The Anthropocene in Environmental History, East and West: Human Efforts versus Nature's Power

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The Anthropocene

A prominent buzzword these days in environmental history, geology, and anthropology is the term "Anthropocene," the idea that human actions have become such a powerful force in the transformation and control of the rest of nature as to leave traces in the natural environment that will persist into future ages. The term, proposed by Paul J. Crutzen and E. F. Stoermer,[1] has received recognition from official committees that have examined evidence for it. It is a useful concept, but there is different emphasis concerning its definition between historians and scientists. Geologists look for durable evidence in detectable strata, while historians are interested in the degree to which humans are responsible for lasting changes in the landscape. There is also disagreement about when the Anthropocene began. Humans have had effects on the environment at least since the invention of agriculture, and probably earlier. But in the context of world history, human numbers, the extent of modification of the environment, and the speed with which nature became subject to human domination all took an astounding upturn after the end of the Second World War. J. R. McNeill and Peter Engelke named this the "Great Acceleration."[2] I treat this as the onset of the

Anthropocene. Interestingly, the recommendation of the Working Group on the Anthropocene (WGA) to the International Geological Congress (August 2016) chose near 1950 as the epoch's onset.[3]

Many trends have risen into public consciousness since 1950 that had received little or no notice previously. Global climate change, depletion of the ozone layer, accumulation of carbon dioxide in the atmosphere, oceanic pollution by floating debris, a sharp increase in the number of invasive species and other species made extinct, and rapid deforestation in the tropics are a few examples, unfortunately among many others.

The Role of Capitalism

Several scholars, notably Andreas Malm, Donna Haraway, and Jason W. Moore, have made the contention that capitalism is a driving force behind the Anthropocene, an idea that has led them to propose that the new age be designated the "Capitalocene."[4] As Colin Powell observed in 2003,

> Money is a coward. It flees from corruption and bad policies, conflict and unpredictability. It shuns ignorance, disease and illiteracy. Money goes where it is welcomed and where investors can be confident of a return on the resources they have put at risk.[5]

A better method to attract banks and capital can hardly be imagined. “Capitalocene” may be a clumsy term, and will not replace “Anthropocene,” but it does represent an important aspect of environmental history.[6] Capital provides an engine of growth giving energy to urban expansion, tourism, and the use of resources.

The results of capital development include urbanization and many effects of infrastructure and transportation that transform the habitats of animals and plants, causing deforestation and loss of wetlands. It introduces disruptive species such as rapidly reproducing animals including predators, and invasive plants, with unfortunate effects on biodiversity and ecosystems. Funds became available for construction of offices and business establishments, hotels, restaurants, homes and infrastructure such as roads, water supply and sewage systems, petrol stations, and all the other intrusive necessities of urban life.

Nature’s Power

The model of the Anthropocene as a progressive establishment of human control over nature, however, is misleading in an important way. Humans imagine that they are in control of the environment, even in suggesting that the present age be denoted the “Anthropocene.” But nature is not just the stage setting of the human drama: she is an ever-present actor, and many of her actions are beyond human control. There are volcanic eruptions, tsunamis, hurricanes, floods, earthquakes, and engulfing wildfires. Among these disasters are plagues that slay

thousands or millions, and their danger has not abated in the present time. They occur in both West and East, and often represent a connection between the two.

One of the best-documented of early epidemics is the Plague of Athens during the Peloponnesian War of the 5th Century BCE, which contributed, to the defeat of Athens by Sparta.[7] We have considerable evidence about the pestilence that killed a large fraction of the Athenian population, including their leader Pericles. There is, for example, the account of the great historian Thucydides, who suffered from the disease himself and survived, and provides a Hippocratean[8] account of the symptoms and course of the effects felt by the victims. Our detailed information on the Plague of Athens provides a description of the reaction of individuals and societies that is useful in understanding social responses to epidemic disasters Even so, there are problems in identifying the particular disease agent. Thucydides says that the plague entered Athens through the port of Piraeus from Egypt, and speculates that it must have come down the Nile to Egypt from Ethiopia. But it is more probable that the source in fact was further east. Trade routes led to Egypt from Central Asia. The course of the medieval Black Death of the 14th century came along the Silk Road to the Mediterranean, and scholars have located its original appearance in Yunnan. A similar origin for the Plague of Athens seems likely.

