

The Environmental Fall of the Roman Empire

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Abstract: Global environmental history is currently being enriched by troves of new data, and new models of environmental variability and human impact. Earth scientists are rapidly expanding historians' knowledge of the paleoclimate through the recovery and analysis of climate proxies such as ice cores, tree rings, stalagmites, and marine and lake sediments. Further, archaeologists and anthropologists are using novel techniques and methods to study the history of health and disease, as revealed through examination of bones and paleomolecular evidence. These possibilities open the way for historians to participate in a conversation about the long history of environmental change and human response. This essay considers how one of the most classic of all historical questions – the fall of the Roman Empire – can receive an answer enriched by new knowledge about the role of environmental change.

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On the twenty-first day of April in AD 248, Rome celebrated her one thousandth birthday. For three days and three nights, the haze of burnt offerings filled the streets. An exotic menagerie befitting the seat of a tricontinental empire was presented to the people, and massacred: thirty-two elephants, ten elk, ten tigers, sixty lions, thirty leopards, six hippopotami, ten giraffes, the odd rhinoceros, and innumerable other wild beasts, not to mention one thousand pairs of gladiators. The *ludi saeculares* (“century games”) summoned forth a host of archaic memories, “skilfully adapted to inspire the superstitious mind with deep and solemn reverence,” in the words of Edward Gibbon.¹ The celebration still carried shadowy associations with the underworld; the rituals encouraged the diversion of pestilence. Despite the deliberate primitivism of the rites, the *ludi saeculares* could be credited, like so much else, as a creative re-discovery of the imperial founder, Augustus. The *ludi saeculares* were in every sense an imperial affair, a stage-crafted display of the awesome power that

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Rome enjoyed, unbroken for centuries on end. Little did contemporaries know they were witnessing a sort of valediction: the last secular games of Rome.

It is easy, from our distance, to imagine that there was some measure of denial in such an exuberant celebration of the Roman millennium – as if the inhabitants of Rome were enjoying the ancient equivalent of cocktails on the deck of the Titanic. But perhaps we are blinded by hindsight. The Rome of AD 248 offered much to inspire a sense of familiarity and confidence. The *pomerium*, or urban boundary, remained a construct of the imagination in an unwalled city that sprawled over into its hilly countryside. The coins minted to honor the games maintained a ponderous texture of true silver; to hold one of these coins even today is to feel the combination of precious metal and public trust that steadied the value of the imperial money. The Romans' ancestral polytheism, nested in the very fabric of their civic life, gave historical assurance that the city's place was written in the stars. Presiding over the spectacle was Emperor Marcus Julius Philippus, also known as Philip the Arab. Though he hailed from the southern reaches of Syria, he was not a conspicuous outsider in an empire whose integrative capacities are virtually unmatched in history. Early in his reign, he had shown impressive energy: he attempted administrative reforms in Egypt, oversaw a great burst of road improvements in places as removed as Mauretania and Britain, and enjoyed a satisfying victory over northern barbarians. Above all, as Philip clearly recognized, the city herself demanded obeisance, being the critical, central node of power at the nexus of people, army, and senate. In Rome, campaigns were planned, careers plotted, fortunes decided.²

Philip's Rome would have felt familiar to Augustus, its first emperor. And yet, just one generation on, we find ourselves

in a truly alien world. The serene confidence of the empire had been rudely shaken. Hulking stone fortifications, the Aurelian Walls, went up around a city in which distance and mystique had so recently seemed protection enough. The silver had dissipated from the empire's coins, which, now spewed in super-abundance from the mints, more resembled crude wafers. A new kind of man – the Danubian soldier with little time or awe for the *urbs* – had irreversibly wrested control of the state from the moneyed senatorial aristocracy. Careers were made and unmade in the barracks of northern garrison towns, rather than in the old capital. Beneath the imperial city itself, in the honeycomb of burial caverns known as the catacombs, there is evidence that the obscure cult of Christianity was, for the first time, making uncanny strides toward becoming more than a marginal curiosity.

