The Ecology of Empire: How Climate and Disease Pandemics Shaped the Decline of Rome

Jewelyn Mims

How will historians record the world-altering events of 2020? For the first time in a century, nations around the globe are facing multiple civilization crises, chief and most pressing among them is the life-threatening pandemic of the novel coronavirus (COVID-19). The coronavirus pandemic has caused over 2.6 million deaths worldwide. It has ushered in a stark global economic recession and exacerbated not only wealth inequalities but laid bare the cultural, civil, and political divisions leading to societal, national, and international instability. History can provide important lessons from the past. Disease pandemics, ecological disasters, and subsistence crises are not modern phenomena. From time immemorial microscopic organisms have lived and thrived alongside animal and human populations: some as benign or helpful agents that assist in shaping humans' natural environment, while others are dangerous pathogens that have evolved or lain dormant for providence and opportunity to enter desirable new hosts.

The Romans are known as the producers of an enormous multicultural and diverse empire that conquered the entire Mediterranean basin, Europe, Britain, and parts of the Near East. From modest origins in the Italian peninsula to an interconnected network of rural territories and awe-inspiring urban cities, Rome became the center of a highly "globalized" world in Antiquity (753 BC – 1453 AD). The Roman Empire's army and its citizens were arguably the most highly traveled in the ancient world, with the capital and provinces connected by vast trade routes, shipping enterprises, and roads that promoted immigration and accessible long-distance travel. Throughout Rome's long history, it endured waves of social, political, religious, and cultural upheavals. Conventional historical scholarship has tended to place military, political, and social turmoil as the main factors for the decline and

fall of the Western Roman Empire in 476 AD.[1] However, over the last thirty years, environmentally focused historiography on Rome's empire and the Late Antiquity period shows that climate change and various forms of endemic and epidemic diseases may have contributed to Rome's fall.[2]

Environmental historians, ecologists, and climatologists used new archaeological evidence, studies of demography, natural sciences, and paleopathology to assert that the Romans unknowingly created and were subject to an environment where disease pathogens flourished, evolved, and traveled freely to new groups of human populations. High-density communities and tightly packed urban settlements, as a result of steady population growth despite high mortality rates, enabled diseases to thrive. In addition, climate change unavoidably altered Rome's natural environment. For example, a significant climate cooling period triggered by volcanic eruptions and atmospheric pollution in the Mediterranean beginning in the second half of the sixth century AD ushered in a "little ice age." This was arguably responsible for decreased food production, famine, and the migration of non-indigenous animal species and disease vectors. A combination of any of these environmental factors intensified already heightened sociopolitical and military conflicts. In the case of the last four to five centuries of the Western and Eastern Roman Empire, environmental stressors inhibited the West to reestablish itself and

---

[1] Some revisionist and cultural historians, such as Peter Brown, have argued that the Roman Empire never really collapsed in the West but rather transitioned to a "Late Antiquity" period characterized by Rome's invasion and control by Germanic tribes, the rise of Christianity, and the development of the Byzantine Empire in Constantinople and the East. Peter Brown, *The World of Late Antiquity: AD 150-750* (New York: Norton, 1989).

[2] A growing number of historians such as Kyle Harper, Michael McCormick, Robert Littman, and Dionysios Stathakopoulos have shown that the prevalence of endemic diseases and the occurrence of widespread viral pandemics precipitated severe societal decline and the eventual "fall" of the Roman Empire. Kyle Harper, *The Fate of Rome: Climate, Disease, and the End of an Empire* (Princeton: Princeton University Press, 2017); Michael McCormick, "Tracking Mass Death during the Fall of Rome's Empire (I)," Journal of Roman Archeology 28 (2015), 325-57; Michael, McCormick, "Tracking Mass Death during the Fall of Rome's Empire (II)," Journal of Roman Archeology 29 (2016), 1004-007; Dionysios Stathakopoulos, *Famine and Pestilence in the Late Roman and Early Byzantine Empire: A Systematic Survey of Subsistence Crises and Epidemics* (Burlington: Ashgate, 2004).

accelerated the systemic conflicts in the remaining Eastern Empire. Environmentally focused studies of the ancient Mediterranean and the expansive Roman Empire reframe how scholars understand the driving forces behind societal decline and how viral pandemics can precipitate steady and irreversible paths to civilization collapse. The natural ecosystem of the Mediterranean basin coupled with the influence of the large "globalized" character of the Western and Eastern Roman Empire on the environment between the second and sixth centuries AD created conditions conducive to population stress and vulnerability. This environmental susceptibility, the occurrence of three major disease pandemics, and other environmental stressors such as periods of climate and ecological instability significantly impacted Roman society. Together these factors caused not only population, economic, and societal decline but ultimately led to the collapse of the Roman Empire.

Ecologists such as Robert Sallares characterize the natural environment of the Mediterranean basin and much of the territory of the Roman Empire by its encapsulation of the Mediterranean Sea, mountainous and hilly landscapes, coastlines, limestone-based geology, and large land biodiversity due to the different geographical areas of the Mediterranean region. Flora, fauna, and agriculture were dependent on the habitats that were supported mainly by upland rivers that descend toward the sea and annual winter rainfall, which fed river water levels and inundation. Therefore, the population variety and density of plant and animal life were small due to poor habitats.[3]

The climate of the Mediterranean is defined by seasonal weather of mild, wet winters and hot, dry summers with "periodic climate cycles lasting for centuries or longer, caused by variations in annual-mean solar radiation."[4] For example, the earlier Iron Age (~1100 BC – 776 BC) and Hellenistic periods (323 BC – 31 BC) of the Greco-Roman world were cold and humid, while the Assyrian (~2500 BC – 609 BC) and Persian (~559 B.C – 330 BC)