Climate Change

A huge body of evidence is available for studies of climate change. When I entered the storage facility of the US National Ice Core Laboratory (NICL),[9] at the foot of the Rocky Mountains west of Denver, I experienced the coldest temperature I had ever felt: -36°C. The book of Job, in the Bible, asks the question, "Have you entered the storehouses of the snow?"[10] I felt that I was doing so. There, on shelves filling a large but inadequate space of 1,540 cubic meters, lay thousands of silvered cylindrical sleeves containing sections of cores of ice pulled from the ice sheets of Antarctica and Greenland, and from mountain glaciers: an archive of the history of the Earth's climate and atmosphere. Many cores were drilled from ice surface to bedrock, some approaching 4 km in length, so that one core is represented by thousands of ice segments on the shelves. Looking at one of them removed from its sleeve, I could see layers one above the other, each representing the annual snowfall of a year many centuries in the past. These layers can be dated exactly, using electrical conductivity, visual counting, and stable isotope analysis—more accurately than a method such as radiocarbon allows, and they represent unbroken records stretching back as far as 800,000 years in Antarctica. [11] Glaciers are fast melting all over the Earth. There is a pattern of loss of volume almost everywhere that measurements are taken, and photographs taken over decades show spectacular losses. So an archive like this one and similar facilities in other

countries is precious.[12] In the future, it may become impossible to collect such a library of ice.

Archival records of the history of climate change extend back through time for hundreds of thousands of years, representing long-term natural cycles, rapid climate variations, and the possible importance of human-induced change, but the knowledge of these archives and the ability to interpret them is a relatively recent development. Through experimentation, study of proxy records, historical documents, and computer models that simulate the past, and potentially the future, with increasing accuracy, climatic scientists have achieved a general consensus on the process of climate change that is useful to historians as they develop interpretations of the changing relationships of human societies to the environment.

The overwhelming majority of climate scientists have reached a consensus that the great acceleration of carbon dioxide in the atmosphere and resultant heating of the climate in recent decades is the result of human activity. But even in earlier times when non-anthropogenic processes dominated, mankind had to deal with climatic phenomena such as ice ages, the medieval optimum, and the Little Ice Age, which were widespread in the Northern Hemisphere, both West and East.

Land Against the Sea

Nature's rebellion against the Anthropocene may be seen clearly in effects coming from the interaction of sea and land: tsunamis, storm surges, rising sea level, and flooding, all difficult to defend against.

The Netherlands has a constant need to control water to defend the country, much of which was and is below sea level. Dikes and the hydraulic windmills protect the lowlands against drowning. The long historical experience of the Dutch in their struggle against rising sea levels and storm surges has attracted new interest in the twenty-first century, in view of concerns about global warming and events such as the flooding of New Orleans by hurricanes Katrina and Rita. Indeed, communities facing possible inundation in places like the Gulf Coast and Bangladesh now seek the advice of Dutch water management experts.

Virtually every square kilometer of the Netherlands landscape bears evidence of human effort. Without constant exertion, most of it would be covered by the North Sea. Historically landowners began to surround units of land with dikes, creating enclosures called polders.[13]. Emptying water from a polder, especially one below sea level, could only be accomplished by pumping, and the windmill was adapted to lift water. Careful watching of the rivers and constant labor on dikes and dams were forced on the inhabitants by a continually shifting environment.

Constantly threatening were storm surges sweeping in from the North Sea, impelled by gale winds and intensified by high tides. They could swallow polders

and villages, drowning crops, animals, and people in salt water. Surges in the twelfth and thirteenth centuries broke through between North Holland and Friesland, forming and enlarging a brackish arm of the sea in the heart of the lowlands called the Zuider Zee, a mixed blessing that offered access to the world for the merchant fleet but provided a dangerous portal for the North Sea with its gnawing tides and waves.[14] As Petra van Dam noted, "The innovations in hydraulic technology of the period 1300-1600 must be understood as response to the rapidly changing conditions in Holland's wetland environment."[15]

The accomplishments of the Dutch in the "Golden Age" of trade, prosperity, empire, and intellectual and artistic flowering included the reclamation of large areas of land and installation of hydraulic infrastructure.[16] Windmills were set up on the dike to pump the water from lakes into canals.[17] The search for more efficient pumps led to technological improvements. One of these was the Archimedes screw pump.[18]

One of the centralizing reforms was the Rijkswaterstaat, a national administration that undertook water management projects and founded a professional school for hydraulic engineers.[19] It exists today because historic experience has shown that environmental survival makes a national policy necessary for water management.

