2012.
1.3 Approaching the study of disasters in the past

For the Low Countries, the research groups of Tim Soens and Bas van Bavel have worked on medieval and post-medieval flooding, as well as other disasters – particularly exploring how social and economic conditions contributed to creating the risk to which these populations were exposed. Beyond this exclusively historical sub-discipline, however, most other disciplines have done little to engage with the study of historical disasters. The exception is historical climatology, which finds much common ground in tracing the occurrence of specific events in order to provide data for reconstructions of historical climate and in some cases to investigate the impact of climatic changes on society. Medieval economic historians, on the other hand, although well placed to contribute toward the study of disasters in the past have generally ignored disasters as a research question. There are a number of reasons for this. Curtis ascribes the general drift of the historical discipline away from the social sciences as one of the main reasons. A prevailing view is that medieval disasters bear no relevance to modern issues due to the fact that medieval culture, particularly religious thinking, was so far removed from modern beliefs that no useful comparisons are possible. Perhaps most pervasively, natural disasters are still regarded by many as entirely natural occurrences. This is problematic as the historical discipline, as Bruce Campbell has argued, has largely rejected nature and the environment as a ‘protagonist’ emphasising instead the primacy of human actions and decisions in precipitating cultural change.

Archaeology as a discipline is well placed to investigate the human-environment relations between natural hazards and vulnerable societies. Indeed, this was among the ‘grand challenges’ identified as priorities that archaeologists should aim to tackle according to an international gathering of prominent archaeologists in 2012. However, as with economic history, archaeology as a discipline has done little to engage with wider debates in disaster studies, a fact highlighted by some national research frameworks. This is crudely illustrated by a search of the major disaster studies journals (Disasters, Natural Hazards, Journal of Mass Emergencies and Disasters) with the keyword ‘archaeology’. Very few of the research papers returned through this method include anything more than a passing reference to archaeological evidence.

40 Bankoff 2003.
41 Bankoff 2013.
43 E.g. Ogilvie, Farmer 1997; Brázdił et al. 2005.
44 E.g. Behringer 1999; Anderson et al. 2016.
45 Curtis et al. 2016.
The sparsity of interaction between archaeologists and other disciplines working on disasters is certainly not indicative of archaeologists’ avoidance of studying sites and landscapes affected by natural disasters. Indeed, a conference of the Society for Medieval Archaeology held in 2016\textsuperscript{50} sought to explore the contribution that archaeologists can make to the study of disasters for the medieval period.\textsuperscript{51} In most instances where archaeologists have encountered evidence for the occurrence of natural disasters, however, the disaster is not the primary research objective. The relatively rare cases where this has occurred include early work by SHEETS which provided a broad but brief overview of archaeological evidence for the occurrence of natural hazards.\textsuperscript{52} Since then, a number of researchers have produced synthetic and comparative work on archaeology and disasters,\textsuperscript{53} but these have generally been limited in scope and have, necessarily, focussed on either specific periods, geographic regions and/or types of hazard. A number of researchers have examined specific case studies in detail; FERNÁNDEZ et al., for example, examined archaeological evidence for the impact of a high magnitude flood event on a medieval village in Asturias, NW Spain,\textsuperscript{54} while FORLIN and GERRARD conducted investigations into the impact of a devastating landslide in 1522 which buried the town of Vila Franca do Campo on São Miguel in the Azores, Portugal.\textsuperscript{55} Looking at how historic communities responded to the risk posed by hazards, GARDINER and HARTWELL reconstructed the phasing and chronology of medieval and post-medieval flood defences located in English wetland environments.\textsuperscript{56} Turning to the longer-term implications of living with the risk of natural hazards, Stephen RIPPON has made the flood risk inherent to wetland environments a central part of his research into human occupation of these locales\textsuperscript{57} while MENOTTI et al. interpreted the flood risk experienced by Bronze Age lake shore settlements in the central European Alpine region as a motivation for the development of complex ritual practices.\textsuperscript{58} RIEDE has examined the impact of prehistoric volcanic eruptions in Europe and called for further integration of archaeology into the study of past disasters.\textsuperscript{59} The above examples demonstrate that one of SHEETS’ key conclusions over 40 years ago that: “archaeologists are almost completely unaware of the hazard research conducted by social scientists within the

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\textsuperscript{50} Waiting for the End of the World: perceptions of disaster and risk in medieval Europe, held from 2\textsuperscript{nd}–4\textsuperscript{th} of December 2016 at Rewley House, Oxford, United Kingdom.

