Examples of human societies that collapsed prior to c. 1700 ce

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Classic Mayan civilization was among the most advanced to ever develop in the New World prior to European contact, and at its height, Mayan cities supported populations estimated at 250 to 750 people per square mile. 1 They were the only advanced Mesoamerican civilization to have developed an extensive system of writing; they also developed their own unique calendar, and extensively studiedmathematicsand astronomy.

The Classic period of Maya civilization is thought to have begun around 250 CE, based on scholarly interpretation of glyphs on Mayan monuments. 2 It is thought that the occurrence of certain repetitive glyphs within an area signify the rise of a local dynasty or kingdom. Based on the number of archeologically verified houses, the Mayan population is estimated to have exponentially increased to its peak of approximately 13 million in around 750CE3, accompanied by a similar increase in the number and size of monuments and buildings.

After this point these numbers decline until around 900 CE, which is said to mark the collapse of the Classic Mayan civilization in general. Among Mayan cities of the Classic period, however, some were noted to have peaked and collapsed as early as 600 CE, while others persisted much longer, such as Chichen Itza (around 1250 CE). 4

The end of the Classic Maya period was not the end of Mayan civilization itself, because Spanish explorers such as Cortes encountered Mayan resistance as they established their presence in the area. While diseases introduced by the Spanish occupation eventually brought the survivors' numbers down to an estimated 3, 000 in 1714 CE5, the Spanish occupation

itself was not a significant factor in the decline of a civilization which had already reached its zenith and collapsed centuries before.

Although the Spaniards' religious fervor drove them to destroy several of the Mayan manuscripts out of fear of paganism, the surviving written records have enabled archeologists to understand much about the Mayan writing system, and the explorers' own documentation of the Maya have proved helpful to scholars6. Modern scientific methods have enabled us to understand a great deal about the factors that may have undermined such an advanced society and brought about its downfall.

Located at latitudes of 17o to 22o north of the equator, rainfall in the land of the ancient Maya is seasonal and unpredictable, and hence in reality, the habitat of the Mayan civilization can be most accurately described as a seasonal rainforest or desert7. Rainfall varies with location, from 500 mm a year along the north coast, to 4, 000 mm a year in some southern areas8. Due to the unpredictable timing and amount of rain in any given season, even modern farmers have frequently encountered difficulties in growing crops.

The Maya obviously succeeded in their agricultural efforts for a long time, and cities such as Tikal even show evidence of the construction of cisterns and reservoirs to store water in times of drought9. However, considering the high population density of Classic Mayan cities at their peak, even with their successful agriculture and ability to store water reserves in times of drought, the Maya would still have been vulnerable to severe, prolonged drought – perhaps enough to send them into collapse.

To find records of what the climate in the Mayan homeland was like at that time, geologists from the University of Florida gathered sediment cores from several lakes in the Yucatan area and analyzed the patterns of deposition, which indicate that the driest interval in the region in the past 7, 000 years had coincided with the collapse of the Classic Maya civilization, between 800-1000 CE. A further study by Larry Peterson and Gerald Haug used x-ray fluorescence to analyze oceanic sediment cores.

Titanium and iron deposits in the sediment were used as indicators of rainfall, because these elements originate predominantly from continental rocks and thus a high amount of titanium and iron deposits would reflect on a high volume of rainfall on land in that year. The results corroborated the previous study that had been made using freshwater sediments, indicating an unusually long and severe drought during the period of Classic Maya collapse10. Despite this evidence, the drought theory behind the collapse of Classic Mayan civilization remains far from providing a complete and thoroughly satisfactory explanation.

It fails to account for the previously mentioned differences in the dates of collapse of cities that lay within the same region and presumably suffered from the same drought. It has been suggested that the first cities to fall to the drought were more vulnerable by virtue of location, being less proximate to natural bodies of water, such as springs and rivers. This could then lead to warfare between cities due to competition for scant resources, and since the Mayan cities never were united into a single empire, it is likely that such warfare may have greatly destabilized Mayan society.

As with other cases of collapsed societies throughout history, it is likely that multiple causes, of which drought was the most significant but by no means the only one, contrived to bring about the fall of the advanced Mayan society. Another society that was founded, peaked, and collapsed close to our modern day home would be the Anasazi of Chaco Canyon. This society had collapsed well before the arrival of Columbus, but unlike the Maya, left behind no written records. What is known about the Anasazi comes from using a combination of scientific methods to analyze what remains of their society.

The Native Americans who first settled the U. S. Southwest faced a problem that is still obvious today. This region has very low and unpredictable rainfall. Drought is often cited as the obvious major reason for Anasazi society's collapse, but recent studies indicate that the Anasazi sites themselves may still have been able to sustain a population at the time of their abandonment. 11 In the study of the decline and collapse of Anasazi society, archeologists have relied heavily on a few methods of analysis.

