



# Lessons from the past, policies for the future: resilience and sustainability in past crises

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## Abstract

This article surveys some examples of the ways past societies have responded to environmental stressors such as famine, war, and pandemic. We show that people in the past did think about system recovery, but only on a sectoral scale. They did perceive challenges and respond appropriately, but within cultural constraints and resource limitations. Risk mitigation was generally limited in scope, localized, and again determined by cultural logic that may not necessarily have been aware of more than symptoms, rather than actual causes. We also show that risk-managing and risk-mitigating arrangements often favored the vested interests of elites rather than the population more widely, an issue policy makers today still face.

**Keywords** Plague · Pandemic · Environmental stress · Existential risk · Risk mitigation · Resilience · Government responses · Complex historical societies · Inequality · System recovery

## 1 Introduction

Effective risk management and assessment require knowledge of past events to generate comparative risk scenarios. Yet understanding the impacts of environmental stress on historical societies is an underdeveloped and fragmented field of study, with substantial disagreement among specialists. As a result, we cannot say with precision what constitutes an existential risk to a given historical society, i.e., a risk that could trigger the collapse of a political or cultural system. Past human societies as a whole have been extraordinarily resilient in the face of severe challenges, but the configuration of social and political structures was always impacted in a number of ways, with substantial implications for development pathways (e.g., the different medium-term outcomes of the Black Death in England and

France) (Borsch 2005, pp. 55–66; Herlihy 1997). Historical case studies, therefore, can offer valuable guidance on present day issues in designing risk management strategies and sustainable policies (Haldon and Rosen 2018; Rosen 2007). Detailed research into what, if any, role environmental challenges have played in the transformation of previous societies, including in conflict, migration, critical systems failure, and politics, is an essential requirement, along with grounded inquiry into socio-economic feedback loops.

The study of complex historical societies can reveal how such challenges worked to transform structural relationships and daily life. But it can also tell us about what happened when the dust settled and how both leaders and governments and the members of society more broadly re-evaluated their situations. There are several key questions that historical case studies reveal. *Did people in the more distant past think about system recovery?* We show that this depends significantly on system structure and capacity, nuanced and constrained by ideological assumptions. Contemporaries perceived the scope of recovery within a state as a goal, but were focused on their own institutions, while considering recovery at a global scale was rare and conceptualized and promoted generally within the purview of religion. *Were people aware and did they respond, negatively or positively, to changes in their (perceived) social situation, impacts on the economy and finance, on beliefs and attitudes?* The answers reflect different historically specific understandings

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of a situation, both the type of society as well as their social status. Moreover, in the pre-modern/pre-scientific world, moral and religious responses were as important as practical responses. *Did rulers and elites, or farmers and producers, implement policies that would mitigate risk and absorb future shocks?* We suggest how some past societies, ranging from the later Roman period down to the early modern world, responded, consciously or less so, to transformative and unpredictable environmental pressures. One common thread of these historical examples is a tendency of system recoveries to focus on elite-level actors, rather than all levels of society that were more numerous. However, as some of these cases demonstrate, a more just and equitable resiliency can lead to longer-term stability for the state and its institutions.

How societies in the past responded to stress depends on three key sets of conditions: their complexity (the degree of interdependency across social relationships and structures), their institutional and ideological flexibility, and their systemic redundancy, all of which together determine the resilience of the system. These three conditions do not exist in isolation, but combine and recombine in innumerable historical configurations. Historians must reduce this to ideal-typical models, since it is practically impossible to analyze them all. Moreover, we must research particular historical case studies to illustrate these general patterns and to show how each case is subtly different from the next.

‘Resilience’ is invoked in different ways within different disciplines. In historical research, it has largely played a role in work on collapse and adaptation, where societies are understood as complex adaptive systems and in which ecological models have been influential. Since the basic structural dynamics of a societal system contribute to the types of collapse to which it may be subject, approaches to collapse, and resilience that unites structure and process are the best way forward in applying historical examples to contemporary planning initiatives with respect to environmental problems. This is a helpful approach, especially when allowances are made for individual human agency and belief systems (Cumming and Petersen 2017; Haldon 2020, building on ecological theory and formal resilience theory; also Anderies 2006; Berkes and Ross 2016; Gunderson and Holling 2002).

Resilience and the potential for a society to maintain cohesion and cultural continuity through periods of system-challenging stress has costs. The question of how to distribute the costs of resilience, and the degree to which this might be built into any system, varies across time and cultural milieu. In the following, we examine several cases in past societies where we can observe (1) both top-down and bottom-up responses to significant environmental challenges, how different sectors of society responded or reacted, and where we can detect positive as well as negative outcomes;

(2) the differential costs of resilience when states are faced with substantial economic and political challenges; and (3) state- and society-level responses to pandemics and both planned and unintended consequences.