\textsuperscript{51} Note that this conference has given rise to an edited volume: GERRARD et al. 2020. The contributions contained within present analogous and complementary subject matter to this book and, as such, many of these contributions are referenced throughout the remainder of the text.

\textsuperscript{52} SHEETS 1980.

\textsuperscript{53} E.g. GUTTORMSEN 2008; GERRARD, PETLEY 2013.

\textsuperscript{54} FERNÁNDEZ et al. 2019.

\textsuperscript{55} FORLIN, GERRARD 2017; GERRARD et al. 2021.

\textsuperscript{56} GARDINER, HARTWELL 2006.

\textsuperscript{57} E.g. RIPPON 2000a; 2000b; 2001; 2004.

\textsuperscript{58} MENOTTI et al. 2014.

\textsuperscript{59} RIEDE 2014.
past few decades”\textsuperscript{60} can no longer be said to represent the \textit{status quo}. His other primary conclusion, however, that: “whatever piecemeal knowledge has been generated by archeologists with respect to natural disasters largely has been ignored by hazard researchers”\textsuperscript{61} certainly still holds some truth.

The area in which archaeology has contributed most significantly to the study of disasters, beyond the limits of the discipline itself, is archaeoseismology. Archaeological evidence can be used to estimate the physical characteristics of past seismic hazards which, in turn, can enhance knowledge about the nature of future seismic activity. Conducted overwhelmingly with a natural science rationale, the data obtained from archaeological sites relating to past earthquakes can inform models of contemporary and future seismic risk. The value of this data for evaluating modern-day risk has, however, had an unfortunate blinkering effect meaning that archaeoseismological research rarely engages with the relationship between past societies and the seismic events they investigate. This is a short-coming recognized by archaeoseismologists themselves.\textsuperscript{62} and was the subject of a recent research project at Durham University which sought to redress this situation for the medieval period in Europe through the investigation of a number of key case studies.\textsuperscript{63}

Compared to seismic hazards, meteorological hazards have not seen the same intensity of research. Archaeologists frequently encounter evidence for the occurrence of these type of events on archaeological sites; floods are attested through layers of alluvium or marine sediments, discrete layers of wind-blown sand attest to past storm activity\textsuperscript{64} and even rainstorms occasionally leave an archaeological signature.\textsuperscript{65} Of course, certain hazards, such as windstorms, droughts or lightning strikes are ephemeral and rarely leave lasting impressions in the archaeological record. For those hazards which do leave an identifiable material signature, analogous to the way in which archaeoseismologists have studies seismic hazards, such data has been interrogated to answer practical scientific questions – for example investigating changes in river flood regimes.\textsuperscript{66} Synthetic and comparative research on the impact of these events on contemporary society, however, has been lacking. In the rare cases where archaeologists have considered such events as a primary research topic, the focus is often on archaeological methods and research is usually published in discipline specific journals which may not be read by readers beyond the boundaries of the archaeological discipline.

\textsuperscript{60} Sheets 1980: 25–26.
\textsuperscript{61} Sheets 1980: 26.
\textsuperscript{62} Sintubin 2011: 8.
\textsuperscript{63} The Leverhulme Trust funded project ‘Risk and Resilience: exploring historic responses to earthquakes, 1200–1755’. See also Forlin, Gerrard 2017.
\textsuperscript{64} Brown 2015.
\textsuperscript{65} Hinzen et al. 2013.
\textsuperscript{66} Kiss, Laszlovzsky 2013.
Part of the reason that archaeology has not figured more prominently in interdisciplinary approaches to disaster can be explained by some of the difficulties peculiar to archaeological techniques and sources of evidence. By definition, disasters are short-term occurrences which alter conditions from what is considered ‘normal’ at a given location. In most cases therefore, only a short window of time exists for the deposition and accumulation of an archaeological signature. In the case of some types of hazard, such as volcanic eruptions, landslides, floods and some earthquakes, the deposition of large volumes of ash, sediment or debris in short spaces of time (hours and days) is a common occurrence, providing a recognisable archaeological signature. However, other types of hazard such as windstorms, snowfalls, and droughts rarely leave behind any long-term material evidence. Even in the case of those hazards which are more recognisable archaeologically, later site clearance and the reworking of material can often truncate and erase evidence for the occurrence of earlier hazards.