In short, in the space of a single generation, the lineaments of the period we now call *late antiquity* had come into view. No period of Roman history is so screened from our gaze as the generation that passed between Philip and Aurelian; and few were so momentous. How we imagine the changes that occurred in those tumultuous decades, often beyond our ken, will decisively shape how we view that fathomless historical episode: the decline and fall of the Roman Empire.

Gibbon described the subject of his famous history as the triumph of "barbarism and religion." This was a vantage formed in the heady world of Enlightenment letters. Gibbon's genteel disdain for superstition nurtured a sense of remote affinity for the Romans. And his ravaging critical faculty, turned against the partisan ancient and ecclesiastical histories, made his *Decline and Fall of the Roman Empire* a landmark then (in the late eighteenth century) and a monument still. In its sources and preoccupations, Gibbon's text is resolutely a prod-

uct of its own age. Indeed, every generation looks upon the past through the eyes of the present. It is no surprise or disservice for us to return anew to the Roman past, awakened to the fact that the *environment* can be a protagonist in human history, armed with radically new tools for reconstructing the relationship between humanity and nature.³ While explanations for the fall of Rome have never lacked, it might seem surprising that environmental change has nonetheless remained such a marginal candidate. The sudden assimilation of environmental history into the mainstream of our historical consciousness is a testament to just how quickly we have come to know the drama of environmental instability in times past and present.

The environment is not an inert backdrop to human history: from the cold winter to the dry year, we experience seasonal and interannual variation. We are trained to notice and to respond to climate variability on annual scales. Most of us are also at least dimly aware that the hospitable climate we currently inhabit – the Holocene, circa 10,000 BC to the present – is really an interglacial, a periodically friendly interlude between ice ages. The Holocene has been an epoch of relatively warm and stable climate relative only to the jagged Pleistocene, when snowcaps could blanket the mid-latitudes, and vast tracts of the earth’s surface became uninhabitable in the geological blink of an eye. The clinching evidence for natural climate variability during the Holocene has come principally from a new kind of physical archive. Natural archives, like ice cores, tree rings, marine deposits, and cave minerals, can stretch back thousands to tens of thousands of years. Over the last few decades, glaciologists, dendrochronologists, and other intrepid explorers of the earth’s past have submitted to historians the possibility of reconstructing climate history on civilizational

time-scales with razor precision.⁴ The cold season became the frosted decade; the dry year became the arid century. The discovery of Holocene variability, on a scale and at speeds significant enough to influence human fortunes, has been a revelation.

The history of human health and disease is also a story of environmental change. The physical testimony of human bones, the stories frozen in their isotope chemistry, and the expansive possibilities of gene sequencing are enabling historians to trace deep transformations in human health and disease in ways that were previously inconceivable. The patterns of change emerging from the bioarchaeological record are both stark and surprising. For instance, accumulated skeletal evidence has inescapably shown that the Romans were short in stature, unimpressive relative to their Iron Age predecessors and Dark Age successors.⁵ (Julius Caesar, reputed to have been tall, may have stood imposing only among a population in which the average man stood five feet, five inches.) Achieved stature is a function of both genes and environment, and the environmental contribution, in turn, is the result of net nutrition, or the income of nutrients during development minus the expenditures of labor and disease. For the Romans, the heavy burden of infectious disease drained their bodies’ metabolic resources and stunted their growth.

Deciding how to integrate environmental change into the story of Rome’s decline and fall will intersect with some already well-worn tracks in the historiography. Gibbon set a pattern that many have followed since: he looked *inward*, to the flaws inherent in the very constitution of empire, to find the cause of Rome’s fall. He wrote: “The decline of Rome was the natural and inevitable effect of immoderate greatness. Prosperity ripened the principle of decay; the causes of destruc-