One lies in the field of dendrochronology and is particularly useful since the Anasazi, particularly at Chaco Canyon, made heavy use of timber for their construction. Using the thickness of individual tree rings from a particular piece of timber, dendrochronologists are able match patterns in the rings of different trees from the same region. By comparing several different trees in this manner, dendrochronologists are able to correctly associate each ring with a specific year, starting from trees in the present day and dating back for thousands of years.

Dendrochronological studies thus present highly detailed information regarding the weather patterns of the U. S. Southwest and can indicate not only years of high rainfall or drought, but also the amount of rainfall and the season within a particular year during which the rain fell12. Scientists have also analyzed the contents of pack rat middens to gain insight into the local vegetation. Pack rats (Neotoma spp.) are rodents that have lived in the area for thousands of years, and gather vegetation and other organic material from within their small territorial range, preserving it in their nests, called ‘ middens’.

Pack rat midden analysis has allowed scientists to determine that the initial area around Chaco Canyon was forested with pinyon and juniper trees which no longer grow today in the vicinity, and led to the conclusion that the Anasazi of Chaco Canyon had deforested their surrounding woodland for firewood to fuel their pottery making, and for construction material as Chaco became an effective political and religious center for the Anasazi society. 3 Furthermore, studies of strontium isotopes in other types of wood used at Chaco indicate that several conifer logs had actually been imported from more distant areas such as the Chuska and San Mateo mountains, presumably after Chaco itself had been deforested. 14 It is believed that thisdeforestationled to irreversible nutrient loss in the soil of the Chaco area, which is further strengthened by studies offoodremains at archeological sites.

These remains indicate that as the food supply in Chaco deteriorated, its inhabitants resorted to eating rabbits and mice, and eventually cannibalism, as evidenced by boiled human bones with smooth ends and human muscle

protein found in preserved dried human feces. 15 It is probable that cannibalism came with social unrest, possibly a revolt by the providers of Chaco Canyon against the elite, and that together with these factors, a drought (dated by tree rings to around 1130 CE) pushed Anasazi society at Chaco past its limits.

Numbering at possibly 5, 000 or more at their peak, the Chaco Anasazi had already exhausted and deforested theirenvironment, and likely fought amongst themselves for the remaining resources. The final example I choose to discuss is the collapse of the Norse settlement of Greenland. Greenland is a harsh and fragile environment, but at the time of the Norse occupation around 980 CE, it was experiencing a relatively warm period that lasted from 800 – 1300 CE, ending with the start of the Little Ice Age.

Information about Greenland’s climate is derived from palynological studies, wherein scientists analyze pollen found in mud deposits extracted from the bottom of lakes and bogs, and ice core studies. Pollen studies reveal what sort of plants were growing in the area, and can reveal subtle shifts in climate when pollen from cold-tolerant species is prevalent.

Similar to dendrochronology, ice core studies reveal the amount of snowfall within a year, and by using a mass spectrometer it is possible to analyze the content of oxygen isotopes within a layer ofsnow, with the ratios of these isotopes indicating the average climate during that year. Ice cores can also reveal how stormy the year was in which the snow fell by analyzing concentrations of sodium and calcium ions, which are brought inland by sea spray. 16 By 1000 CE the Norse had settled Greenland in two different areas with a total population of around 5, 000.

They relied on hay farming to feed their livestock, which consisted of goats, sheep, and cows, but due to the length and severity of their winters, they were forced to estimate how many animals they could support with their stockpiled hay, and slaughter the remainder. If the winter lasted longer than expected, the consequences could obviously lead to the starvation and death of the few remaining livestock. Their pastoral lifestyle, use of turf for buildings, and need for firewood demanded the clearing of native vegetation, and livestock trampling hampered the regeneration of trees.

Palynological studies support the conclusion that the Norse had deforested the environment and caused soil erosion, with the decline of pollen from willow and birch trees as well as the presence of topsoil at the bottom of lakes indicating the loss of plant cover and soil. The loss of abundant lumber resulted in the halting of construction involving wood, and the lack of firewood limited the Norse in their efforts to pasteurize dairy products and extract iron for their implements.

Unlike the Norse, the Inuit who settled Greenland in about 1200 CE managed to exploit the resources of the sea with their kayaks, hunting plentiful fish (which the Norse oddly refused to eat, as evidenced by the complete lack of fish remains in garbage) and whales, whose blubber could be used for fuel and warmth. Possible hostile contact between the Norse and Inuit may also have led to the decline of Norse society on Greenland, because it prevented the Norse from peacefully interacting with their neighbors and learning from them how to adapt to the extreme conditions.

Another factor that weakened the Norse settlement was the increasing difficulty of transportation, and hence trade andcommunication, across the

sea with mainland Norway, as the cold weather brought by the Little Ice Age set in and ice began to make seafaring dangerous. 17 Summarized concisely in the words of Jared Diamond, the Norse settlement of Greenland collapsed due to “ environmental damage, climate change, loss of friendly contacts with Norway, rise of hostile contacts with the Inuit, and the political, economic, social, and cultural setting of the Greenland Norse. ” 18