

The Overarching Concept Behind Civilizations' Collapse

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Abstract:

Civilizations are known to collapse from a variety of causes—foreign invasions, internal conflicts, disease outbreaks, etc—but there is a crucial and shared concept that brought many civilizations to the brink of collapse: environmental and ecological impacts. Following Joseph Tainter's overarching theory, the paper examines the outcomes of unsustainability by using the Roman Empire's legacy as a representational example. The social and structural aspects of Rome and an illustration of its geographic and climatic circumstances were all discussed intricately to portray a full picture of not only the moment of collapse but also the nescient decisions that led Rome to the brink of collapse. In the end, Rome's case was brought to close comparison with the global modern civilization that we have today. This historical paper serves not only as an attempt to recapture the lessons of the past but also as a call to action for the future.

Keywords: Civilizations' Collapse, Rome's fall, Tainter's Theory, Environmental and Ecological Impacts

1. Introduction

On April 21, AD 248, Rome celebrated its one-thousandth birthday. Already embellished with its ubiquitous marble monuments, triumphal arches, and golden-roofed temples, Rome appeared even more magnificent with flowers and banners. All over the empire, every social class eagerly queued to attend the gala, proving the quarter million seats at the Circus Maximus and the Coliseum's capacity of 50,000 to be inadequate.¹ For three days and nights, circuses carried games of every kind, and the haze of burnt offerings filled the streets. The *ludi saeculares*, or century games, summoned forth an "exotic menagerie," assembled by the tri-continental empire to then be massacred.^{2,3} The festival was a stage-crafted demon-

stration of the Roman Empire's surplus resources, highly developed social structures and physical features, and enormous population. However, little did contemporaries know they were witnessing the last secular games of Rome, and an alien world awaited them.

The Romans' glee at the fancy gala and yet their nescience of the forthcoming collapse set forth a dramatic irony that raises two insightful questions: What causes these civilizations to collapse, and is our own trodding toward the brink of crumple?⁴ Two terms, "civilization" and "collapse," are worth elaboration. In this work, a civilization is a socially stratified society with a centralized organization to regulate various social roles, where surplus resources bring

extraneous objects irrelevant to survival, such as literature and art. A collapse, on the other hand, occurs when civilizations encounter a rapid decline of an established level of socio-politico-economic complexity and usually population.⁵ By these two definitions, many civilizations collapsed: the Roman Empire, the Classic Lowland Maya, and the Hittite Empire are several examples. While they differ in location, environmental and ecological factors were significant causal factors for the collapse of all these complex societies.⁶ Is this a coincidence?

Before discussing environmental aspects in detail, it is worth mentioning Dr. Joseph Tainter's overarching theory in his book *The Collapse of Complex Societies*, which postulates that the more complex a civilization is, the more it costs to maintain that complexity.⁷ In other words, when the least costly solutions to perceived needs, such as resources and order, are progressively exhausted, more costly responses must meet any further need for increased complexity. Also, a high expense will be required to sustain the existing level of sophistication.⁸ Tainter believes that civilizations ultimately collapse on their own success. The environmental and ecological hazards that lead to the collapse of civilizations remain cohesive with Tainter's theory. First, natural resources, such as land, are limited, so there is only a finite amount of resources to uphold a civilization's complexity. Second, an increase in complexity carries ecological costs. Robert Malthus offered great examples of these points, describing the relationship between population and well-being as inverse due to limited land and nutrition and emphasizing how unrestricted growth inevitably brings epidemics and pestilence.⁹ Malthus's theory constructs ecological catastrophe as the fate of human development. The third aspect relates to the ability of environmental issues to force the demand for complexity investments and make them costly. All these aspects were showcased by Rome, whose history serves as a vivid example of how environmental and ecological issues, specifically the lack of resources, climate change, and disease, together with their resulting complexity perils, drive civilizations toward the brink of collapse.¹⁰ Using the Roman Empire's legacy as a representational example, this paper examines how environmental and ecological issues are a shared medium for the collapse of civilizations and will be for our own—if no action is taken.