tion multiplied with the extent of conquest; and as soon as time or accident had removed the artificial supports, the stupendous fabric yielded to the pressure of its own weight.”⁶ The environment might well have a place within this internal chain of causes. Just ten years after the final volumes of Gibbon’s history were published, the mother of all endogenous models appeared in the first edition of Thomas Malthus’s *Essay on the Principle of Population*. Malthus’s core insight was simple, and remains elegant: because of the limits on food production, population and well-being stand in an intrinsic and inverse relationship to one another. Growth, if not forestalled by some constraint, inevitably recoiled back upon itself, as “sickly seasons, epidemics, pestilence, and plague, advance in terrific array, and sweep off their thousands and ten thousands. Should success be still incomplete, gigantic inevitable famine stalks in the rear.”⁷ The reverend’s theory makes ecological catastrophe the ironic fate of human development.

Conversely, environmental catastrophe does not have to be self-induced. Powerful exogenous determinism has its advocates. As John Brooke writes in *Climate Change and the Course of Global History*, “Until the onset of modern accelerated population growth, no pre-modern society of consequence occupying a reasonably adequate biome suffered a purely endogenous ‘Malthusian crisis’; rather, adversity, crisis, and collapse were fundamentally shaped by exogenous forces: the impacts of drought, cold, and epidemic disease drove episodic and abrupt reversals in societal complexity and the human condition.”⁸ Up until the Industrial Revolution, climactic fluctuation was unmoved by human stimulus, and climate variability was driven foremost by changes in the amount of radiative energy entering the atmosphere. On geologic timescales like

the Pleistocene, the mechanics of our orbital journey around the sun create icy spells lasting millennia. Within the Holocene, solar cycles of shorter periodicity altered the amount of heat received by the earth, while volcanic eruptions coughed up clouds of sulfates that prevented energy from reaching the planet’s surface. The oceans and the atmosphere form a coupled system, and the circulation of heat through the deep, interconnected, and variously salty waters of the earth is responsible for pulses of climate change, whose rhythms and effects are far from completely understood. Until the very recent past, the climate system has varied on its own tempo and terms, blissfully indifferent to human endeavors.

However, to lay the patterns of epidemic disease exclusively at the feet of nature would too easily exonerate humanity in coaxing along the evolutionary history of our own microscopic rivals. Quite unawares, we humans have had a determining part in the evolutionary destiny of the very bacteria and viruses that, until recently, were the most important agents of human mortality. The niches we construct for ourselves have inadvertently shaped the evolutionary conditions of the microbes that haunted our forebears. The role of infectious disease has been exogenous, only in the narrowest neoclassical sense of the term, which predicts that mortality rates are determined by real-wage levels.⁹ Malthus can inspire more capacious readings that urge us to look for other pathways of feedback between civilization and environment. Even in the case of climate variability, it will benefit us to give special attention to the precise means through which environmental turbulence sometimes did – and sometimes did not – stretch societies beyond their capacity to endure. As with any good story, the drama of environmental history lies in the interplay between structure and contingency.

At this moment, as new models of environmental change and human impact gather momentum, the watchword is *resilience*: the capacity of human societies to respond to the shocks of nature, to draw on batteries of stored energy to fund the recovery from the lashes of climate change and disease.¹⁰ Resilience is not infinite, however, and to look for it in ancient societies is also to be alert for the signs of persistent stress, and the realization that just beyond the threshold of endurance lies cascading change and systemic reorganization. Resilience asks us to consider the ecological specificity of a social system, in which lie its reserves of strength, as well as its tensions and vulnerabilities. The notion of resilience lets us look anew at Rome in the middle decades of the third century and allows us to see, perhaps, not a society waiting for its “principle of decay,” as Gibbon phrased it, to unfold in course, but one whose depleted stores left it exposed to the unforeseeable strokes of environmental misfortune.