It is also difficult, and indeed one of the major challenges encountered in the following chapters, to combine archaeological data with data relating to the past from other disciplines. Climatic data obtained from proxies such as tree rings or ice cores usually operate at interannual time-scales while documentary data can, in some instances, be securely dated to a particular calendar date. On the other hand, the chronological resolution applicable to most archaeological data – in the absence of well dated material culture, such as coins, or absolute dating methods, such as tephra- or dendro-chronology – rarely allows individual contexts and artefacts to be precisely dated beyond a date range less than c.100 years. This poses a problem when dealing with specific historical events, such as a natural disaster, as it becomes difficult to convincingly demonstrate that archaeological evidence can securely be connected to a specific, documented disaster. This is exemplified by the documentary evidence which records the burning of the Cistercian Abbey of Strata Florida, Ceredigon, Wales, as the result of a lightning strike in 1284. Although the archaeological evidence corroborates the written description – the solidified molten lead unearthed during excavation is a detail specifically mentioned in the historical source – it is impossible to definitively prove that the melted roofing lead recovered was a product of that particular blaze and not another fire, of which there are a number of possible, historically documented,

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67 Schofield 2009.
68 Cooper, Peros 2010: 1226.
69 Although, of course, historical documentary data brings with it its own set of chronological issues relating to calendrical systems and source reliability, a topic discussed fully by Brázdil et al. 2005.
70 This is exemplified by the high-energy deposit discussed in Chapter 3.3.1 in relation to the storm of 1362.
71 Galadini et al. 2006: 408.
72 Christie 1887: 115–117.
1.3 Approaching the study of disasters in the past

These chronological issues may explain to some degree why medieval archaeology has particularly engaged with disasters in Norse Iceland. Here tephra layers from volcanic eruptions provide precisely dated reference points which can be used to anchor archaeological layers in time. This allows analysis of the material changes that took place in the aftermath of a particular eruption, with chronological evidence of their association to the hazard. This research is often conducted by, or in association with, volcanologists with primarily scientific aims but a number of studies have explicitly focussed on the social impacts and consequences of these disasters.⁷⁵

Another challenge in approaching the study of disaster from an archaeological perspective lies in the controversy that surrounds the impact of exogenous natural forces on human societies. As with the traditional historical viewpoint, discussed above, archaeologists are also wary of straying too far into the realms of environmental determinism. When researchers have proposed a link between environmental factors and cultural change, they invariably attract criticism – a fact which has likely impeded research into human environment relations within the discipline.⁷⁶ The recent periodisation of geological time based, to some extent, on the impact of disasters on human societies,⁷⁷ for example, provoked criticism for misinterpreting the evidence and ascribing cultural changes to climatic factors when other plausible explanations are available.⁷⁸ In an example from medieval archaeology, within which the impact of environmental fluctuations on society has not traditionally been a major research theme, the desertions at the medieval villages of Barton Blount, Derbyshire, and the village identified as Goltho, Lincolnshire, were interpreted as largely a result of the impact of the declining climate brought about by the onset of the Little Ice Age. The excavator, Guy Beresford argued that, under the deteriorating climatic conditions, the clay soils would have become unworkable for long periods – making continued occupation at the sites untenable.⁷⁹ Swift rebuttals followed, dismissing Beresford’s interpretation as simplistic environmental determinism, pointing to the continuity of settlement at neighbouring village sites as evidence that “raindrops [are not] locally selective”.⁸⁰ In addition, further detractors invoked the post-Black Death economic and demographic situation as a more plausible explanation for abandonment.⁸¹