## 2 Pandemics: responses, resilience, and consequences

### 2.1 The justinianic plague

By the year 500, the Western Roman Empire had disappeared as a cohesive political state across Western Europe, but the Eastern Roman Empire simultaneously flourished. The Western half had divided into successor “barbarian” kingdoms, while the Eastern Roman Empire was centered around the Balkans, Anatolia (mod. Turkey), and the Middle East. One of its main initiatives, the re-conquest of formerly Roman regions in the west, such as North Africa and Italy, had begun well—with quick and cheap conquests. At the height of this re-conquest in the early 540 s, the Justinianic Plague erupted across the Mediterranean world and Europe. The Justinianic Plague was a pandemic of the bacterium *Yersinia pestis* that remained active for over two centuries, c. 541–750 C.E. Its impact on the Eurasian population has been suggested as significant (i.e., causing the deaths of tens of millions), while its effects on human behavior from economics to culture and religion have also been described as pivotal (Meier 2016; Harper 2017; Sarris 2006). Some have described it as the watershed moment separating a flourishing Ancient World from the darker Medieval World. While this master narrative is deeply problematic and has been challenged in recent years, individual outbreaks—the local impact of the plague during that two-century framework—have been entirely ignored (Mordechai and Eisenberg 2019; Mordechai et al. 2019). The problematic ‘catastrophe’ narrative is simply copied and pasted across all of its outbreaks (Sarris 2002, 2011).

Yet if we examine particular outbreaks, even the destructive demographic narrative demonstrates the ability of the Eastern Roman state to react both immediately to the increased numbers of deaths, maintain vital administrative efforts, and continue its long-term political goals. The contemporary writers Procopius of Caesarea and John of Ephesus recorded intricate details about the first outbreak in the city of Constantinople in 542 C.E. The number of deaths was significant, especially given the city’s urban density, but hard numbers or even percentages are completely uncertain. Procopius wrote that the outbreak lasted for three particularly virulent months and claimed that 5000 and then 10,000 people died per day. Using these numbers, the number of deaths would have reached 675,000 by the end of the three months, while the population of Constantinople was perhaps

around 500,000, so these numbers are impossible (Procopius, *Wars* 1914, II. xxii–xxxiii). John of Ephesus included even higher numbers, up to 16,000 deaths per day (John of Ephesus). Some modern scholars have suggested that 20% of the city's population died and more recently that 50% died, although these percentages are conjectures based on dubious assumptions (Bratton 1981; Stathakopoulos 2004; Harper 2017). Recent attempts to use epidemiological modeling could not resolve this problematic question (White and Mordechai 2020).

While sixth century Romans would not have understood modern epidemiology, there are examples of self-isolation to stop the spread of plague. Procopius recounts that many people who had the economic means locked themselves into their houses as a way to avoid infection. Sometimes this attempt backfired, since entire houses would perish from plague and the dead would remain unburied for days (Procopius, *Wars* 1914, II. xxii–xxxiii). During later outbreaks of plague in Constantinople, elites, including the emperor himself, fled to nearby urban centers, while in other cases an entire city fled the arrival of the plague, decamping into the mountains (Theophanes Confessor, *Chronographia*, AM 6053; Paul the Deacon, *History of the Lombards* 1878, 4.14). In total, Romans understood that the plague was an unexpected new phenomenon and adapted accordingly by trying to mitigate its spread. These lessons of how to prevent the spread of plague also suggest that people around the Mediterranean world not only tolerated disruptions to their socio-economic activity, but even embraced them in some cases—preferring flight over simple isolation. Despite the limited information at their disposal, communities and individuals attempted to weather the storm using whatever means were at their disposal.

As twentieth century disease outbreaks suggest, even a much smaller percentage increase in deaths per day can quickly overwhelm the existing capacity of a modern state to bury its dead (Crosby 2003; Kilgannon 2020). The imperial administration and the emperor Justinian (r. 527–565), who took a personal hand in directing the response, recognized the overwhelming burial problem and responded quickly by appointing an administrator named Theodorus to solve it. Theodorus received money to hire people to help bury the poorer members of society, whose families could not afford or arrange for their burial. Initially, they were placed in existing cemeteries, but as these filled up, Theodorus' task force dug new larger trenches and pits to place the large numbers of bodies, a scene reminiscent of current day burials. Theodorus, and by extension the state itself, could clearly adapt to different burial requirements both culturally and logistically as the situation required it. Unlike in many cases today, the various political factions stopped their fighting and helped provide the manpower for Theodorus to meet his grim new task (Procopius). Despite the significant

mortality, these burial measures resolved the most pressing issue for Constantinople: removing dead bodies to ensure other infections did not spread.