2. The Rise of an Empire

Going back from the secular games of 248 AD to the very foundation of the city of Rome, an agglomeration of typical Iron Age huts existed along the hilly banks of the Tiber River. Soon, the Romans stepped forcefully into the

imperial space established by Hellenistic kingdoms; its development was sudden from incessant conquests. The state budget rose by 70% when General Pompey defeated Syria and doubled with Pergamon's annexation in 130 BC. The value of gold in Rome fell by 36% when Julius Caesar conquered Gaul, and in 167 BC, the Romans captured the Macedonian treasury and eliminated taxation for themselves.¹¹ The Romans' era of pillaging other provinces for loot essentially boosted their own complexity by expanding military services, opening pathways to citizenship, forming various hierarchies, encompassing a broad spectrum of arts, and being nonpareil in civil engineering. The empire had a positive feedback system: more conquests gave more wealth, which offered more development that then needed to be sustained by more conquests. Resources, however, are limited. Since conquests required much preparation and resources, the expanding empire soon ran out of profitable ones. As a result, an imperial structure built on the income of conquest now had to sustain itself through taxes. Since Rome was built as an agrarian tributary empire, agricultural taxes became approximately 90% of the government budget.¹² With subsistence farmers producing little surplus, repeated fiscal crises occurred during the first two centuries AD.¹³ Although insignificant to the civilization's survival, these setbacks, deeply rooted in limited resources, hinted at the empire's unsustainable foundation.

It was no idle boast for Romans to call the sea *mare nostrum*, "our sea," when Augustus brought the last stretches of Mediterranean shoreline under Roman domain. The Mediterranean Sea became the empire's core, and it was a patchwork of microclimates.¹⁴ The western territories were subject to the influence of Atlantic patterns, which regulated the storms of critical rains passing into the Mediterranean; the Eastern Mediterranean included the sweep of westerlies from the Atlantic, influencing winter precipitation levels; and Egypt, the empire's breadbasket, had the life-bringing Nile floods watered by the Indian Ocean monsoons.

At that time, the empire had the wholehearted support of the climate. During the "Roman Climate Optimum," the Mediterranean had an unusually warm, wet, and stable climate. The heat was matched with moisture in the West; Spain and Italy appear to have been well-watered, and the sacred floods of the Nile River revealed a period of astonishing dependability to local agriculture.¹⁵

The Romans' success had another accomplice: innovation. Utilizing accumulated Indigenous knowledge and risk-management techniques, the engineers of the Roman Empire devised machinery to supply food and manage water, monitored grain production along the banks of the Nile as a safeguard against climate fluctuations, and

constructed public granaries to provide another margin of protection. The hallmark of their innovation was the development of intricate networks of roads and sea lanes that interconnected the empire, allowing the movement of bulk goods and resources to sustain the already complex society. Innovation and luck enabled the Romans to outrun Malthus's reaper.

3. Rome's Collapse

However, things took a turn when the empire's growing population soon crowded the continents. The inadvertent consequence of more people across a limited area of land was a more insalubrious environment. In Cicero's letters to his friend Tiro, he showed a deep concern for Tiro's "low diet and purgatives" and shared his unease with "the ravages of the disease" that spanned across the empire.¹⁶ Yet, this period was what Edward Gibbon called the "most happy and prosperous [era]."¹⁷ With the gift of hindsight, we might look upon the arc of development and the happiest age and see not a lurking principle of decay waiting to be unwinded but a civilization whose cumulative ecological pressure from urban density and imperial connectivity, entailed by the very terms of complexity itself, was compelled to approach its destiny.

In the middle of AD 160, a pestilence arose in the east through Rome's bustling Red Sea trade. The Antonine Plague was highly contagious and lethal, spreading, ironically, along the very networks that held the empire together. Signs of the plague were ubiquitous, and invocations to Apollo, the diverter of plague, appeared across the empire. In a cruel coincidence, a massive volcanic eruption in AD 169 ended the "Roman Climate Optimum." The western and eastern territories experienced a lack of precipitation, but most severely, the Nile waters failed to rise: the contemporary bishop of Alexandria described the Nile riverbed as drier than a desert.¹⁸ As a result of declining irrigation and yet a growing population, food became scarce, and the balance of nature tilted. In AD 246, a provincial official in the Oxyrhynchite district of Egypt was grabbing wheat at shockingly high prices, implying acute desperation.¹⁹ The repercussions of a catastrophic resource crisis in Egypt could be felt empire-wide.