If you could go back in time from the secular games of AD 248 to the very foundation of the city of Rome – nearly ten “ages of man” – you would have found an inauspicious, but typical, Iron Age agglomeration of huts along the hilly banks of the Tiber River. The eighth century BC was an age of beginnings, but for a long time, the western reaches of the Mediterranean stood in the shadow of the Aegean and Near Eastern experiments. Centuries elapsed before there were any signs of the coming Roman miracle; when it did arrive, it seemed sudden and inexorable. The Romans stepped forcefully into the imperial space created by Hellenistic kingdoms and, after razing the Carthaginians, their only western rival of any importance, seized hegemony of the Mediterranean. The Roman package – aggressive colonization, assimilation through military

service, open pathways to citizenship, co-optation of local elites, and, of course, civil engineering *nonpareil* – meant that by the time Augustus brought the last significant stretches of Mediterranean shoreline under Roman dominion, it was no idle boast for Romans to refer to the sea as *mare nostrum*, “our sea.”

What kind of empire did the Romans build? Foremost, it was an agrarian tributary empire. A comparative framework trains our eyes to see the all-important annual cycle of tax gathering as the central dilemma of Roman statecraft. It also threatens to flatten out the real uniqueness of Roman ecological and economic achievements, which constituted the true source of Rome’s vulnerability, and its ultimate demise. This distinction begins with the obvious – but extraordinary – fact that the Romans stand as the only people ever to unify the basin into a single political organism. Yet this fails to capture the full geographical accomplishment of Roman *imperium*, whose deep continental annexes reached north across the 56th parallel, while the southern edges dipped below the 24th parallel north. “Of all the contiguous empires in premodern history, only those of the Mongols, Incas, and Russian czars matched or exceeded the north-south range of Roman rule.”¹¹ Few empires, and none so long-lived as the Roman empire, grasped parts of the earth reaching from the upper mid-latitudes to the fringes of the tropics.

This empire was a network of cities looking toward the waters, and there is no doubt that the Mediterranean Sea was at its core. The Mediterranean basin is one of the globe’s most complex climate regimes. The delicate, moody features of the Mediterranean climate – arid summers and wet winters against a relatively temperate backdrop – are recognizable around the world. But the Mediterranean itself is unique; the dynamics of a giant, inland

sea, combined with the crenellated texture of its inland terrains, pack extreme diversity into miniature scale. The region is a patchwork of microclimates.¹² And because of its position at the juncture of the subtropics and mid-latitudes, the Mediterranean zone is crossed by an array of distinct climate processes. The western territories are subject to the influence of Atlantic patterns, in particular North Atlantic pressure gradients, which decide whether the storms carrying all-important rains will pass into the Mediterranean or spin north over the European continent. The controls on the Eastern Mediterranean are even more complicated, still including the sweep of westerlies from the Atlantic, but also hypersensitive to other mechanisms that influence the levels of winter precipitation. And Egypt, the breadbasket of the empire, plugged the Romans into wholly other climate regimes; the life-bringing Nile floods originated in Ethiopian highlands, watered by the Indian Ocean monsoons.

Control of grain production along the Nile's verdant flanks gave the Romans a natural insurance policy to buffer against the vagaries of the Mediterranean climate. And this was only one of many. The Romans had the advantage of building an empire atop countless indigenous risk-management strategies, a stock of peasant knowledge accreted over millennia. Over that ground cover of local wisdom, the engineers of the Roman empire built a machinery of food provision and water management that was political in nature, and monumental in scale. Despite the renown of the aqueduct and the grain dole, what is truly striking is the extent of the imperial food system left to the market. Public granaries provided a margin of protection, and in times of acute crisis, the government inserted itself. But the best insurance policy was the network of roads and sea lanes, along which private merchants moved bulk

goods with ease. The high Roman Empire is notable for the distinct absence of severe food crisis.¹³ Dearth is always relative, but Malthus's "gigantic inevitable famine" seems not to have stalked the Romans, so much as periodic bouts of high prices.