The pandemic appears to have reached the rest of the Mediterranean from Egypt, where it arrived perhaps via the Red Sea and the Indian Ocean trade from Central Asia. From Egypt, it reached Constantinople through the regular grain shipments the city required to sustain its population. Other port cities around the eastern Mediterranean were struck soon afterwards (Procopius). In the first few years after the outbreak in 542, the grain shipments from Egypt appear to have been reduced due to some combination of a smaller population that required less food and the disruption of trade routes due to the pandemic. Yet within five years the grain shipments had returned to their original quantity demonstrating that the state had bounced back and was able to provide resources as it had before the outbreak (Zuckerman 2004).

In both of these short-term solutions, the state was remarkably flexible in its approaches to quickly meet an entirely new problem with limited resources at hand. Most of the Eastern Roman budget was used to pay the army, with a smaller amount for the salaries of administrators (Hendy 1985, 157ff.). The Roman government was able to quickly shift resources, establish an entirely new ad hoc administrative section, and ensure the continued flow of food to Constantinople to prevent large-scale famine despite a significant epidemic outbreak.

The short-term flexibility depended on systemic capabilities developed and maintained over centuries, which had long incorporated significant fluctuations to the supply of goods (Rickman 1980). For instance, procurement of grain in Egypt was likely a highly planned and regulated practice that had been operating for almost six centuries. Both the government in Constantinople and local officials in Egypt prioritized grain procurement as a core systemic function. The grain shipments had significant built-in redundancies that would guarantee that enough grain reached Constantinople despite unexpected (but known and relatively common) dangers such as shipwrecks, spoiled food, and unfavorable sailing weather slowing shipments. Administrators often had significant experience in their positions adapting to these known problems and likely passed much of this to their replacements. This approach allowed the system to mitigate disruptions such as the outbreak of plague. However, major political disruptions such as the conquest of Egypt by the Persians several decades later had a far more significant result—the abrupt ending of all shipments from Egypt—which forced the government to scramble to search for new grain-supplying regions (Haldon 2016).

Despite the immediate disruption of plague, the Eastern Roman state was able to continue its existing military, political, and administrative goals. Justinian's re-conquest of Italy proceeded in slow, halting steps and was completed within

a little over a decade; Italy was then integrated back into the Eastern Roman state (Heather 2018). In the East, the status quo in the conflict with the Persian Empire was largely maintained and the Roman state continued spending vast sums on the military for the next half century. Taxes and resources continued to flow freely to the state with no evidence of plague-related problems (Sarris 2006).

Part of this was due, in all probability, to the redundancies built into the imperial system itself as in the case of the grain supply noted above. The late Roman system was, by modern standards, inefficient and did not prioritize the market gains at every level or create massive, intricate supply lines. Instead, it prioritized flexibility in using governmental resources, while assuming most needs would be met locally, a system that also generated duplication of activity in various administrative departments both centrally and in the provinces. Within these constraints, and in part as a direct result of them, the Roman state appears to have had little trouble returning to its baseline requirements even amidst the most significant epidemic to yet strike the known world.

It is impossible to discern what the immediate demographic (let alone cultural, economic, and social) impact of this plague outbreak was. What is clear, however, is that the state weathered the storm through short-term efforts to protect the population of Constantinople, while the populace itself created their own measures to prevent the spread of plague. While commerce and food supplies might have been stressed during the immediate outbreak, contemporary historians do not report on food shortages; regardless, both of these returned to their pre-outbreak levels within just a few years. The outbreak did not change long-term political goals, the state's ability to fight wars, or raise taxes, and move resources around, and unlike other examples in this paper, there was no discernible change in power structures and elite–lower class labor relations. In fact, the plague outbreak seems not to have catalyzed any significant changes in the way the East Roman state was managed. Its demographic impact may have produced short-term shock waves across Constantinople (and probably other parts of the empire about which we are less well-informed), but it hardly transformed the shape of the world or even the empire.

## 2.2 The Black Death: one cause, many outcomes

A much better-known case of plague is the notorious Black Death of 1346–1352, the second of the three pandemics of *Yersinia pestis* that have impacted the world since the late ancient period (the third was a global pandemic from c. 1855–1950). Claims of mortality rates of as much as 50% give the impression that this event must have been devastating for the societies affected. Yet when we examine how different states and societies responded, we find that—without minimizing the terrible impact on people and

communities—the medieval world did not grind to a halt, still less did a series of revolutionary transformations occur. Indeed, the Black Death struck at the beginning of the Hundred Years' War, and in spite of its demographic impact both the kingdoms of England and France continued to field effective armies, even if there was a brief pause in hostilities (similar to contemporary calls for ceasefires in ongoing international conflicts in the context of COVID-19). Instead, some societal developments that were already under way accelerated while various groups within society responded by exploiting their situation and attempting to slow down, stop or otherwise control changes which they perceived as disadvantageous.