A few generations after the first virus, the Romans experienced a second wave of pandemic disease—the Plague of Cyprian. For nearly twenty years, it blazed sporadically across the Roman world, infecting both towns and villages and "destroyed whatever was left of mankind," according to Zosimus.²⁰

With an increase in ecological pressures and the heavy burdens they brought, the Romans attempted to preserve the empire by conducting reforms. During the reigns of

Diocletian and Constantine, they subdivided provinces to control rebellions, expanded the size of government, increased capital, and doubled the size of the army to foster influence.²¹ As a result, complexity heavily increased as bureaucracy increased by 13,000 employees and as multiple capitol meant additional social structures. The implementation of these practices was not without costs: the government demanded heavy taxes on peasants. However, since the empire's intensive deforestation and unsustainable farming led to soil erosion and decreased crop yields, the peasants who tried to meet demands by pressuring the barren lands for more resources began a positive feedback loop.²² By AD 300, taxes doubled, and again by AD 364. This period was marked by a declining population, political fragmentation, and lower levels of material complexity. The struggle for dynastic legitimacy turned into imperial dissolution, and the Roman Empire collapsed.

Ecological issues, including the Antonine and Cyprian Plagues, were clearly not the sole cause of Rome's fall. However, they did instigate a phase of crisis that made it prone to other issues.²³ The Romans' nescient success in constructing their unsustainable empire made them susceptible to diseases, resource depletion, and climate change. Will this be our future?

4. Is Our Civilization in Danger?

Our civilization, humanity's *global* civilization, is more complex and interconnected than ever before. Intricate networks of roads and sea lanes allow trade and transportation, while the Internet facilitates communication and collaboration. There arise thousands of social roles for individuals and, to a degree, roles for each state in the global functioning of this civilization, governed by supranational organizations such as the UN. On the other hand, science and innovation provide public health, renewable energies, and methods of sustainable development that offer buffers against ecological consequences. However, problems originate from high complexity. Overconsumption of natural resources from a growing appetite worsens climate change; a deep connectedness of vast population allows diseases such as COVID-19 and Zika to spread along the very networks of roads and seas; and the indispensable bonds between states means the collapse of one would bring fatal impact worldwide. While the Romans believed that their innovative buffers were superior to the forces of nature, history proves otherwise, alluding that innovation will not be the panacea for us.²⁴

With the gift of hindsight, however, we are also the only civilization with clear knowledge about our outcome.²⁵ Unlike the Romans during the secular games, civilians in Great Britain started an environmental movement nearly

two centuries ago.²⁶ Nonetheless, even when we perceive the issues, a central dilemma to taking dramatic action is the vague costs and benefits: the costs upfront, the benefits accruing largely to unknown people in the future.²⁷ Yet, our own ethical values compel us to think that those future generations are worth struggling for, and to increase the slightest chance of preserving the global civilization as we know it today.

Although our civilization is in danger—as Rome’s similar legacy taught us—from the shared environmental and ecological issues, we can save it with collaboration, dedication, and unselfishness, requiring, as Tainter puts it, “a leap of faith [toward sustainability] at which [many] may rightly hesitate.”²⁸

Endnotes

1. “Rome’s 1000th Birthday Coin Details - the Roman Empire.” Coins.www.collectors-Society.com, coins.www.collectors-society.com/wcm/coinview.aspx?sc=355262. Accessed 26 Jun 2024.
2. Harper, Kyle. “The Environmental Fall of the Roman Empire.” *Daedalus*, vol. 145, no. 2, Apr. 2016, pp. 101–11, https://doi.org/10.1162/daed_a_00380.
3. Thirty-two elephants, ten elks, ten tigers, sixty lions, thirty leopards, six hippopotami, ten giraffes, a rhinoceros, and countless other wild beasts, not to mention one thousand pairs of gladiators, were sacrificed (Harper).
4. Tainter, Joseph A. *The Collapse of Complex Societies*. Cambridge University Press, 1988. p.4
5. The questions bring forth two assumptions. First, civilizations do collapse (not just decline or deteriorate) with a rapid decrease in complexity and population. Second, we have only one civilization—humanity’s global civilization.
6. Both the Classic Lowland Maya and the Hittite Empire suffered a severe drought that damaged crop yields, led to famine, and then social-political instability. Rome will be discussed later.
7. Tainter, *ibid*.
8. The magnitude of costs depends on how extractive, economical, information-processing, organizational, and environmentally damaging a solution or response is.
9. Malthus, T. *CAMBRIDGE TEXTS in the HISTORY of POLITICAL THOUGHT an Essay on the Principle of Population* Malthus: An Essay on the Principle of Population Donald Winch Frontmatter More Information. 1992, assets.cambridge.org/97805214/19543/frontmatter/9780521419543_frontmatter.pdf.
10. In this paper, environmental and ecological issues are synonyms. An environmental issue is defined as the challenges that face Earth and its natural systems because