The Roman economy defied the dour logic of Malthusian pessimism, according to which the teeming populations of the empire should have crunched the food supply. The high empire stands as one of the most significant phases of economic "efflorescence" in the centuries before industrialization. In this period, the gains from trade and the diffusion of technological improvements allowed a large-scale society to forestall the real and overarching limits of the land's productivity. The Roman economy achieved growth, even on a per-person basis, straight into the teeth of population expanse. The best evidence comes from the dry sands of middle Egypt: recovered papyri enable fragmentary reconstructions suggesting that, here in a province subjected to heavy fiscal extraction, the wages of the most ordinary laborers (diggers, donkey drivers, dung haulers) increased across the first two centuries of Romanization.¹⁴

Trade and technology let the Romans outrun the Malthusian reaper for no short season. But the success of the imperial economy seems to have had another accomplice: the climate. The "Roman climate optimum" emerges from a range of proxies as a distinct phase of late Holocene climate. In the Mediterranean, it was a period of unusually hospitable alignment: warm, wet, and stable. Levels of total solar irradiance were consistently elevated, and there was a striking absence of signatures of major volcanic eruption. Of the largest twenty-five eruptions in the last two and a half millennia, none occurred between the death of Julius Caesar and the year AD 169.¹⁵ Proxies of warm temperature, like the glaciers that retreated up the Alps,

stand in affirmation. Heat was matched with moisture in the West; Spain and Italy appear to have been well-watered. The effects in the East were uneven, although the Levant enjoyed a persistent cycle of humidity, for which the most concrete testimony is the evidence of shoreline settlements high above the Dead Sea. And the sacred floods of the Nile River revealed a period of astonishing dependability.¹⁶

Climate, then, stood in alliance with commerce and technical progress, as the Roman efflorescence defied or deferred the paradoxical laws of premodern development. People crowded the basin. If there is a sign, though, that quietly points us toward a qualification of this optimistic picture, it is the Romans' short stature. Biological well-being remained as – or more – elusive than ever for the inhabitants of the imperial Mediterranean; life expectancy was low, even by ancient standards. The inadvertent consequence of more people was a more insalubrious environment.¹⁷ In Rome, the dog days of summer brought on an awful tide of gastroenteric illnesses, with an autumn surge of malaria following on its heels. Malthus, we might say, was right for the wrong reasons. The poor health of the Romans was unmediated by food shortage or low wages. In a scenario not unlike the “antebellum paradox,” when American stature suffered a setback in the mid-nineteenth century *despite* the arc of development, urban density and imperial connectivity in the Roman Empire were as conducive for microbial ecology as human prosperity. Thanks to their imperial ecology, the Romans were rich, but sick.

Wealth offered no escape from the brutal facts of life and death. The wife of the emperor Marcus Aurelius bore him at least fourteen children – six girls and eight boys – yet only one of the girls and one of the boys verifiably outlived both of their par-

ents. In the letters of Marcus, we catch glimpses of the fevers and diarrheas that laid low so many little scions of the imperial line. Yet the reign of Marcus was the apex of what Gibbon, with justification, called “the period in the history of the world, during which the condition of the human race was most happy and prosperous.”¹⁸ Today we might look back on the happiest age and see not a lurking principle of decay waiting to unwind, but a society in which cumulative ecological pressure was entailed by the very terms of development. Such a perspective prepares us for what happened next: in the middle of the AD 160s, a pestilence arose in the immediate wake of an eastern military campaign. The Romans believed the soldiers who impiously sacked the city of Seleucia on the Tigris had unlocked a deadly vapor. In reality, the unfamiliar pathogen was probably introduced into the virgin populations of the Mediterranean via Rome's bustling Red Sea trade. It was smallpox.¹⁹

The Antonine Plague, as it is known, can claim to be considered the world's first pandemic; it is the prime exhibit for what William McNeill called the convergence of the civilized disease pools of Eurasia.²⁰ Highly communicable and highly lethal, the disease was conducted along the very networks that held the empire together. Signs of the plague, both giant and subtle, are ubiquitous. Building virtually ceased. Mass graves provide chilling testimony, and confirm literary reports of unprecedented mortality. Invocations to Apollo, the diverter of plague, appear across the empire. Emergency military conscriptions were levied. The price of goods leapt. Although the scale of the Antonine Plague's impact is hotly debated at the moment, it is not unreasonable to believe that the pandemic was as devastating and consequential as the introduction of smallpox into the New World. Marcus

himself succumbed, probably, to the disease.