The arrival of the Black Death in 1348 is sometimes associated with the eventual breakdown of 'feudalism' and the rise of capitalism, as the plague's high mortality and consequent shortage of labor was supposed to have dramatically changed the way the labor market was structured. In short, it is said to have challenged existing landlord-tenant relationships and the whole basis of serfdom (the legal binding of peasants to the lands of elites). Yet in England serfdom was already declining by the time of the Black Death (Hilton 1985, pp. 55–58; Campbell 2005). Moreover, landlords can respond to labor shortages in various ways—in eastern Europe, for example, they increasingly tied labor to the land and imposed a more oppressive serfdom on the peasantry. From the later twelfth century on, reflecting elite demand in respect of consumption and increased expenditures, and backed by royal legislation, landlords in England demanded heavier labor services, reducing peasant holdings and thus the ability of the serfs to do anything more than maintain a bare subsistence.

This last tendency was intensified, again with the backing of the state, in further repression of peasants' rights and freedoms following the demographic collapse caused by the pandemic. Yet a trend toward labor shortages and demographic changes had set in well before this, following the so-called Great Famine (1315–1317). In this context, the Black Death was less a prime cause than a further exacerbating and intensifying factor (Britnell 2004, pp. 368–387; Cohn 2007; Whittle 2007; Postan 1973; Hilton 1973/2003, 1975). The Black Death and the accompanying increased pace of demographic contraction did not in themselves, therefore, lead either to the end or to an intensification of servile relationships. Rather, a number of regionally nuanced factors played a role, among which one of the most important was the degree of class difference. As wealthier peasants resisted labor services, the poorer members of their communities could be employed—and exploited—as wage earners. Indeed, one answer to the lords' demands for greater cash liquidity was the leasing of their estate land to wealthier peasant tenants. Where this occurred the demand for wage-labor among the lessees of lords' estate lands rose, thus



stimulating a clearer rural social hierarchy (Britnell 2004, pp. 429–450, esp. 432–433). The internal social structure of peasant communities was the key determining element.

The contours of rural and urban society in England shifted considerably between the later twelfth and later fifteenth centuries, but no single factor was the cause. A reassessment of the Black Death reveals that its diverse indirect consequences were perhaps more important than the immediate, felt and visible impacts as reported by eyewitnesses, that tend to draw our attention. As such, the Black Death played an important role in accelerating existing trends, pushing some—but over several decades—beyond a threshold that then led to substantial change. When thinking about similar moments in the past or the present, it is the impact on the underlying structures of social and economic organization to which we need to pay attention.

### 3 The costs of resilience: balancing vested interests

#### 3.1 The Ottoman case: the limits of resilience

Government intervention to address problems perceived from the center often fail to adequately take into account the range and complexity of causes underlying the issue addressed in state action. The Ottoman Empire from the late sixteenth to early seventeenth centuries CE provides a good illustration of the limits to resilience in a pre-industrial society. Beginning from a small emirate in northwest Anatolia ca. 1300 CE, Ottoman rulers had by the 1550s expanded their territory to three continents covering 30 present day countries and built an empire that drew on administratively and geographically diverse sources of income. A key factor in the empire's resilience was thus its size. It developed systems to mobilize crucial resources from distant locations to provision its cities and military and to balance regional surpluses and deficits, including food, labor, timber, and strategic materials (e.g., gunpowder). The security provided by Ottoman soldiers as well as legal and tax provisions encouraged the expansion of agriculture and the containment of mobile pastoralism. The empire seemed resilient to socio-environmental stress: when tested by a series of local droughts, shortages and famines during the 1560s–1580s, Ottoman officials were able to contain the damage by shifting tax burdens from the affected areas, ordering fixed-price sales of grain from other provinces, and in some cases arranging direct shipments from local or imperial granaries (White 2011; Mikhail 2011; Agoston 2004).

The Ottoman system of resource management could recover from small impacts, but multiple, continuous or repeated shocks pushed it towards breakdown, a situation that underlies the scale of crisis in the empire during the

1590s–1600 s. This was a period of major crisis triggered by environmental and human stressors followed by a protracted and intermittent recovery, in terms of population, agricultural production, political stability and military power. Extended drought in central Anatolia in 1591–1596 severely curtailed food output causing prices to double. Near-famine conditions developed in some regions. This coincided with a series of extraordinarily cold winters, a combination that caused a major epizootic outbreak affecting sheep and cattle across Anatolia, the Crimea, and the Balkans, eventually reaching Hungary and Central Europe. This massive death of livestock deprived rural producers of a major source of wealth and subsistence, and deprived Ottoman armies of a key source of protein (White 2017 with detail and sources).