[3] Robert Sallares, "Environmental History," in *A Companion to Ancient History*, ed. Andrew Erskine (Chichester: Wiley-Blackwell, 2009), 165-166.
[4] Sallares, "Environmental History," 165-166.

periods were hot, dry, and prone to drought.[5] As a result, observed climate patterns and evidence demonstrate that most of the Roman Republic and Empire's history was in a period of warm and dry climate conditions peaking around 150 AD. Historian Kyle Harper terms this period the "Roman Climate Optimum" (RCO.) A transition through a gradual climate cooling around 150 – 450 AD caused the later Roman Empire and Byzantine period in 450 – 700 AD to experience cold and humid weather patterns. This climate pattern typifies that in semi-arid regions of the Mediterranean, cold and humid conditions meant increased rainfall which aided in grain production and population growth.[6] However, regions of Rome's empire with more arid conditions, such as the Near East and parts of North Africa, likely saw prolonged periods of drought which significantly impacted agricultural growth and production.[7] Therefore, in the Roman Empire, agricultural cultivation and food production were reliant on innovative irrigation systems that utilized seasonal weather patterns, especially as Rome's territory drastically expanded throughout the first through fifth centuries AD. Whereas warm climate conditions made the Romans fortuitous, they existed in a period that favored an agrarian empire built upon a "pyramid of political and economic bargains alongside trade and technology that facilitated the growth and prosperity of Rome's empire."[8] The temperate and warm climate of the Mediterranean also provided ideal conditions for the cultivation of crops that boosted the Roman economy through

---

[5] Robert Sallares, "Ecology," in *The Cambridge Economic History of the Greco-Roman World*, ed. Walter Scheidel, Ian Morris, and Richard P. Saller (Cambridge: Cambridge University Press, 2007), 19.

[6] Sallares, "Environmental History," 166; Sallares, "Ecology," 19; see also Harper, *The Fate of Rome*, 14-15 for Harper's climate theory of a "Roman Transitional Period" that spanned the years AD 150 to AD 450.

[7] Sallares, "Ecology," 20; Sallares, "Environmental History," 167.

[8] Harper, *The Fate of Rome*, 14-15. Full quote, "We are learning that the Romans were, in planetary perspective, lucky. The Empire reached its maximal extent and prosperity in the folds of a late Holocene climate period called the Roman Climate Optimum (RCO). The RCO reveals itself as a phase of warm, wet, and stable climate across much of the Mediterranean heartland of empire. It was an inviting moment to make an agrarian empire out of a pyramid of political and economic bargains. Alongside trade and technology, the climate regime was a silent, cooperative force in the seemingly virtuous circle of empire and prosperity."

the expansion of agricultural commodities and trade networks. Crops, for products like wine and olive oil, reached areas outside of the Mediterranean in the northernmost regions of Rome's empire, such as Britain and modern-day France.[9] However, as new scientific evidence and historical analysis indicate, cycles of climate change could also negatively affect the civilizations of the Mediterranean.

The incorporation of new techniques such as radiocarbon dating, geological and archeological surveys, and climatology can signify sudden and extreme shifts in the regions' climate. In the case of the Roman Empire, natural disasters in the form of earthquakes, dust storms, volcanic eruptions, and catastrophic floods were common occurrences.[10] While the adverse effects of these types of disasters might have only caused short term damage to the population, towns, and urban economy of Rome's empire, presumably natural disasters are evidence of contributing factors, and propelling agents of climate change, resulting in the alteration of the Mediterranean's landscape. For example, volcanic activity and floods were responsible for the most serious transformations to the natural environment of the Roman Empire. In the long term, it had significant consequences for the health and demography of its population. River inundation could cause natural environmental degradation as well as modify the landscape of Roman cities and towns by depositing layers of soil sediment, changing the soil chemistry and consistency, and exacerbating issues of drainage and sewage in urban settlements. For example, the Tiber river frequently had instances of severe floods which drastically and permanently altered the landscape of the areas surrounding Rome by depositing soil sediments. Ancient sources written by Tacitus describe the severe floods of the Tiber and the helplessness of Roman citizens and the Roman government to address and manage the problem of river inundation. Tacitus writes,

> In the same year [c. 15 AD], the Tiber, rising under the incessant rains, had flooded the lower levels of the city,

---

[9] Sallares, "Ecology," 20.

[10] Collin P. Elliot, "The Antonine Plague, Climate Change and Local Violence in Roman Egypt," *Past and Present* 231, Issue 1 (May 2016), 3-31; Sallares, "Ecology," 20-21.

> and its subsidence was attended by much destruction of buildings and life… they were reluctant that Tiber himself, bereft of his tributary streams, should flow with diminished majesty. 'Whatever the deciding factor — the prayers of the colonies, the difficulty of the work, or superstition — the motion of Piso, that 'nothing was to be changed', was agreed to.[11]

While the flooding of rivers in the Italian peninsula was a difficult task for its inhabitants to manage and was also left unaddressed due to governmental bureaucracy, it did have the potential to create fertile soil for agricultural production, much like the seasonal inundation of the Nile River valley in Egypt. However, a severe consequence of seasonal and annual floods was that it inevitably changed the landscape of river valleys and coastal plains into marshy, humid wetlands, therefore creating perfect conditions for disease vectors like malaria and other waterborne bacterial and viral illnesses such as typhoid fever and tuberculosis. The abundance of flooded coastal plains and marshlands in the coastal regions of Italy during the Roman Empire aided in the introduction of mosquitoes as a new disease vector causing the prevalence and spread of malaria.[12] Thus, the ecology and climate of Rome's natural environment could be critical to the development of endemic diseases and their ability to spread throughout the empire along trade routes, on shipping vessels, and through military migration.