In a cruel coincidence, the pacific regime of the Roman climate optimum ended almost simultaneously with the advent of the great mortality. A massive volcanic eruption in AD 169 spelled the inevitable end of an unusually stable chapter of climate history. The climate of the next centuries would be disorganized and indecisive, before a sharp and unmistakable descent into what is starting to be known as the “late antique little ice age.” While the Roman Empire was never quite the same after the appearance of the smallpox pandemic, the reality is that the empire did persist, and in recognizable form. A new dynasty of Libyan and Syrian heritage held sway for nearly half a century. If they failed ever to please the Roman Senate entirely, there is no disguising the basic success of their restorative enterprise. Roman citizenship was made universal, and Roman law entered its classical heights. It was in these years that the sour churchman Tertullian proclaimed, “Everywhere there are households, everywhere people, everywhere cities, everywhere life!”²¹ To use the terms we have laid out before, the imperial system, with the Roman people and the Senate at its center, endured without fundamental reorganization, though stressed by new levels of environmental turbulence. The populace reveling in the secular games of AD 248 was not deluded to think that Rome would still be the center of the world after another age of man had passed.

In AD 244, the Nile waters failed to rise. Two years later, they failed again. These patterns are inferred from haphazard scraps of papyri. In March of AD 246, a provincial official in the Oxyrhynchite district of Egypt ordered that all private stocks of grain be registered.²² The provincial government, which usually set prices in com-

pulsory purchases to its own advantage, was grabbing wheat at prices that were shockingly high even for the fair market, implying acute desperation. One papyrologist sensitive to the nuances of these data, has deemed this a sign of “unusual severity.”²³ The contemporary bishop of Alexandria, the great metropolis at the mouth of the Nile Delta, described the Nile riverbed as drier than a desert.²⁴ The reverberations of a catastrophic food crisis in Egypt could be felt empire-wide. Worse was yet to come. If one purpose of the secular games was to ward off the evils of pestilence, the millennium celebration was shortly to prove a stupendous failure.

The weather can induce famines or fan the movements of people that stir sickness. The weather can also upset the hair-trigger ecological equilibria that sometimes control the reproduction of disease vectors like mice or mosquitos. We cannot say if the volatility of the mid-third century climate contributed to the outbreak of epidemic disease that again visited the empire. Contemporaries noted the coincidence of drought and pestilence, but to their ancient eyes, this was a sign of divine wrath rather than environmental disturbance. Whatever the cause, just a few generations after they had recovered from the first attacks of the smallpox virus, the Romans experienced what might be considered the second wave of pandemic disease in global history. The Plague of Cyprian, named after the bishop of Carthage whose sermons provide our most detailed description of the disease, ravaged Alexandria in AD 249. By AD 251, the plague had reached the Western capital. For nearly twenty years, it blazed sporadically across the Roman world.

The Plague of Cyprian has managed to evade serious attention from historians.²⁵ But if we look anew at the period, with our eyes open to the power of environmental fury, the pandemic can be seen every-

where. It is far better supported than the Antonine Plague, despite appearing at the worst-documented moment in imperial history. Pagans and Christians, from both East and West, independently and unanimously insisted on the plague's devastation. While the crisis summoned forth the full range of our witnesses' rhetorical virtuosity, it also inspired some crucially detailed reportage, from Cyprian's excited account of the disease's hemorrhagic presentation to Dionysius's surprisingly specific claims about its demographic impact. Alexandria had lost 62 percent of its urban population, judging from the number of recipients on the public grain dole. Five thousand corpses a day were wheeled out of Rome. According to the pagan historian Zosimus, the Plague of Cyprian infested both towns and villages, and "destroyed whatever was left of mankind. No plague in previous times wrought such destruction of human life."²⁶

The Plague of Cyprian did not cause the fall of the Roman Empire, but it did instigate a phase of crisis that pushed the imperial system beyond the threshold of resilience. When it struck, the fabric of empire unwound. The Romans had faced challenges before: dynastic conflict, external invasion, class violence, and – yes – famine and plague. Even in the sunniest days of Antonine rule, these adversities were not unfamiliar.²⁷ But their concurrence and intensity in the AD 250s induced cascading change. Barbarians no longer just menaced the frontier; they pillaged unwallied towns in the imperial interior. The struggle for dynastic legitimacy turned into imperial dissolution.