This was not, however, the only set of stress factors the empire faced, since it was at this time deeply enmeshed in the so-called Long War (1593–1607) with the Habsburg Empire. Therefore, instead of reducing taxation or providing relief supplies—the usual state response to droughts and famines—the state had to increase requisitions from the Balkan and Anatolian provinces that were the worst hit by escalating shortages and famines. This led to a major rural uprising, the so-called Celâli Rebellion (1596–1610) (White 2011). The combination of famine, violence, population displacement and disease generated a significant mortality crisis in parts of the empire—tax records from the 1620s–1640s suggest up to 50% mortality in many parts of Anatolia after the 1580s (Özel 2004, 2016)—all of which produced a situation that induced a long-term shift in Ottoman population and land use (Özel 2016; White 2011 and sources therein; Oçakoğlu et al. 2016).

The history of the late 1500s–early 1600s is a good illustration of how political complexity could constrain resilience in a situation where a combination of factors amplified the negative consequences of state activities, in this case a focus on revenue, provisioning, and military mobilization at the expense of diversification and risk reduction in during environmental stress. Lack of agricultural diversification in semi-arid regions, dependence on provinces near the imperial capital for extraordinary taxes and requisitions, lack of spare capacity in dealing with both simultaneous military and infrastructural emergencies, all stressed the system to capacity. These factors combined with difficulties of supplying and pacifying inland regions, poor overland communications and the interaction of famine, flight, insecurity, and disease. Together with inadequate public health systems that might mitigate epidemic disease impacts, the result was a severe and sustained population loss leading to an unstable balance between village agriculture and mobile pastoralism—and ultimately a fracturing of state management and control over provincial economies.

While the imperial system as a whole held together, the cost of the vulnerabilities inherent in the Ottoman system

were borne disproportionately by the least privileged social groups. Just as in a markedly different context with the Eastern Roman Empire (the case discussed below), this potentially undermined the resilience of the entire socio-economic and political system, since these groups formed the backbone of pre-modern economies. While these groups possessed a remarkable degree of resilience within the limits imposed by environmental and political conditions, when both acute social and environmental problems combined they could neither sustain their own livelihoods nor shoulder the burdens of imperial economies and ecologies.

### 3.2 Who pays for the survival of an empire?

The role of elites and particular groups in social classes are central to the resilience of ‘states’ themselves. Historically ‘states’ have tended to be dominated—managed and administered—by members of a power-elite drawn from a socially privileged sector of society. Members of such groups are generally concerned as much with their own interests as they are with those of the state or ruler they serve, although some pre-modern states have been able to maintain, for a while, an establishment entirely divorced from the vested interests of their society.

The Eastern Roman Empire was undoubtedly one of the most sophisticated states in western Eurasia, with a complex and effective fiscal and administrative structure that maximized resource extraction and maintained a balance of power between the state, elites and provincial society. By the early tenth century, after two centuries of rebuilding following the shock of the early Islamic conquests, it was entering a period of expansion in both the Balkans and the Middle East. In parallel, there had evolved a social elite of office holders and landowners who gradually achieved a near monopoly on the senior and middling posts in the military and civil administration. It was their task to implement government policy in the provinces, but their increasing wealth and status meant that by the tenth century they were also a potential source of opposition to the central government. The tension between these two aspects of the East Roman state revealed itself in the efforts of the elite to expand its wealth in land, generally at the expense of village communities who were a key element in the state’s finances and provided the core of the provincial armies, thus jeopardizing the effectiveness of the central state administration itself.

It should be noted that this is a structural problem common to all pre-modern/pre-capitalist systems: states must rely on elites to maintain themselves, yet those elites, whatever their origins, also develop vested interests that compromise or jeopardize those of the state. The ways this relationship has worked itself out historically varied enormously. The problem remains today, of course, although ‘elites’ are generally both more complexly structured and sectorized (national, international

and multinational), and state autonomy—and thus state economies—compromised by global economic factors: the interests of international finance and investment capital rarely overlap neatly with those of nation states, as variations in the markets, particularly during moments of global crisis, daily illustrate.