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⁷⁴ Williams 1889: 154.
⁷⁶ Rippon et al. 2014: 236.
⁷⁷ Namely the proclamation of the Meghalayan Age based on an extreme drought which occurred c.4200 years BP and is interpreted as having significant implications for societies throughout the Near East, the Indian subcontinent and China.
⁷⁸ Middleton 2018.
⁷⁹ Beresford 1975: 51-52.
⁸¹ Wright 1976.
Beresford’s original counter argument was that differential abandonment between nearby villages might be explained by relatively minimal differences in local soil composition⁸² and, indeed, soil chemistry and geology are now being recognized as major determining factors in the development of medieval villages.⁸³ Furthermore, 40 years after the publication of Beresford’s interpretation of the deserted medieval village sites at Barton Blount and Goltho, similar conclusions were drawn regarding the desertion of the medieval settlement at Cedars Park, Stowmarket, Suffolk. At this site it is suggested that increased wetness during the climatic decline of the 14th century provoked the cutting of increasingly large enclosure ditches to drain surface water while cobbled surfaces may also have been a response to the difficulties of traversing wet clay. Such conditions, it is argued, would have made the surrounding clay soils difficult to work. ‘Puddling’ on clay soils requires time to dry out before the soil can be worked so increased wet weather could have, therefore, reduced the number of days when soils could be worked below a viable threshold making abandonment a favourable option.⁸⁴

Comparably, Platt has made the case that the sudden appearance of homesteads equipped with moats in medieval England, during the early 14th century, relates to the climatic decline known as the ‘Dantean Anomaly’ (c.1315–c.1322).⁸⁵ This climatic aberration was marked by unprecedented rains throughout 1315⁸⁶ leading to a severe famine which was swiftly followed by a cattle panzootic in the 1320s. Platt, therefore, argues that these environmental fluctuations created conditions – dearth and hunger – among the populace that drove those with something to protect to dig moats around their homesteads for security.

Of course, in all of these examples, economic and social considerations are just as paramount as climatic and environmental factors. Although modern scientific climatic reconstructions call into question received wisdom surrounding the role of climate in facilitating and constraining human activity⁸⁷ it remains controversial to equate developments in human affairs with changes in nature and environment. The above examples not excluded, all other potential avenues should be fully explored before climatic and environmental factors can be considered as plausible drivers of cultural change. Where many in the past have entirely eschewed ascribing any impact to these forces, however, the potential impacts of changes in the natural environment on contemporary populations is becoming increasingly clear.

As we will see, there are many cases in which medieval populations chose not to relocate in the aftermath of severe disasters and continued to occupy locations which

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⁸² Beresford 1981: 36.
⁸³ Williamson et al. 2013: 79–80; Rippon et al. 2014: 200–201
⁸⁴ Woolhouse 2016: 122.
⁸⁵ So called due to the fact that its abatement more or less coincided with the death of the Italian poet Dante Alighieri. See Platt 2010; 2012.
⁸⁷ See for example Campbell 2016b.
had been drastically altered by natural hazards. Even when extreme natural forces were unleashed, therefore, many choices remained undetermined allowing human populations considerable leeway in which to choose how to respond. Consciously or unconsciously, no doubt, the cost/benefit calculations which medieval populations entered into in these situations factored in not only economic and social considerations – such as the costs of setting up anew compared to resettling the original place of habitation, dependencies to local lords and the proximity of family members and friends – but also intangible factors encompassing ideas of 'place' and familial ties to the land. The various pathways open to medieval populations in the aftermath of fluctuations in the environment and climate, therefore, were constrained by both the realities of the physical changes in the environment as well as economic and social considerations. From two sides, therefore, these two categories of factors affected what decisions people made and how they chose to react. While environmental forces never 'determined' what people did, abrupt changes, to a greater or lesser extent, did influence decisions and what options were viable.