As the Industrial Revolution got under way, Dutch engineers used steam engines for pumping. In the twentieth century, the source of energy that became

dominant was electricity. The twentieth century brought construction of works of unprecedented size in attempts to control the sea and rivers. The first of these was the separation of the Zuider Zee from the North Sea by a dam. At one end of the Oosterschelde barrier, an inscription announces, "Here the tide is ruled by the wind, the moon, and us." The project has been declared one of the world's seven engineering wonders. The Netherlands is greatly concerned about global warming and rising sea level. Steps have begun to fortify coastal defenses.

Nevertheless, the devastating storm surge of February 1953 made breaches in the dikes, inundated 200,000 hectares, and drowned 1,835 people, forcing evacuation of 72,000.[20]

One proposal for the future includes a higher dike along the entire North Sea coast from border to border, storage basins, and new "super pumping stations" to empty river water into the sea. Such a plan would continue the historical trajectory of water control works, and would represent an escalation of human attempts to control nature. The success of Dutch efforts to sustain the land was and is possible only because the environmental facts led to the ascent of the public realm over localism and the privatistic aspects of the market economy. Civic freedom in the Netherlands allows environmental concerns to weigh in the social choices that must continue to be made for the survival of land and community.

Earthquakes and Tsunami

As a demonstration of nature's unruly power in spite of the Anthropocene, it is difficult to find a more striking example than the tsunami. The danger is well known, and defenses have been erected along threatened coasts, but they have in many cases proved inadequate. Three examples that caused serious losses of technological structures and human lives can be noted here.

The 1960 Chilean earthquake with magnitude 9.5, certainly one of the top megathrusts ever recorded, generated a tsunami that affected coastlands throughout the Pacific and parts of the Southern Ocean. Twenty-five meters high, it destroyed countless buildings, killed about 1,600 people in Chile, and upset many of the statues on Easter Island. When the waves reached Hawai'i, they were 11 meters high and caused millions of dollars damage and 61 deaths. At the island of Honshu in Japan, they maintained a height of 5.5 meters, made 1,600 homes unlivable, and took nearly 200 lives.

A much more deadly natural disaster was the 2004 Indian Ocean earthquake and tsunami, which began with a shock of magnitude 9.2 off the west coast of Sumatra lasting almost ten minutes. The resulting tsunami, with waves up to 30 meters high, affected 14 countries around the Indian Ocean as far as East and South Africa, killing about 280,000 people.[21] The west coasts of India and Sri Lanka were affected. Some of the tsunami escaped into the Pacific Ocean and affected Mexico, California and British Columbia. It also reached Antarctica. Huge

impacts were inflicted on the environment by the invasion of salt water, including almost every ecosystem.

This audience need not be reminded of the Tohuku earthquake and tsunami of 2011, which illustrate the power of nature to counter highly developed human technology. Located 70 km off the east coast at magnitude 9.1, it was the most powerful earthquake recorded in or near Japan.[22] The tsunami waves reached 40.5 meters in height, poured over the seawalls, and penetrated up to 6 km inland. Nuclear power plants including three reactors at the Fukushima Daiichi complex suffered loss of electricity and resultant explosions. Other nuclear plants were damaged, and most were decommissioned. There was heavy damage to infrastructure throughout northeastern Japan; 1,150,000 buildings collapsed to various extents. 18,000 people were reported dead or missing, and 340,000 were displaced. Coastlands around the Pacific felt the tsunami, and later detected radioactivity and debris of every kind.

Conclusion

In conclusion, the idea of the Anthropocene as an epoch when human activities, began to act as a major force in environmental change that has left geologically detectable evidence can well be maintained. A motive power in this development is capitalism. But the idea that humans are now in total control of nature, or are even the most important force in environmental change, must give

way to recognition of the power of environmental forces and natural disasters that can negate many achievements of human technology. [23] It must not only be asked when the Anthropocene began, but also when it will end, as it surely will.