The coinage of the period is a perfect objective correlative: its fiduciary value withstood repeated debasement of the precious metal content, until it did not. In this crisis, its value finally collapsed, and only the reorientation of the entire currency system around gold lifted the economy from

the spiral of inflation. The ageless civic paganism of the Mediterranean seemed to sputter, losing ground to an obscure, if vocal and highly organized, rival that seized the mission field opened by the deep social dislocation and painful inefficacy of the ancestral gods. Although late Roman rulers loved to advertise their "restoration of the times," this was clearly special pleading. What was ultimately to emerge from the wreckage in the later third century has rightly been called "a new empire."²⁸

Human societies are embedded in their natural environment, and the challenge for historians is how to assimilate the mountains of new knowledge about the past environment rising up around us. For centuries, historians have been able to explain the transformations of the later Roman world, including the crisis of the third century, without needing to consider the blunt factors of climate change and disease. It takes patience, as well as some imagination, to go back and pretend we do not know the ending. The proud urban people who cheered in the circus, or sang in the processions of the *ludi saeculares* in AD 248, could little have imagined that dynamic cycles in our proximate star, or the chance mutation of a virus in a far-off forest, would rattle the foundations of the familiar world they inhabited. That was the revenge of the giant imperial ecology they created, at the very moment in history they chose to create it. It is exhilarating, if also a little daunting, for us to be confronted with the evidence of global environmental history, which is just beginning to let us reimagine the human past, while allowing, always, an occasional and wary glimpse to the present.

ENDNOTES

- ¹ Edward Gibbon, *The History of the Decline and Fall of the Roman Empire*, vol. 1 (London: William Strahan and Thomas Cadell, 1776), ch. 7.
- ² For more about Philip the Arab, see Clifford Ando, *Imperial Rome AD 193 – 284: The Critical Century* (Edinburgh: Edinburgh University Press, 2012), 115, 121.
- ³ Of course, newer environmental history builds on the pioneering efforts of the *Annales* school, as well as scholars like Hubert H. Lamb and William H. McNeill. For an exciting conspectus of new approaches and tools, see Michael McCormick, “History’s Changing Climate: Climate Science, Genomics, and the Emerging Consilient Approach to Interdisciplinary History,” *Journal of Interdisciplinary History* 42 (2) (2011): 251 – 273.
- ⁴ For an overview of what is possible, see the studies collected in Piero Lionello, *The Climate of the Mediterranean Region From the Past to the Future* (London: Elsevier, 2012).
- ⁵ Although this is the conclusion of several studies, the most methodologically sophisticated study to date is Monica Giannecchini and Jacopo Moggi-Cecchi, “Stature in Archeological Samples from Central Italy: Methodological Issues and Diachronic Changes,” *American Journal of Physical Anthropology* 135 (3) (2008): 284 – 292.
- ⁶ Gibbon, *The History of the Decline and Fall of the Roman Empire*, vol. 1, ch. 39.
- ⁷ Thomas Malthus, *An Essay on the Principle of Population* (London: J. Johnson, in St. Paul’s Churchyard, 1798), ch. 7.
- ⁸ John L. Brooke, *Climate Change and the Course of Global History: A Rough Journey* (New York: Cambridge University Press, 2014), 9.
- ⁹ John Landers, *Death and the Metropolis: Studies in the Demographic History of London, 1670 – 1830* (Cambridge: Cambridge University Press, 1993).
- ¹⁰ Carl Folke, “Resilience: The Emergence of a Perspective for Social–Ecological Systems Analyses,” *Global Environmental Change* 16 (3) (2006): 253 – 267.
- ¹¹ Walter Scheidel, “The Shape of the Roman World: Modelling Imperial Connectivity,” *Journal of Roman Archaeology* 27 (2014): 7 – 32.
- ¹² Peregrine Horden and Nicholas Purcell, *The Corrupting Sea: A Study of Mediterranean History* (Oxford: Blackwell Publishers, 2000). See also Cyprian Broodbank, *The Making of the Middle Sea: A History of the Mediterranean from the Beginning to the Emergence of the Classical World* (Oxford: Oxford University Press, 2013).
- ¹³ Peter Garnsey, *Famine and Food Supply in the Graeco-Roman World: Responses to Risk and Crisis* (Cambridge: Cambridge University Press, 1988).
- ¹⁴ Kyle Harper, “Peoples, Plagues, and Prices in the Roman World: The Evidence from Egypt” (under review).
- ¹⁵ M. Sigl, M. Winstrup, J. R. McConnell, et al., “Timing and Climate Forcing of Volcanic Eruptions for the Past 2,500 Years,” *Nature* 523 (7562) (2015): 543 – 549.
- ¹⁶ For a recent summary of what we know (which is already becoming outdated), see Michael McCormick, Ulf Büntgen, Mark A. Cane, et al., “Climate Change during and after the Roman Empire: Reconstructing the Past from Scientific and Historical Evidence,” *Journal of Interdisciplinary History* 43 (2) (2012): 169 – 220.
- ¹⁷ Walter Scheidel, *Death on the Nile: Disease and the Demography of Roman Egypt* (Leiden: Brill, 2001).
- ¹⁸ Gibbon, *The History of the Decline and Fall of the Roman Empire*, vol. 1, ch. 3.
- ¹⁹ See the essays collected in Elio Lo Cascio, *L’impatto Della “Peste Antonina”* (Bari: Edipuglia, 2012). The identification of the pathogen will remain uncertain until it is genetically se-