1.4 The contribution of archaeology to the study of disasters

Despite the difficulties in approaching disasters from an archaeological perspective, archaeologists can make a valuable contribution to the study of disasters. Perhaps the most obvious point is that archaeology can extend our knowledge of disasters far back in time. In most parts of the world, reliable scientific data relating to hazards is rarely available before the 19th century. As a result, hazards with a long return period often sit beyond the period covered by instrumental records. In these cases, information on the causes, magnitude and effects of such hazards must be collected through alternative means – including historical sources and investigations of the archaeological and geological records. A good example are high magnitude earthquakes in the Himalaya. By correlating extant historical records with geological evidence and radiocarbon dates derived from trenching, together with standing building evidence – in this case medieval temples – seismic activity in the region can be investigated over longer time periods than those covered by instrumental records. This permits both the identification of undocumented seismic events and the characterization of modern day risk if similar events were to recur in the present day.

Another important area which can benefit from an archaeological contribution is the provision of precise information concerning the impact of a rapid-onset hazard. While historical sources often provide descriptions of the occurrence of hazards, these sources are usually low in detail and cannot always be taken at face value – often

89 Rajendran et al. 2013.
dates and details were misreported or elaborated\textsuperscript{90} while the coverage of documentary
evidence, at least for medieval Europe, is biased towards the literate and land-owning
classes. In rare cases, where high magnitude rapid-onset hazards such as floods, land-
slides, earthquakes or volcanoes cause the destruction of a settlement or structure,
this can promote the long-term preservation of in-situ remains. This, in turn, preserves
a record of the final abandonment and destruction of the site by the hazard and, per-
haps, the last-minute responses of the affected population. While a number of high
profile sites of this category, mostly from the Classical world, are known such as the
Roman settlements of Pompeii and Herculaneum and the Minoan town of Akrotiri on
the Greek island of Santorini, medieval case studies are also known. One of the most
fully investigated is the case of the castle of Saranda Kolones, Paphos, Cyprus, where,
during the 1222 earthquake, as the structure collapsed, most of the inhabitants appear
to have made a hasty escape leaving behind objects of value as they fled.\textsuperscript{91} Remains of
one unfortunate individual who perished after escaping down a latrine shaft only to
find his only exit blocked indicate at least one human casualty,\textsuperscript{92} with faunal remains
crushed beneath fallen masonry attesting to further losses.\textsuperscript{93} In the aftermath of the
earthquake the archaeological evidence suggests salvage attempts either to recover the
bodies of casualties or to claim and reuse the fallen masonry for the repair of the town
of Paphos, which had also suffered severe damage during the earthquake.\textsuperscript{94} Evidence
from a nearby cave may indicate the presence of refugees made homeless following the
earthquake while newly built structures suggest attempts to remedy this situation by
constructing new housing in the earthquake’s aftermath.\textsuperscript{95} Such an example demon-
strates the rich level of detail that archaeological data can lend to an event which,
although documented by contemporary sources to some degree – the earthquake itself
was recorded but little mention was made of the castle – would be otherwise unknown.

The demographic and economic impacts of hazards can also be investigated
through archaeological evidence. While medieval chroniclers often record the number
of fatalities lost to specific natural hazards – 50,000,\textsuperscript{96} for example, were reported to
have been lost in a 13\textsuperscript{th} century flood in the Netherlands\textsuperscript{97} – these cannot be trusted at
face value. Although as above, archaeological evidence can confirm the presence of

\begin{footnotes}
\item[92] Rosser 1986: 47.
\item[93] Megaw 1957: 49.
\item[95] Rosser 1985: 94.
\item[96] This number is certainly an exaggeration as it seems doubtful the chronicler would have had access
to any accurate figures if these were even produced. High figures such as these were merely used by
medieval writers to illustrate that a very high number had died. Ziegler 1969: 51–53.
\item[97] Pertz 1861: 215.
\end{footnotes}
fatalities,\footnote{The absence of fatalities from an archaeological site affected by a disaster may not automatically contradict historical sources stating that high casualties occurred as, where possible, bodies might be removed in the aftermath of an event in order to carry out proper burial rites.} it is impossible to quantify exact numbers in any given event. Over a longer timespan, however, demographic decline can be inferred through material remains. Systematic test-pitting in eastern England, for example, provides material evidence for the acute decline which followed the Black Death allowing an estimate of the percentage of demographic change in the locales studied.\footnote{\textsc{Lewis} 2016.} This approach could theoretically be applied to landscapes or settlements affected by wide-area hazards, such as tephra falls, landslides or aeolian sand inundations, in order to gauge what, if any, impact these hazards had on demography and economic activity over the medium-long term.