Volcanic activity present in the later Roman Empire, in the mid-sixth century AD, is another important factor that could have monumentally altered the weather and atmospheric conditions of the Mediterranean climate, creating an ideal environment for the introduction and spread of new disease pathogens. Recent scholarship by historians and climate scientists studying polar ice cores illustrates how an intensification of global volcanic eruptions beginning in the middle of the second and third centuries AD and climaxing in the sixth century AD in the Roman Empire's

---

[11] Tacitus, *Annals*, 1.76, 79; Sallares, "Ecology," 21.

[12] Sallares, "Ecology," 21; Sallares, "Environmental History," 168; Robert Sallares, "Disease," in *A Companion to Mediterranean History*, ed. Peregrine Horden, and Sharon Kinoshita (Oxford: John Wiley & Sons), 250-62.

provinces polluted the atmosphere, changed solar cycles, and decreased the amount of solar energy in the Mediterranean over the course of three to four centuries.[13] Volcanic ash in the atmosphere led to what Colin P. Elliot describes as "global dimming," where atmospheric sulphates linger in the air and affect weather and precipitation patterns, as well as significantly decreasing temperatures for prolonged periods of time.[14] This new colder climate pattern, which was accelerated with a series of massive volcanic eruptions in 536, 540, and 547 AD, effectively ended the cycle of seasonal warm, humid, and dry weather patterns that facilitated population growth and agricultural prosperity. Cooler climate conditions would have shortened the growing and harvesting seasons for food crops and possibly led to periods of famine and malnutrition.[15] Furthermore, the stability of the prior "Roman Warm Period" made the Mediterranean societies of the Roman Empire even more "climatologically" sensitive and vulnerable to the occurrence of sudden climate change, especially in regions such as Egypt. Egypt relied on a precious balance of annual Nile floods, as they were accustomed to more predictable and stable weather patterns.[16] Hence, extreme changes to the environment during the mid to late Roman Empire introduced a period of harsh climate deterioration and what some historians have termed a "mini-ice age" or the "Late Antique Little Ice Age."[17]

This climate disruption coincided with the first emergence of bubonic plague in the Eastern Roman Empire during

---

[13] See C.P. Elliott, "The Antonine Plague, Climate Change and Local Violence in Roman Egypt," *Past & Present* 231, Issue 1 (May 2016), 3–31; Kyle Harper, "How Climate Change and Plague Helped Bring Down the Roman Empire," *Smithsonian Magazine,* December 2017; Michael McCormick, "Radiocarbon Dating the End of Urban Services in a Late Roman Town," *Proceedings of the National Academy of Sciences,* Apr 2019, 8096-8098; Timothy P. Newfield, "Mysterious and Mortiferous Clouds: The Climate Cooling and Disease Burden of Late Antiquity," *Late Antique Archaeology* 12, Vol 1 (2016), 89-115; Penny Sarchet, "125-Year Mini-Ice Age Linked to the Plague and Fall of Empires," *NewScientist* 3060 (February 2016); and Stathakopoulos, *Famine and Pestilence.*

[14] Elliott, "The Antonine Plague," 19-20.

[15] Sarchet, "125-Year Mini-Ice Age."

[16] Elliott, "The Antonine Plague," 22.

[17] Harper, "How Climate Change and Plague," 15.

the age of Emperor Justinian (527 – 565 AD). According to historian Doug Lee, "such climatic disruption could have contributed to the movement of plague-bearing rodents into the empire."[18] Like the catastrophic floods which brought mosquitoes into the Italian peninsula, the volcanic eruptions and resulting environmental stressors contributed to the conditions necessary for the migration of new animal species. For example, the black rat (*Rattus rattus*), proved to be the host of a deadly new disease pathogen, *Yersinia pestis* or bubonic plague.

While there is very little primary source documentation for anthropogenic climate change in the Roman Empire during the second to sixth centuries AD, it is not hard to imagine that an empire which was continually growing in geographical and population size would engage in technological and productive activity that would evolve and modify their natural environment. Prime examples include architectural industry, such as the Roman aqueducts used to deliver water to bath complexes and sewer systems in the increasing urban metropolises of the Roman Empire, mining in rock quarries to obtain marble, and large deforestation projects, to support the lumber industry. Additionally, during the early Imperial period of the second and first century BC, models show that high levels of metal pollution were created from silver mines to increase the money supply in the Roman Empire.[19] Harper reminds us that, "the Romans did not just modify landscapes; they imposed their will upon them. They slashed and burned forests. They moved rivers and drained basins and built roads through the most intractable swamps."[20] Thus, the ecology of the Mediterranean and the territory of Rome's empire was fundamentally affected not only by climate change but by human activity of empire building. This resulted in repercussions of ecological modification, evolution, and degradation, with the worst among them the creation of new infectious disease ecologies.

---

[18] Sarchet, "125-Year Mini-Ice Age."

[19] See Willem M. Jongman, "Gibbon was Right: The Decline and Fall of the Roman Economy," in *Crises and the Roman Empire: Proceedings of the Seventh Workshop of the International Network Impact of Empire, Nijmegen, June 20-24, 2006*, ed. O. Hekster, G. de Kleijn, and Daniëlle Slootjes, (Boston: Brill, 2007), 189, Graph 2.

[20] Harper, *The Fate of Rome*, 17.