quenced, but a strong scholarly consensus has emerged around smallpox, as Lo Cascio's volume makes clear. Kyle
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- ²⁰ William H. McNeill, *Plagues and Peoples*, 1st ed. (Garden City, N.Y.: Anchor Press, 1976).
- ²¹ "Ubique domus, ubique populus, ubique respublica, ubique vita," from Tertullian *De Anima* 30.3.
- ²² P. J. Parsons, ed., P. Oxy. 42.3048, "Proclamation of Iuridicus and Registration of Corn" (Oxford: Sackler Library, 1974). Low- and high-resolution images of the papyri are available at <http://163.1.169.40/cgi-bin/library?e=q-000-00---oPOxy--00-0-0--oprompt-10---4-----o-1l-1-en-50---20-about-3048--00031-001-0-outfZz-8-00&a=d&c=POxy&cl=search&d=HASH5412aoc-44c9708ca044ded>.
- ²³ Dominic Rathbone, "Prices and Price Formation in Roman Egypt," in *Économie antique: prix et formation des prix dans les économies antiques*, vol. 2, ed. Jean Andreau, Pierre Briant, and Raymond Descat (Saint-Bertrand-de-Comminges: Musée Archéologique Départemental, 1997), 194.
- ²⁴ Eusebius *Historia Ecclesiastica* 7.21.
- ²⁵ For a full treatment, with detailed discussion of the sources cited here, see Kyle Harper, "Pandemics and Passages to Late Antiquity: Rethinking the Plague of c. 249–70 Described by Cyprian," *Journal of Roman Archaeology* 28 (2015): 223–260.
- ²⁶ *Ibid.*, 236.
- ²⁷ C. P. Jones, "Aelius Aristides, ΕΙΣ ΒΑΣΙΛΕΙΑ," *The Journal of Roman Studies* 62 (1972): 134–152.
- ²⁸ Timothy D. Barnes, *The New Empire of Diocletian and Constantine* (Cambridge, Mass.: Harvard University Press, 1982).