of the harmful effects of human activity. Similarly, an ecological issue is a change in the natural environment, resulting from mostly anthropogenic impacts, that leads to a disruption of the structure and functioning of nature. A lack of resources is considered an environmental issue because not only is it a result of unsustainable uses of natural resources, but their depletion also causes significant environmental damage, such as a lack of biodiversity. Secondly, climate change is obviously an environmental issue because it is a challenge facing the natural system. Lastly, disease is considered an ecological issue, for it originates from a change in the natural environment, usually through the pressures from the increasing human population and the lack of resources that make the environment more insalubrious.

11. Tainter, *ibid*, pp.128-133
12. Tainter, *ibid*, p.133
13. Augustus, the first emperor, often relieved the state budget from his own wealth that came from the conquest of Egypt.
14. Harper, *ibid*.
15. McCormick, Michael, et al. “Climate Change during and after the Roman Empire: Reconstructing the Past from Scientific and Historical Evidence.” *Journal of Interdisciplinary History*, vol. 43, no. 2, Aug. 2012, pp. 169–220, https://doi.org/10.1162/jinh_a_00379. Accessed 26 Jun 2024. p.203
16. “M. Tullius Cicero, Letters, APPENDIX C.” *Www.perseus.tufts.edu*, www.perseus.tufts.edu/hopper/text?doc=Perseus%3Atext%3A1999.02.0022%3Ayear%3Dvolume+1+appendix+c. Accessed 26 Jun 2024.
17. Gibbon, *The History of the Decline and Fall of the Roman Empire*, vol. 1, ch. 3.
18. “Eusebius of Caesarea, *Historia Ecclesiastica*, Book 7, Chapter 21.” *Www.perseus.tufts.edu*, www.perseus.tufts.edu/hopper/text?doc=7.21&fromdoc=Perseus%3Atext%3A2008.01.0640. Accessed 26 Jun 2024.[5]
19. Harper, *ibid*.
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21. Tainter, *ibid*, pp.145-148
22. Bernard, Seth, et al. “An Environmental and Climate History of the Roman Expansion in Italy.” *Journal of Interdisciplinary History*, vol. 54, no. 1, The MIT Press, Jan. 2023, pp. 1–41, https://doi.org/10.1162/jinh_a_01971.
23. There were dynastic conflicts, external invasions, and class violence. Hulking stone fortifications went up around cities because Barbarians not just menaced the frontier but pillaged the now-fragile unwallled towns in the imperial interior. Zosimus, a writer of the second half of

the fifth century A.D., wrote that "...as a result of [extreme] taxes, city and countryside were full of laments and complaints and all invoked the barbarians and sought the help of the barbarians." Germanic and other tribes (Vandals, Alani, Suebi, and Burgundians) also joined forces and attacked from all sides. (Tainter, *ibid*, p.147)

24. Borrowing the idea of Tainter's complexity theory, the problem with research that grows costly and complex is that it can produce fewer and fewer outputs per unit of investment. A good example comes from a 2005 publication from the National Bureau of Economic Research, stating that even a modest 1 percent reduction in cancer mortality would be worth nearly \$500 billion. (Murphy, Kevin, and Robert Topel. *NBER WORKING PAPER SERIES the VALUE of HEALTH and LONGEVITY*. 2005, www.nber.org/system/files/working_papers/w11405/w11405.pdf.)

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28. Tainter, *ibid*, p.50

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