It would be misleading to judge the Roman Empire's size and success before its decline in the western part of its empire in the fifth century AD as an indicator of the health of its citizens and population. Realistically, the ancient civilizations of the Mediterranean, including the Roman Empire, "suffered from a substantial disease burden, consisting of both endemic and epidemic diseases."[21] The urban and rural populations of the ancient Mediterranean were under the constant threat of contracting harmful and potentially fatal bacteria and infectious viral pathogens. Therefore, the populations of the Greco-Roman world had a high mortality rate, although this was counteracted by a high fertility rate.[22] Infant mortality was also very high for various reasons that this article will not address, but poor sanitation, contaminated food, and infectious diseases made the mortality rates of adults just as critical. During Rome's empire, the life expectancy for an average adult member of the Roman elite was thirty-seven years. Variations, of course, existed, but the "Scheidel model" of life-expectancy demonstrates that the ecological and urban environment of the Roman Empire was not necessarily conducive to prolonged life. [23]

Historian Dionysios Stathakopoulos helps define the three types of infectious disease outbreaks which occurred in Rome's empire. He states that "endemic" disease in the geographical territory of the Mediterranean and the Roman Empire was a result of the constant occurrence of an infectious pathogen in a particular location or population with "geographical but not chronological limitations." [24] Disease epidemics are cases where a massive and unexpected explosion of a location and time-limited pathogen arose in a human population. An example of this would be the

---

[21] Sallares, "Ecology," 34.

[22] Walter Scheidel, "Demography," in *The Cambridge Economic History of the Greco-Roman World*, ed. Scheidel, Ian Morris, and Richard P. Saller, (Cambridge: Cambridge University Press, 2007).

[23] Walter Scheidel is one of the leading demographers in the field of Greco-Roman history. Walter Scheidel, "Roman Wellbeing and the Economic Consequences of the 'Antonine Plague," *Princeton/Stanford Working Papers in Classics*, SSRN Electronic Journal (2009), 4. Scheidel notes that he revised an early model of his life-expectancy table (1999), which had a lower mean age for life expectancy based on the research and model of Robert Woods (2007).

[24] Stathakopoulos, *Famine and Pestilence*, 5.

introduction of smallpox to the Roman population during the Antonine Plague of 165 – 180 AD. Stathakopoulos also notes that pandemics, while rare in the ancient Mediterranean and Europe during the Roman Empire, were catastrophic events because pandemics ultimately do have chronological limitations but no geographical boundaries. As a result, the widespread capabilities of a disease pandemic in the largely "globalized" Greco-Roman and pre-modern world of the later Roman Empire and Late Antiquity period had devastating effects on civilizations and communities already laden with widespread disease.

The most prevalent endemic disease during the Roman Empire was malaria. In considering the disease ecology of the ancient Mediterranean, malaria is important because it is a temperature and climate-dependent disease. Malaria primarily affected the regions of the Mediterranean during the summer and autumn seasons and in geographical locations near water or marshy areas due to floods and climate change. Greece, Italy, and settlements along the Nile River valley in Egypt were especially prone to widespread outbreaks of malaria and the sizable amounts of deaths that accompanied the disease. Eventually, communities with endemic malarial disease developed immunity in adults, though infants and children remained at high levels of risk.[25] Nevertheless, Stathakopoulos indicates that "immigrants or intruders [as in the case of 'barbarian invasions'] would be at greater risk of becoming infected with malaria than indigenous populations, who had developed partial immunity to the disease due to constant reinfection."[26] Galen, a Greek physician and writer in the second century AD in the style of Hippocrates, provides insight into the nature of malarial fever, its common occurrence, and the ability for an individual to have multiple or "mixed" infections. Galen wrote, "That there is such a fever, as I have stated, does not require the evidence of Hippocrates or anyone else as a witness, since we observe it every day, especially at Rome. For just as other diseases are common in other places, so this evil

[25] See Sallares, "Ecology," 35, for climate-dependent occurrences of malaria; he further discusses the impact of malaria in the Mediterranean in "Disease."
[26] Stathakopoulos, *Famine and Pestilence*, 102.

is frequent in this city."[27] Galen's description indicates a "diversity of urban mortality patterns in the ancient world."[28]

Furthermore, the most significant aspect of endemic malarial disease in antiquity is that in places such as central Italy, malaria interacted with other diseases such as respiratory and intestinal pathogens to create new "ecological communities of disease pathogens."[29] This is considerable because not only did malaria reduce the life expectancy of both infants and adults, but in areas where malaria was endemic or constantly recurring, the human population could have continual malarial reinfections while at the same time suffer from other bacterial or viral diseases. Therefore, in the Roman Empire this could be extremely harmful to public health and society, especially considering that human populations, as in the case of the societies of the ancient Mediterranean and Rome, were constantly on the move. The increased connections between different territories through the travel of armies, merchants, slaves, etc. led to the spread of both carriers of disease and the occurrence of multiple viral and bacterial pathogens in communities. Within the large populations of the Mediterranean, the creation of these "pathogen communities" severely impacted the demographics and success of agrarian-based economies and played a significant role in the trajectory of a civilization's history.[30]

For example, when considering the impact of malaria, a climate-dependent disease pathogen, on populations in the Roman Empire it is important to consider how this endemic disease would have influenced human migratory and settlement patterns, have harmful effects on the agricultural labor force in certain areas, and consequently create a regional disparity in food production and wealth. This would eventually lead to possible large scale subsistence crises, a consequence of not only dramatic shifts in the demography of a region but also in the nutrition and overall health and well-being of an area's population. There is a general consensus amongst scholars that the disease ecologies that were

