Chan Chan and El Niño:
A historical perspective and modern lessons

Environmental Change of Latin America policy brief

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Executive Summary

El Niño events are not a modern phenomenon, but a long established one. Residents of Chan Chan of the Chimú civilization in pre-Columbian Peruvian coast were among the ones who faced threats from these events. Its story, therefore, is important to our understanding of these events which become increasingly strong in recent years and can provide a lesson of how we may deal with them in contemporary time. With increasing value in tourism, Chan Chan, now as an archaeological zone, should also be used as a site of environmental awareness, educating both the local residents and tourists.

Context

I. Overview

The Peruvian coast is usually extremely dry due to the existence of strong trade wind that drives warm ocean water westward towards Indonesia. Climate variations, however, may lead to El Niño events that can bring significant rainfall and in extreme cases, floods, to the region. These floods may threaten locals' livelihood, and issue become more problematic currently as El Niño events are becoming more intense in recent years with global warming ("'Extreme' El Niños to double in frequency under 1.5C of warming, study says", 2017). Therefore, it seems crucial for policy makes to learn more about El Niño and to raise locals' awareness to such events.

These El Niño events, indeed, is not a new phenomenon. We have already seen struggles from prehistoric periods thanks to recent archaeological researches. Let us learn about the story of Chan Chan with climate change before we delve deeper into why its story is important.

II. A prehistoric example: Chan Chan

The Chimú civilization was the largest pre-Columbian civilization that existed at this extremely dry northern Peruvian coast. It dominated the entire north coast of Peru during the late Intermediate period from 1000 A.D. to 1476 A.D (Keatinge and Day, 1973; Kolata, 1990) Its capital, Chan Chan, built from the 9th century, was the largest Pre-Columbian city in South America. It has undergone significant urban growth. At its height, it covers an area of 6 km^2 with a population of around 60, 000 (Kolata, 1990)

Figure 1: Location of Chan Chan. Chan Chan is located in Northern Peruvian coast which is usually extremely dry under normal conditions. Map created from Google map.

The urban expansion of Chan Chan was linked to the construction of hydrological technologies. The society of Chan Chan is heavily reliant on agricultural production, yet the overall dryness of the northern Peruvian coast posted a challenge. To counter this disadvantage, hydrological irrigation canals were constructed outside the urban center to support agricultural production (Kolata, 1990; Moore, 1991; Dillehay, 2003; Dillehay and Kolata, 2004). There is also evidence of sunken gardens, an agricultural option that the local farmers took advantage of to grow crops in this extremely dry environment (Kolata, 1990).

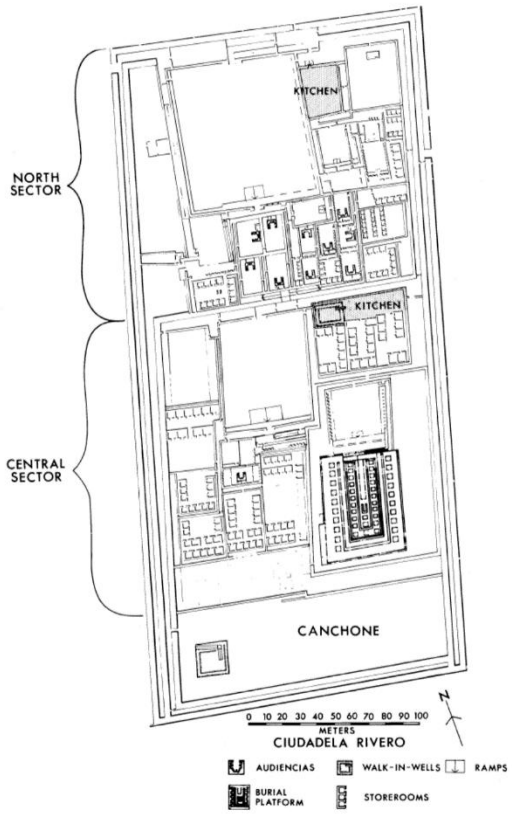

Figure 2: A map of Ciudadela Rivero. From Keatinge and Day, 1973.

Irrigation canals and Chan Chan's social structure

Chan Chan is a highly centralized society that is controlled by elites, who make use of heavy capital and labors for both agricultural production and the construction of irrigation canals (Dillehay and Kolata, 2004). This figure shows Ciudadela Rivero, an enclosed structure of Chan Chan. The large number of store rooms in the central sector where the elite live compared to the north has suggested that the elites controlled agricultural production and investment of irrigation canals (Keatinge and Day, 1973). Using architectural evidences to understand social structures of ancient civilizations is a common practice among archaeological researches.