In the 920s a series of natural disasters disastrously impacted the agriculture of the western Anatolian provinces, giving the wealthy or powerful opportunities to absorb further properties into their estates (Kaplan 1992; Svoronos 1994; McGeer 2000; Morris 1976). In 927–928 CE there occurred a particularly severe winter in the Balkans and Anatolia, combined with a series of extremely poor reduced harvests. The result was later remembered (just as was the similarly disastrous famine that preceded the Black Death in Europe) as the ‘great famine’. In their description of the resulting social crisis, legal sources distinguish between the ‘powerful’ (military and civil officials paid in gold coin by the central government and possessing liquid assets) and the ‘weak’ (peasant farmers and laborers whose livelihood and ability to pay their taxes depended on their harvest). The latter were forced into selling their land for food or money to survive. It is not surprising, therefore, that a subsistence crisis provided those with the necessary resources an opportunity to exchange liquid assets for large tracts of land.

To protect its own interests the state had to intervene through legislation that attempted to stop this increased inequality. However, the legislation the state promulgated to try to deal with the issue ultimately had only short-term success, chiefly because the people it depended on to implement these laws were themselves the people against whom the legislation was directed. Instead, the government was eventually forced to adopt the tactics of the elite, converting public land into imperial estates in order to secure the income derived from them.

The great famine of 927–928 did not create social change but did accelerate it. Its impact was twofold. It presented the better-off with an opportunity to exploit peasants whose livelihood had been destabilized by the severity of the winter. The state reacted by guaranteeing its survival by effectively seizing control itself of the private land of the free peasantry, who thus found themselves reduced to dependency either by the state that should have protected them or by those who sought to dispossess them. In the state’s attempt to restrain its own elites, it destroyed the fortunes of the more vulnerable members of society.

## 4 Complexity and flexibility

### 4.1 The benefits and indirect costs of state intervention

Antioch (today Antakya, Turkey) in the northeastern corner of the Mediterranean, was perhaps the third largest city in

the flourishing sixth century Eastern Roman Empire. As an administrative center, it connected the empire's heartlands in the S. Balkans and NW. Anatolia to its wealthy province of Syria. Antioch was also an economic and cultural powerhouse, serving as a major node in the network of eastern Mediterranean cities and boasting rare amenities for the time (e.g., night lighting), a religious hub (e.g., it was one of the five key centers of Christianity), as well as a major economic node in the dense network of eastern Mediterranean cities. Over the sixth century, Antioch suffered a series of major disasters that included at least six destructive earthquakes, a major fire, a foreign sack and several smaller raids, the deportation of many of its citizens to a foreign country, and at least four outbreaks of plague. Yet, Antioch survived these disasters and remained a major regional center.

Since Antioch could not be allowed to collapse for the political, ideological and administrative reasons summarized above, the central government at Constantinople ensured its survival by providing it with constant infusions of resources. These included tax remittances, outside workers and resources for reconstruction after each major disaster, and even an extensive imperial initiative to remodel the city (Procopius, *Buildings* 1914, 2.10). The government complemented its material efforts with Public Relations campaigns to lure immigrants to Antioch. It employed propaganda, such as changing the city's name to Theoupolis, literally "the City of God", used in official communications and on newly minted coins. The government instituted additional popular measures such as free food rations, bringing in grain from Egypt to the city where it was baked and handed out (part of the same institution that supplied Constantinople with grain, discussed above). Such practices served to maintain Antioch's population by attracting poor and refugees from the greater region and keeping those destitute from the recent disasters in the city.

From the perspective of the central government, these actions were successful in maintaining Antioch's position, its primary objective in the region. Its actions, however, had indirect consequences. Although specific economic costs are unknown, the governmental support of Antioch was a decades-long process that strained the central government, forcing it to reduce the amount of resources available for other central initiatives such as its foreign policy (e.g., wars in Italy). At the same time, drawing immigrants to Antioch weakened social cohesion in the city. Frequent riots among different groups within the city occurred, frequently based on religious or other markers of difference.

The government's pumping of money into Antioch had other unintended consequences. The city was part of several trade networks, importing goods from across the Mediterranean, such as North African pottery, and exporting them to the inland Syrian cities. At the same time, it exported its own local goods, such as olive oil, across the Mediterranean. This

oil was produced in Antioch's hinterland. The disruption of these economic networks damaged Antioch's commercial relationships and crashed the local economy, worsening the economic condition of the residents of Antioch's hinterland and likely establishing a feedback loop that further encouraged migration to the city. The former trend of rural economic expansion stopped, and although Antioch slowly re-established its inter-regional connections, its local olive oil industry never recovered (Mordechai 2018).

Whether governmental policy on Antioch could resolve these more complex stresses remains unknown. A decade into the seventh century, Antioch was lost temporarily to a Persian attack and then permanently to Islamic conquest. Such regional disruptions prevent us from assessing the longer-term results of the imperial government's policies on Antioch. Although the causes and even the process of the Islamic conquest remain unclear and debated, the disruption wrought by the sixth century disasters and the imperial response likely contributed to the eastern provinces' vulnerability over the longer term.