---

[27] Galen, *7.453K* quoted in Robert Sallares, *Malaria and Rome: A History of Malaria in Ancient Italy* (New York: Oxford University Press, 2002), 222.
[28] Sallares, "Environmental History," 173.
[29] Sallares, "Ecology," 35.
[30] Sallares, "Disease," 252.

created by overlapping infectious pathogens would have facilitated greater risk and poorer health in cities as opposed to smaller rural communities. However, given the amount of increased urbanization in antiquity, especially during the Roman Imperial and Late Antiquity period, it is observable how this would lead to the model conditions needed for "acute infectious" and epidemic diseases which are "density dependent" to spread. Diseases such as dysentery, smallpox, typhus, tuberculosis, and eventually bubonic plague (*Yersinia pestis*) would spread rapidly in highly populated urban areas and have the capability to reach pandemic levels of disease transmission.[31] Given the evidence of a significant level of climate change towards the end of the Later Roman Empire, it could be deduced that disease ecologies similar to malaria possibly increased in frequency and severity, causing a decline in Rome's empire due to an even greater increase in overall mortality rates and demographic crisis.

The Roman Empire suffered three major disease pandemics: the Antonine Plague (165 – AD 180), The Plague of Cyprian (250 – 270 AD), and the Plague of Justinian (541 – 549 AD). The first recorded pandemic by authors in antiquity is the Antonine Plague. One of the primary witnesses, the Greek physician Galen who wrote in the second century, sometimes lends his name to the epidemic as the "Plague of Galen" because of his descriptions of plague victims.[32] During the reign of the co-emperors Marcus Aurelius "Antoninus" (160 – 180 AD) and Lucius Verus (161 – 169 AD), a plague epidemic swept through the Roman Empire, beginning with the infection of the Roman army under the command of Verus. Roman soldiers were returning to Rome from a Parthian military campaign in the East near Antioch when the disease began to spread, making the Roman army the likely main disease vector to the rest of the empire.[33] Galen, in his book *Methodus medendi* or *The Method of Medicine*, describes the symptoms of the sickness.

---

[31] Sallares, "Ecology," 36-37; Stathakopoulos, *Famine and Pestilence,* 94-102.
[32] Rodney Stark, "Epidemics, Networks, and Conversion," in *The Rise of Christianity: A Sociologist Reconsiders History* (Princeton: Princeton University Press, 1996), 76.
[33] Harper, *The Fate of Rome*, 64.

> On the ninth day a certain young man was covered over his whole body by an exanthem [rash], as was the case with nearly all who survived… In those who were going to survive who had diarrhea, a black exanthem appeared over the whole body. It was ulcerated in most cases and dry… The blackness was due to a remnant of blood which had putrefied in the fever blisters.[34]

In addition to the rash of ulcerated fever blisters, other symptoms included fever, black excrement, vomiting, foul breath, and nausea. While fragmentary and not particularly specific in all his descriptions, historians have used Galen's diagnoses to conclude that the Antonine Plague was the introduction of smallpox into the Roman Empire's populace. The virus traveled westward through the empire, reaching Egypt first until it spread into Greece, the city of Rome, and the other westernmost parts of Rome's territory. After the Antonine Plague's initial waves during the latter half of the second century AD, where Rome was at the height of its imperial power, it is estimated that the population of the Roman Empire was seventy-five million people.[35]

The impact of the Antonine Plague on the depletion of Rome's population is still an issue of scholarly debate. Some scholars have argued that the mortality rate was as low as one to two percent while others have proposed as high as fifty to sixty percent, arguing that the smallpox disease was a "novel" pathogen and no prior immunity existed among the Roman populace.[36] However, some historians such as Stathakopoulos disagree with this argument and suggest that instances of smallpox could have existed earlier in areas of the Mediterranean prior to the 160s AD, citing evidence from Babylonian disease incantations and Thucydides' description of the plague in Athens in 430 BC.[37]

---

[34] Galen, *Methodus medendi* 5.12—Kühn 10.360ff and 10.367, in R.J. Littman and M.L. Littman, "Galen and the Antonine Plague," *American Journal of Philology* 94, No. 3 (1973), 243-55.
[35] Harper, *The Fate of Rome,* 10.
[36] Christer Bruun, "The Antonine Plague and the 'Third-Century Crisis,'" in *Crises and the Roman Empire: Proceedings of the Seventh Workshop of the International Network Impact of Empire, Nijmegen, June 20-24, 2006,* ed. O. Hekster, G. de Kleijn, and Daniëlle Slootjes, (Boston: Brill, 2007).
[37] Stathakopoulos, *Famine and Pestilence,* 94-95.

Stathakopoulos argues that there may have been smaller outbreaks of smallpox in areas of the Mediterranean basin before the second-century outbreak, which later turned into the Antonine Plague pandemic. Nonetheless, the consensus among scholars regarding the mortality rate of the Roman population during the Antonine Plague is somewhere between twenty-five to thirty percent of the total population.[38] Regardless of the true extent of the mortality rates, most historians and demographers agree that the decline in the population of the Roman Empire after the Antonine Plague was "widespread and catastrophic," with historians such as Harper presenting a concrete number of seven million deaths but acknowledging that even that number is too low.[39]

The Antonine Plague pandemic illuminates two main points of significance. First, evidence indicates that the initial wave of mass spread took place in colder winter months, and the severity of the pandemic could have been exacerbated by other factors such as climate and subsistence insecurities. Additionally, colder weather during winter months combined with low rates of rainfall are the conditions especially favorable to the spread of smallpox. Galen describing the plague at Aquileia in 168/9 AD, said, "most of us died, not merely from the plague, but because the epidemic was happening in the depths of winter."[40] There is also evidence that the death toll was exceptionally high in Egypt during the months of January and February in 179 AD.[41] Stathakopoulos' study of epidemic diseases records their seasonality in a graph which accompanies his catalog recording all disease and subsistence episodes from 284 – 750 AD.[42] The graph shows that out of twenty-eight occurrences of disease epidemics, the two seasons with the highest peaks in cases are winter and

---

[38] R.P. Duncan Jones, "The Impact of the Antonine Plague," *Journal of Roman Archaeology* 9 (1996), 108-36; Jongman, "Gibbon was Right;" Sallares, "Environmental History;" Scheidel, "Roman Wellbeing;" Stark, "Epidemics, Networks, and Conversion" citing McNeill (1976); Stathakopoulos, *Famine and Pestilence*.