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[1] Paul J. Crutzen and Eugene F. Stoermer, "The 'Anthropocene,'" *IGBP (*International Geosphere-Biosphere Programme) *Newsletter* 41 (2000): 16-18.
[2] J. R. McNeill and Peter Engelke, *The Great Acceleration: An Environmental History of the Anthropocene since 1945*. Cambridge, MA: The Belknap Press of Harvard University Press, 2014.
[3] Damian Carrington, "The Anthropocene Epoch: Scientists Declare Dawn of Human-Influenced Age," *The Guardian*, 29 August 2016.
[4] Andreas Malm, "The Origins of Fossil Capital," *Historical Materialism* 21.1 (2013): 15-68; Donna Haraway, "Anthropocene, Capitalocene, Plantationocene. Chthulucene," *Environmental Humanities* 6.1 (2015): 159-165; Jason W. Moore, ed., *Anthropocene or Capitalocene?: Nature, History, and the Crisis of Capitalism*. Oakland, CA: PM Press, 2016.
[5] Quoted in J.A. Roy Bodden, *The Cayman Islands in Transition: The Politics, History, and Sociology of a Changing Society*. Kingston: Ian Randle Publishers, 2007, p. 146.
[6] Christophe Bonneuil and Jean-Baptiste Fressoz, *The Shock of the Anthropocene: The Earth, History and Us*, London: Verso, 2016. The authors criticize both "Anthropocene" and "Capitalocene," offering a total of eight arguable designations of the latest period, adding Thermocene (warming), Thanatocene (ecocide), Phagocene (consumption), Phronocene (language), Agnotocene (externalizing nature), and Polemocene (resisting deterioration).
[7] J. Donald Hughes, "Responses to Natural Disaster in the Greek and Roman World," in *Forces of Nature and Cultural Responses*, edited by Katrin Pfeifer and Niki Pfeifer. Dordrecht: Springer, 2013, pp. 111-138.
[8] That is, Thucydides applied the principle that in studying a disease, one must carefully observe the symptoms and their changes over time: a principle attributed to Hippocrates (5th century BCE), often called "the father of medicine."
[9] NICL is a joint program funded by the US Geological Survey and the National Science Foundation. It is located in the Denver Federal Center, west of Denver, Colorado. Scientific aspects of NICL'S work are coordinated by a Science Management Office in the Climate Change Research Center at the University of New Hampshire.
[10] Job 38:22.
[11] Richard B. Alley, *The Two-Mile Time Machine: Ice Cores, Abrupt Climate Change, and Our Future*, Princeton, Princeton University Press, 2000.
[12] Ben Orlove, Ellen Wiegandt, and Brian H. Luckman, eds, *Darkening Peaks: Glacier Retreat, Science, and Society*, Berkeley and Los Angeles, University of California Press, 2008.
[13] Charles Singer, E.J. Holmyard, A.R. Hall, and Trevor I Williams, eds., *A History of Technology*, Oxford, Clarendon Press, 1956, Vol. 2, 682-683.
[14] TeBrake, "Taming the Waterwolf," 497.

[15] Petra J. E. M. Van Dam, "Ecological Challenges, Technological Innovations: The Modernization of Sluice Building in Holland, 1300-1600," *Technology and Culture* 43.3, July 2002, 500-520, 506

[16] Simon Schama, *The Embarrassment of Riches: An Interpretation of Dutch Culture in the Golden Age*, New York, Alfred A. Knopf, 1987

[17] Jan de Vries and Ad van der Woude, *The First Modern Economy: Success, Failure, and Perseverance of the Dutch Economy, 1500-1815*, Cambridge, Cambridge University Press, 1997, 31.

[18] Hills, *Power from Wind*, 120; Van de Ven, *Man-made Lowlands*, 148-149.

[19] Harry Lintsen, "Two Centuries of Central Water Management in the Netherlands," *Technology and Culture* 43, No. 3, July 2002, 549-568.

[20] Lintsen, "Two Centuries of Central Water Management," 567.

[21] Y. A. Kontar, V. Santiago-Fandino, and T. Takahashi, editors, *Tsunami Events and Lessons Learned: Environmental and Societal Significance*, New York: Springer, 2016.

[22] Pradyumna P. Karan and Unryu Suganuma, editors, *Japan after 3/11: Global Perspectives on the Earthquake, Tsunami, and Fukushima Meltdown*, Lexington, University Press of Kentucky, 2016.

[23] Carolyn Merchant, *The Death of Nature*, San Francisco: HarperOne, 1990.