#### 4.2 A societal response to graduated change and its unintended consequences

A second case study from the same period reveals a different story with the participation of the central government. The history of the eastern regions of the later Roman Empire in the fifth-seventh centuries CE offers a good example of how one sector within a social system lost even as society as a whole benefitted. Between 470 CE and lasting until ca. 670/720 CE (Izdebski et al. 2016), climate change led to increased winter precipitation that enabled a profound transformation in late antique society. The increased winter rainfall, crucial for cereal cultivation in most of the Eastern Mediterranean, shifted the ecological frontier between arid areas and the land suitable for cereal cultivation. Although the introduction of farming on these marginal lands often required sophisticated irrigation and water-harvesting techniques (in the Negev desert, for example), the changing climate permitted an extension of agricultural production into regions previously left uncultivated or used only as pastures. Eastern Roman society was remarkably efficient at turning the environmental challenge of increased precipitation into an economic opportunity, and several regions saw an unprecedented expansion of agriculture and rural settlement (Izdebski et al. 2016). This increase in agricultural production in turn encouraged contemporaries to specialize in cash crops, such as olives and vine, visible in a number of micro-regions across the Eastern Mediterranean (see for instance England et al. 2008; Varinlioglu 2011; Izdebski 2013a, b).

However, this climate-related economic growth also contributed to a shift in the balance of control over resources between urban and rural populations in Anatolia and the

Levant. In the late fifth and sixth centuries, new agricultural regions had fewer cities, while large villages dominated as opposed to densely populated urban centers. Although the dramatic expansion into marginal lands occurred on the fringes of urbanized regions, new settlements encroached on lands that were located beyond the traditional hinterlands of existing urban communities, and escaped their political and economic control (e.g., Niewöhner 2006). This inaugurated a decline in the political and cultural role of many cities, contributing to an ongoing transformation of economic relationships between town and country, and elites and the producing population (Brandes and Haldon 2000). Climate changes allowed rural populations to accelerate this process and become more independent from cities while at the same time leading to a more general urban decline.

Here we see a situation in which different social groups depend on various ecological niches. Environmental stress led to varying consequences for each of them, leading to a renegotiation of economic relationships and to changes in the balance of power. In the late Roman world, urban populations were relatively privileged, both in their access to local resources and the state support they often received. In theory, therefore, they should have fared better through greater access to resources. But their position was actually undermined by what would generally be understood as a beneficial environmental change: their control and dominance over rural populations diminished as a result of the expansion of rural settlement onto new agricultural land, made possible to a large extent by a shift in precipitation patterns.

## 5 Discussion

A number of conclusions or lessons can be drawn from these examples, all of which involved states or societies that were complex, possessed institutional and ideological flexibility, and a degree of systemic redundancy, which is to say, overlapping institutional arrangements that in many instances could permit elements of one facet of social organization or state structure to fail without jeopardizing the system as a whole. First, the costs of resilience have never been shared evenly among the different components of complex social systems. Political complexity has always had advantages and disadvantages in maintaining resilience in the face of environmental stress. Resilience in one social group or institution—the rapid return of its baseline function, lifestyle and living conditions—influenced other groups within the same society. But to understand the potential for all groups to receive just returns we need to understand the connections between different social groups and their environments. The underprivileged or less powerful have always been the most

likely to bear the costs of societal resilience to environmental stress.

The examples also illustrate the point that even where efforts were made consciously to assist a whole community—for example, in the case of sixth century Antioch—the outcome could often generate unpredictable changes that could impact that community negatively. Not only do short-term strategies that sustain a state or a specific bundle of vested interests not necessarily promote longer-term societal resilience, they can also increase longer-term structural pressures leading to systemic crisis. To a degree this applies also in the case of the Black Death in England, where the unforeseen longer-term result of the short-term responses was an increase in peasant social mobility and rural social diversity, facilitating a transformation of the labor market and social class relations. This forced the social elite to realign itself with new fiscal and market circumstances in order to protect its socio-economic dominance and at the same time inaugurated a longer-term challenge to its monopoly on local and central political office.

Nevertheless, there are examples where states possess sufficient systemic resilience to overcome very serious short-term challenges without further exacerbating existing inequalities, as the example of the Justinianic Plague suggests. While no modern public health infrastructure existed, the imperial government readjusted quickly to meet two immediate needs: burial of the dead and the provision of food supplies for the population. By fulfilling these two duties and when combined with individual self-isolation, Constantinople sustained itself and rebounded within just a few years. Flexibility built into the imperial administration provided the empire with the capacity to manage a number of (expected) short-term problems, from lower crop yields to catastrophic weather, that allowed the state to mitigate sudden changes to market supply. These short-term strategies secured the stability to meet the state's longer-term strategic aims such as the re-conquest of Italy, as well as continuity of administration and government.