[39] Stathakopoulos, *Famine and Pestilence,* 95; Harper, *The Fate of Rome,* 18.

[40] Duncan Jones, "The Impact of the Antonine Plague," 44, citing Galen, 19, 17-18 Kuhn.

[41] Duncan Jones, "The Antonine Plague Revisited," 44; see also for the ecological factors that are favorable for the spread of smallpox.

[42] See Table 5.1 in Stathakopoulos, *Famine and Pestilence*, 90.

summer. This data further substantiates the theories of historians and climatologists who link the prevalence or severity of disease ecology and their pathogens to climate.

Secondly, the Antonine Plague as the first recorded instance of a pandemic in Imperial Rome reveals that the plague was the first in a series of "exogenous" shocks to the demography of the Roman Empire. Scholars across the board agree, though with varying levels of severity, that the general consequences of the Antonine pandemic included a drastic reduction in the military and the availability of new army recruits, a staple of Roman imperial power. It also caused a sharp decline in tax collection and government revenue, which fostered high rates of inflation, and a noticeable decline in the members of the bureaucracy and merchant class across all hierarchical levels, including emperors. Lastly, the most adverse consequence saw a stark decrease in landowners, farmers, and agricultural workers (slaves). As a result, there were not enough people left alive in rural provinces to work and farm the large amounts of land necessary to provide enough food crops. Therefore, as a result of fewer supplies, there was a bleak period of food insecurity which caused the inflation of food prices. This subsistence crisis led to higher levels of malnutrition and poorer health, as most of the Roman populace had limited access to affordable or "safe" food, resulting in an increase in disease vulnerability to future pathogens and outbreaks. Unfortunately, that is exactly the consequence that historical analysis points to almost a century later during the next wave of plague, the "Cyprian Plague."

Approximately a century after the Antonine Plague, circa 249/250 AD, another plague erupted in the regions of North Africa and spread throughout the Roman Empire, eventually reaching the city of Rome.[43] The pathogen of unknown origins is named after Cyprian, the Bishop of Carthage (~200 – 258 AD), whose ecclesiastical writings are the main source of literary evidence. Due to a lack of archeological and scientific evidence, historians rely on detailed descriptions of contemporary accounts, mostly written by Christian authors such as Dionysius of Alexandria,

[43] Stark, "Epidemics, Networks, and Conversion," 77; Kyle Harper, "Pandemics and Passages to Late Antiquity: Rethinking the Plague of C.249–270 Described by Cyprian," *Journal of Roman Archaeology* 28 (2015), 223-60.

Pontius of Carthage, and Eusebius (who wrote slightly later).[44] However, the plague descriptions are embedded in "apocalyptic" styled writing and are religious propaganda of Christian sermons that encouraged faith and compassionate Christian service. One passage describes the disease while also lamenting the fact that the virus killed both Christians and pagans indiscriminately. Cyprian writes,

> The pain in the eyes, the attack of the fevers, and the ailment of all the limbs are the same among us and among the others, so long as we share the common flesh of this age… as the strength of the body is dissolved, the bowels dissipate in a flow; a fire that begins in the inmost depths [marrow] burns up into wounds in the throat; that the intestines are shaken with continuous vomiting; that the eyes are set on fire from the force of the blood; that the infection of the deadly putrefaction cuts off the feet or other extremities… hearing is blocked, or the vision is blinded.[45]

Based on this description, theories on the pathogen that caused the Cyprian Plague include some form of hemorrhagic fever and possibly Ebola.[46] Some scholarly theories suggest other possible disease pathogens such as an early type of measles or another outbreak of smallpox.[47] However, in Kyle Harper's recent article, he states that "The disease was of exotic origin and moved from southeast to northwest. It spread, over the course of two or three years, from Alexandria to other major coastal centers. The pandemic struck far and wide, in settlements large and small, deep into the interior of the empire." Harper goes on to describe how the Plague of Cyprian differed from previous outbreaks of epidemic disease by proving to be unusually persistent and breaking the cycle of climate dependent occurrences and the

---

[44] Harper, "Pandemics and Passages," 223-260.
[45] Cypian, *De Mort*, 8 in Harper, "Pandemics and Passages," 229.
[46] Harper, "Pandemics and Passages," 224; Kyle Harper, "Solving the Mystery of Ancient Roman Plague," *The Atlantic*, November 2017.
[47] Stathakopoulos, *Famine and Pestilence* argues for smallpox; William H. McNeill, *Plagues and People* (Garden City: Anchor Books, 1976) proposes measles.

typical "seasonality of death in the Roman Empire." Unlike the Antonine Plague, which was the most severe in winter and summer, the Cyprian pandemic started in autumn and continued until the following summer. Furthermore, according to Harper, "the pestilence was indiscriminate; it struck regardless of age, sex, or station. The disease invaded 'every house.'"[48] This seems to confirm the possibility of a far more infectious pathogen such as an Ebola-type disease. The break in the climate pattern, as well as its high transmission rate amongst various ages of the population, could suggest a pathogen unknown to that region of the Mediterranean during the third century.