The occurrence of a hazard itself is also only one aspect of the impact of a disaster which may be investigated archaeologically. In the case of extreme events, sites may be entombed and preserved in-situ by the action of the hazard itself. In other cases, the occurrence of a disaster may lead to later site abandonment or a period of reduced activity. In the case of a protracted abandonment at some point after the occurrence of a hazard, it would be difficult to demonstrate the causation behind the abandonment with certainty. However, abandonment in advance of or in the immediate aftermath of the occurrence of a hazard may leave a distinctive archaeological signature. In the case of ‘normal’ site formation, an assemblage comprising a limited number of old, low-value, damaged or cumbersome objects would be expected with more valuable or useful items being removed during the abandonment phase. When a site is abandoned for ‘catastrophic’ reasons, however, fewer items are likely to be removed, with a greater incidence of valuable, personal and functional objects. As a result, the nature of the assemblage should be easily distinguishable from a ‘normal’ site.\footnote{\textsc{Young} 2020: 275.} An example comes from the medieval farmstead at Eckweek, Somerset, which appears to have been abandoned rapidly in the mid-late 14\textsuperscript{th} century.\footnote{\textsc{Young} 2020: 260–267.} The factors behind the abandonment of this particular site are unknown although plague (most likely the 1348–52 or the 1361–62 outbreaks), including its indirect effect on the mobility of workers, is considered a possible contender.\footnote{\textsc{Young} 2020: 298–299.}

Archaeological evidence can also provide valuable insights into internal processes within societies before, during and after disasters. In some cases, for example, archaeological evidence may allow something of the role of authorities in the post-disaster rebuilding stage to be inferred. Where it is possible to compare the layout of structures...
before and after the occurrence of a disaster, for example, the alignment of structures may attest to whether rebuilding was planned centrally or if individuals were left to make repairs of their own volition. The latter is demonstrated in the aftermath of conflagrations in medieval Bergen by the permanence of property boundaries, suggesting individual property, and thus the responsibility to repair the damage, were unaffected by the repeated fires which razed the town to the ground.\footnote{Hansen 2015.} Archaeological evidence can also illuminate disasters’ positive and negative economic impacts. As an example, archaeological excavations at Vila Franca do Campo, São Miguel, Azores, reveal that, following the landslide of 1522 in the relatively newly settled Portuguese Azores, the destruction caused by the landslide, rather than tipping the population into total poverty, invigorated the local economy by forcing the surviving population to produce their own roof tiles, where previously they had relied entirely on imports from the Portuguese mainland.\footnote{Forlin, Gerrard 2017: 104.} Clearly, the landslide disrupted the established economic order but it may have, in fact, had some positive economic repercussions.

The archaeological record can also provide evidence for ritual activities which may have been stimulated by the occurrence of natural hazards. Although ritual and belief are notoriously difficult to infer through material remains alone, a number of practices can be connected to beliefs surrounding disasters. For example, one interpretation of burnt marks in churches and vernacular architecture, which seem to have been deliberately created, is that they were believed to bestow protection on the structure from lightning.\footnote{Lloyd et al. 2001.} Similarly, the distribution of \textit{ampullae}, vessels obtained through pilgrimage containing dust, holy water or oil blessed at the shrine of a saint, in agricultural fields across medieval England has been interpreted as evidence for belief in saintly protection against extreme natural events such as hail and drought.\footnote{Anderson 2010.} This type of evidence can be profitably combined with the historical record which, for medieval Europe, is rife with descriptions of processions, prayers and ritual acts which were believed to provide communal or personal protection against natural hazards.\footnote{Hanska 2002.}

As this section has outlined, archaeology has much to ‘bring to the table’ but a holistic understanding of disasters is only possible through the integration of strands of evidence from a wide variety of disciplines. What follows, therefore, while attempting to capitalise on the opportunities provided by the archaeological record, integrates research from other disciplines in order to investigate how disasters affected populations in medieval Britain in as much detail as possible.