In later years of Chan Chan's development, however, there is evidence of increasing El Niño events in the region. These El Niño-driven floods significantly challenged the society of both Chan Chan and the Chimú civilization. A catastrophic El Niño-driven flood in the 12th century that destroyed the irrigation canals of Chan Chan, for example, is believed to be a cause of the military expansionism of the Chimú civilization in Northern Peruvian coast (Kolata, 1990; Moore, 1991). With greater access to previously foreign land, the expansion of the Chimú civilization changed the economic orientation of Chan Chan from exploration of local resources

to a parasitic reliance of foreign resources (Kolata, 1990). Although this new economic structure sustained its economic growth in the following centuries, a new wave of El Niño events devastated its social structure in 15th century. The extremely heavy El Niño-driven floods in the 15th century may be the cause of a large-scale human sacrifice event that happened in the Chimú civilization, indeed the largest in human history (Romey, 2019). The shock to the political and economic stability of the Chimú civilization in the 15th century finally led to its decline when the Inca Empire conquered Chan Chan and the Chimú civilization was integrated into the Inca Empire in 1470.

> "Killing children and young llamas-very precious assets to the kingdom-may have been an effort to persuade the gods to stop the rain that had brought chaos to the Chimú."
>
> -Kristin Romey (2019)

How do we know about historic flooding events?

How do we know about historic flooding events in historical periods? One common method that archaeologists use is to use radiocarbon technology to date flooding events of a specific region. The graph shown here from Dillehay and Kolata's (2004) research uses this technology to measure the flooding events of lower Jequetepeque Valley, a conquered territory north of Chan Chan. As we can see here, while there is little rain in the 9th when Chan Chan was first built, flooding events increased starting from the 12th century until its demise in 15th century.

Site no.*	Context	Conventional age, years	Calibrated age	Sample no.
JE-205†	Occupation layer	4,190 ± 40 B.P.	B.C. 2895–2610	Beta-109092
JE-205	Occupation layer	2,560 ± 50 B.P.	B.C. 840–520	Beta-109091
JE-354	Occupation layer	2,530 ± 50 B.P.	B.C. 805–485	Beta-109089
JE-205	Occupation layer	2,520 ± 50 B.P.	B.C. 800–415	Beta-117746
JE-205	Occupation layer	2,370 ± 50 B.P.	B.C. 530–375	Beta-117747
JE-125	House floor	1,520 ± 60 B.P.	A.D. 415–650	Beta-143883
JE-339	House floor	1,370 ± 70 B.P.	A.D. 560–780	Beta-143885
JE-273	Platform floor	770 ± 50 B.P.	A.D. 1185–1295	Beta-143884
JE-1	Platform floor	720 ± 40 B.P.	A.D. 1180–1230	Beta-109093
JE-18	House floor	710 ± 40 B.P.	A.D. 1245–1390	Beta-109090
JE-2	House floor	700 ± 60 B.P.	A.D. 1235–1400	Beta-114185
JE-240	Buried furrow	670 ± 70 B.P.	A.D. 1245–1420	Beta-114186
JE-19	House floor	640 ± 40 B.P.	A.D. 1285–1405	Beta-143880
JE-249	House floor	640 ± 70 B.P.	A.D. 1265–1425	Beta-114187
JE-19	Platform floor	620 ± 40 B.P.	A.D. 1290–1410	Beta-143879
JE-619	House floor	620 ± 50 B.P.	A.D. 1280–1420	Beta-161940
JE-3	House floor	580 ± 70 B.P.	A.D. 1285–1445	Beta-143882
JE-688	House floor	230 ± 40 B.P.	A.D. 1640–1690	Beta-161941
JE-205	Flood deposit	180 ± 50 B.P.	A.D. 1650–1950	Beta-109092

B.C., before Christ.
*All dates are single chunks of charcoal taken from intact strata with archeological floors and/or features that lie either directly under or over major outwash deposits.
†JE-205 corresponds to the urban center of Cañoncillo.

Table 1: Radiocarbon dated events of major flooding at excavated archeological sites in the lower Jequetepeque Valley. Source from Dillehay and Kolata (2004).

Why does it matter?

In recent years, archaeological researches on prehistoric disasters such as El Niño events using geographical concepts of vulnerability and political geology has becoming more and more popular among archaeologists with increasing funding to do such work (Van Buren, 2001). While these researches illustrated new perspectives of the collapse and struggles of prehistoric societies, stories such as Chan Chan with its struggle with El Niño events can also provide a good lesson to contemporary policy makers. Indeed, Moore (1991) suggests that it is profitable to understand social consequences of specific prehistoric El Niño events than simply generalizing them because of the complexities of these events and possible cultural responses.

The story of Chan Chan, for example, provide these important lessons for us:

- a centralized approach or a community-based agriculture: Agricultural production is highly centralized in Chan Chan. While its centralization helped elite to control labor and capital for large-scale and extensive agriculture, this social structure may make Chan Chan more vulnerable to climate change, such as El Niño events (Dillehay and Kolata, 2004).

  In fact, El Niño events may provide locals some agricultural benefits because rain can contribute to more water resources at specific locations in the Peruvian coastal desert. However, societies with a strong state-controlled agricultural production may not adapt this advantage for recovery that effectively especially because farmers were restricted to move around and change their agricultural approach freely by themselves. Nevertheless, in a more community-based local community, farmers can more easily move around and apply regional and local modifications to previously long-held agricultural approaches. Indeed, as Rosset et al. (2011) suggests, the community-based peasant agriculture, such

as the agroforestry approach in Cuba, is more resilience to climate change than industrial agriculture.