Additionally, the contemporary writer Dionysus of Alexandria indicated that the disease had a high mortality rate, a factor that was unclear with the Antonine Plague and in the writings of Galen. Dionysus wrote a report on the plague and is credited with acknowledging that "at its height, five thousand people a day were reported to have died in the city of Rome alone," as well as two-thirds, or sixty-two percent of the population in Alexandria.[49] The limitation in scientific evidence makes it difficult to validate the literary accounts. However, the fact that Christian writers made it a point to acknowledge the high death rate in contrast to that of their pagan counterparts provides more credibility to the veracity of the contemporary accounts. However, exaggeration in the Christian texts should be considered in respect to motives of religious propaganda.

Analysis of the Plague of Cyprian is important for several reasons. First, contemporary anecdotes of the Cyprian Plague illuminate the religious tensions between Christians and pagans during a serious pandemic in the third century AD, a period already experiencing serious societal and population pressures in Imperial Rome. The "Crisis of the Third Century," where military and social anarchy nearly collapsed Rome's empire, was exacerbated by religious tensions and the steady rise of Christianity. A "crisis of faith" amongst different sects of the populace could have significantly contributed to the civil unrest that was taking place due to political, economic, and social

[48] Kyle Harper, "Solving the Mystery of Ancient Roman Plague."
[49] Stark, "Epidemics, Networks, and Conversion," 77; Harper "Pandemics and Passages," 244-245.

upheavals.[50] If one factors in the massive amount of death as a result of a serious and infectious viral pathogen on top of an already violent period in Rome's history, the demographic ramifications for Rome's population must have been nearly apocalyptic, making the Roman Empire extremely vulnerable to the invading Germanic tribes. Thus, if Christians appear to be more charitable to the sick through convalescence and prayer during a deadly pandemic, this could have helped recruit more followers and shifted the balance in Christianity's favor, placing even more pressure on pagans experiencing an ongoing crisis of religious ideology and freedom.[51]

Furthermore, as Harper proposes, if the pathogen that infected the Roman population to an extremely high degree during the Plague of Cyprian were a type of hemorrhagic fever similar to Ebola, it would indicate that the disease which caused the pandemic was possibly a pathogen of zoonotic origin, a virus that was able to jump from a non-human animal host to a human population. If this were the case, it would have compelling significance for historians reexamining the first documented and scientifically verified case of a zoonotic pathogen in Late Antiquity, the Plague of Justinian beginning in 541 AD. If this hypothesis were accurate, it would mean that the disease burden of the Imperial to the Later Roman Empire was even greater than previously thought and had larger long-term consequences for the economic solvency of the empire.[52] Moreover, the demographic repercussions of having close to two centuries of epidemic pathogens with the potential for pandemic outbreaks in a civiliza-

---

[50] For an overview of religious tension between Jews, early Christians, and Pagans, see section "Religious and Cultural Life in the 3rd Century" in E.D. Townsend Vermeule, et. al. "Ancient Rome." *Encyclopedia Britannica*, (Accessed Oct. 2020); Graeme Clarke, "Third-Century Christianity," in *The Cambridge Ancient History, vol. XII: The Crisis of Empire,* eds. Alan Bowman, Averil Cameron, and Peter Garnsey (Cambridge: Cambridge University Press, 2005); and Tacitus, *Annals*, 15.44. Tacitus provides insight into the early origins of religious persecution in the Roman Empire beginning around the 1st and 2nd century AD.

[51] Rodney Stark argues this theory in detail in *The Rise of Christianity: How the Obscure, Marginal Jesus Movement Became the Dominant Religious Force in the Western World in a Few Centuries* (Princeton: Princeton University Press, 1997).

[52] Sallares, "Disease," 258.

tion's populace would certainly involve a prolonged period of multi-level subsistence catastrophes in all sectors of social order: political, military, economic, agricultural production, and health.

Briefly, the Plague of Justinian occurred after the fall of the Western Roman Empire during the reign of Emperor Justinian (527-565 AD). The first wave began in 541 AD with an outbreak at the port of Pelusium in eastern Egypt according to contemporary writer Procopius' account in his *Histories of the Wars*.[53] The plague potentially arrived on ships bringing grain from the Egyptian provinces. Procopius wrote:

> It started from the Egyptians who dwell in Pelusium. Then it divided and moved in one direction towards Alexandria and the rest of Egypt, and in the other direction it came to Palestine on the borders of Egypt… and from there it spread over the whole world, always moving forward and travelling at times favorable to it… And this disease always took its start from the coast, and from there went up to the interior.

However, it is difficult to verify the plague's origins to this region as the association of disease arriving from Egypt, or more generally Africa, to other locations in the Mediterranean and Europe was a common literary trope following in the tradition of Thucydides in classical Greco-Roman texts.[54]

Procopius highlighted two things of importance when describing the scope and severity of the Plague of Justinian. Procopius wrote:

> During these times there was a pestilence, by which the whole human race came near to being annihilated. Now in the case of all other scourges sent from heaven… it did not come in a part of the world nor upon certain men, nor

[53] Procopius, *Book II*, xxii-xxxiii from *History of the Wars*, 7 Vols., trans. H. B. Dewing, (Cambridge: Harvard University Press, 1914).

[54] Thucydides credits the origin of the Plague of Athens (430 BC- 426 BC) during the Peloponnesian War to Ethiopia or "upper Egypt." The plague of Athens recorded by Thucydides is the first surviving written account of a disease epidemic by an ancient Greek author. Thucydides, *History of the Peloponnesian War*, Book 2.48.1-3.