Secondly, our case studies illustrate that states, even where ideologically predisposed to assist the poorest or weakest in society (e.g., the Christian Eastern Roman empire and the Islamic Ottoman empire) often resolved challenges, both short-term and longer-term, by pushing increased costs for state survival onto those sectors of the society least able to resist—an inevitable consequence of pre-existing systemic inequalities. In the process, however, the state in the past also unconsciously transformed the relationships between the central power and central and regional elites. The great famine in the Eastern Roman empire that followed the severe winter of 927/928 CE tells exactly this story. This case, along with the example of the catastrophic droughts suffered by the Ottomans in the 1590s CE, illustrates how a central government damaged its own economic base when



the largest social group, the lower strata of the society, lost its resilience to environmental stress. Their vulnerability undermined the foundations of the state's fiscal economy: lack of resilience on the part of the less privileged directly impacted the resources available to the state through taxes and requisitions, thus weakening the core functions of the central government, including the military.

A third conclusion is, therefore, that the greater the degree of baseline inequality at the outset of a crisis, the less resilience there is in the system as a whole, the more uneven the distribution of the resilience burden, and the greater the potential for post-solution breakdown of a given social order. Social elites, as identifiable groups, generally survive societal crises and transformations because they have a vested interest in preserving their position and generally retain the resources to do so. While individual members or sectors of elites may die or lose their positions of wealth and power, as a visible societal group, they are often still around and at the top of the heap when the dust settles. Naturally, there are exceptions: rapid revolutionary events such as in France between 1789 and 1794 or Russia in 1917–1918 can result in the effective removal of much of an established super-elite even if individual members of the old establishment changed sides and joined the revolution. But it is not uncommon, even where a major shift in political and ideological control takes place, for substantial elements of an established elite to adapt to radically changed circumstances and retain their basic socio-economic advantage, even where they are no longer the ruling element. This occurred, for example, with the middling elite of Sasanian Iran after the Islamic conquest in the 640s–650s (Pourshariati 2008; Morony 1984); it was true of the middling elites of the Western Roman Empire (Halsall 2007); it was true of local Balkan elites after the Ottoman conquests in the fourteenth–fifteenth centuries CE (Kunt 1983; Inalcik 1973); it was just as true of traditional elites throughout the Middle East, Iran and as far as Afghanistan after Alexander's conquests in the fourth century BCE (Adams 2006; Erskine 2008).

Did people in the past think about system recovery? On a global scale, no. But sectorally, as in the case of central governments with the means at their disposal, the answer varied: the degree of the problems they faced, the nature of economic and social class relationships, and, to some extent, the overall ideology and its key motifs were central factors. Did people understand the challenges and respond appropriately? Here we have to say, it depends: representatives of religions tended to have a more global outlook (i.e., for people of the same faith), but their responses tended to be moral rather than practical (i.e., prayers to stop the calamity), and when they were practical they were inevitably local and short-term (i.e., famine relief, for example). Ruling elites could respond, but they tended to react primarily to perceived threats to their own survival. This might well embrace the

entire state, but as we have seen in some of the examples above, such responses were generally compromised by elite interests, as in the tenth century medieval Eastern Roman empire. Furthermore, they usually were able to respond only to the immediately perceived problem—which may have been just a symptom of deeper issues. And were they able to implement policies to mitigate future risk? Yes, but again, for example in the case of Antioch, often with unforeseen consequences for the longer term.

These historical examples illustrate clearly that policy makers and political leaders today generally have a much greater appreciation of threats and risks, potential and actual—which puts them in a far better position to plan for system recovery. Their ability to respond appropriately, however, continues to be determined by a range of cultural/ideological, political/structural, and economic factors, including elite interests, many of which work to constrain or even discourage the implementation of potentially effective policies that could address both short-term challenges and mitigate future risks. This becomes particularly acute when these elite interests do not align with those of the far more numerous non-elites, who are significantly more likely to be affected, as we have seen.

In this context, we would suggest that the tendency towards structural socio-economic imbalance in responses to environmental challenges must be a question that future policy planners place at the heart of their calculations. Because this sort of imbalance has generally been the case until now does not mean it has to be the case in the future—but in what circumstances this would *not* occur is an important, largely unanswered, and generally avoided question, except as a statement of general rhetoric. Ensuring a more equal and just distribution of the costs and thus extending resilience more evenly across all social-economic sectors would appear to be the obvious solution towards a more sustainable future for any complex socio-political system.

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## Compliance with Ethical Standards

**Conflict of interest** The authors declare that they have no conflict of interest.

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