> did it confine itself to any season of the year… but it embraced the entire world and blighted the lives of all men.[55]

Procopius' words suggest that the inhabitants of the Roman Empire were used to the frequent occurrence of diseases, some throughout the year; but unlike other "scourges sent from heaven," this disease not only spread over the entirety of his world but could not be contained and was unlike anything else the Roman population had witnessed before. Procopius also strongly emphasizes the demographic repercussions of the bubonic plague, which must have devastated the populations of the Mediterranean and the Eastern Roman Empire: "the whole human race came near to being annihilated." The bubonic plague, which began with the Plague of Justinian, continued to ravage the inhabitants of the Mediterranean, Europe, and the territory of the Byzantine Empire in at least seventeen subsequent waves until approximately 750 AD, reappearing approximately six centuries later in Europe during the "Black Death" of the fourteenth century.[56]

Recent archaeological evidence in the form of radiocarbon dating and DNA extraction from gravesites has confirmed the long-held belief that the Plague of Justinian was, in fact, the first case of bubonic plague, the deadly bacteria carried by rodent disease vectors and transferred to humans through fleas, during the sixth century of the Eastern Roman Empire.[57] For historians of ancient history, this is significant to understanding the disease pathology of the Late Antiquity period. It illuminates how disease vectors such as the black rat migrated out of its natural or indigenous environment due to human behavior and climate change. Like malaria, the bubonic plague would become an endemic disease, one that started as a new disruptive invasion with the migration of the black rat from Asia into the Mediterranean and eventually Europe. The culprit responsible for this new "pathogenesis" or pathogen development was arguably

---

[55] Procopius, *Book II*, xxii-xxxiii.
[56] Stathakopoulos, *Famine and Pestilence.*
[57] Kyle Harper, "How Climate Change and Plague;" Sallares, "Disease," 254-255; Caroline Wazer, "The Plagues That Might Have Brought Down the Roman Empire," *The Atlantic*, March 2016.

the hyper-"globalized" and increasingly interconnected environment of Rome's vast empire.

In conclusion**,** the Roman Empire is just one example, in the larger context of the earth, space, and time, of how human civilizations shape the ecology of their habitats. When societies' aggressive social and urban developments encroach on areas of their natural environment, it can lead to unintended clashes with dangerous microorganisms, therefore creating lethal disease ecologies which substantially affect their populations. [58] For all civilizations, nature generates a certain level of vulnerability, and humans' natural environment is in a constantly precarious state of flux. How climate and human behavior shapes the environment can have either beneficial or severely damaging consequences for the civilizations that are dependent on their ecological habitats.

Disease pandemics on the scale of the Antonine, Cyprian, and Justinian plagues might have been rare occurrences, but the amount of time in which the diseases of smallpox, hemorrhagic fevers, and the bubonic plague ravaged the populations of Rome's empire demonstrates the immense vulnerability the Roman civilization had. Disease was so frequent and rampant that the Romans normalized the various health disorders, such as malaria and other gastro-intestinal disorders, which affected its society, only recording instances of epidemic or pandemic proportions when a new disease or massive amounts of death took place. However, a civilization's empire cannot be sustained if its citizens and inhabitants are unhealthy. Rome's downfall could conceivably be due to the slow and very long process of waves of demographic contraction in a society where the probability of death was very high.

In the United States, behavior which undermines a national response to the COVID-19 global health crisis stems from a lack of government leadership by the former president, Donald Trump, who lied to the public, discouraged mask-wearing, and incited his political supporters to dissent, leading to political violence, social unrest, and an insurrection. Civil discord and fears of a severe economic recession have taken precedence over federal and state measures to protect the citizenry from the spread

[58] Harper, *The Fate of Rome,* see especially Introduction, 16.

of the potentially deadly disease. Preoccupation with government-led economic stimulus initiatives designed to help stave off an economic depression, has taken priority over the underlying ecological factors which caused the pandemic. Public officials and news reports give scarce attention to how viral diseases can enter and spread so extensively among human populations due to environmental stressors. Furthermore, in the US, mainstream media and government analysis has largely ignored the reasons why human populations were made vulnerable by a viral epidemic and ill-prepared to respond to the challenges it would place on society.

Traditional historical discourse would result in most scholars and historians recording the events surrounding the developments of 2020's pandemic with a primary focus on the political, social, economic, and cultural repercussions of a viral epidemic. However, what is needed is more interdisciplinary and comparative methods of social analysis and historiography: studies that will give attention to the importance of ecology, demography, the effects of climate change, and environmental degradation on human populations. These topics not only affect society in fundamental ways but they also have significant implications for our health and economies and are of pressing concern for civilizations' future. Environmental epidemics have the capacity to severely impact economic production, labor, and market behavior, while also dramatically shifting the behavior and culture of society's inhabitants. Population pressures in the form of subsistence crises like extreme weather patterns, disease pandemics, spikes in mortality rates, and food and health insecurity can have irreversible consequences for the course of a civilization's progression.

How should history be recorded? It is argued that the focus on the factors that profoundly affect humans' ecological environment and the quality of their lives is one way to interpret the true success of a civilization. While dangerous microorganisms, disease, and subsistence crises have existed for millennia and will continue to occur, it is human behavior that can determine the impact the environment has on society. If the coronavirus pandemic can teach our society anything, it is that in this age of hyper-globalization and increased interconnectedness among the

world's animal and human populations, it would be unwise not to pay attention to or record the ways in which our interaction with the natural environment can leave our modern civilization vulnerable.