Rapid climate change-induced collapse of hunter-gatherer societies in the lower Mississippi River valley between ca. 3300 and 2780 cal yr BP

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Abstract Hunter-gatherer communities in the American Southeast reached an apogee of social and political complexity in the period between ca. 4200 and 3000 cal yr BP. In the lower Mississippi Valley (LMV) the Poverty Point culture defined this period of socio-political elaboration. However, following a significant period of climate change that led to exceptional flooding and a major reorganization of the course of the Mississippi River, this culture collapsed beginning ca. 3300–3200 cal yr BP and the LMV was abandoned for the subsequent 500 years. In this study, we use data from the Jaketown site in the Yazoo Basin of west-central Mississippi to refine the chronology of the climate event that caused the collapse of the Poverty Point culture. A large flood buried Poverty Point-era occupation deposits at Jaketown around 3310 cal yr BP. Lateral migration of the Mississippi River during flooding led to inundation of the Yazoo Basin and re-occupation of ancient river courses. A coarse sand stratum topped by a more than a meter-thick fining upward sediment package marks a crevasse deposit caused by a rupture of the natural levee at Jaketown. This levee breach was part of a larger pattern of erratic flooding throughout the LMV and is associated with major landscape evolution and the abandonment of Poverty Point sites within the valley. Early Woodland peoples re-colonized the crevasse surface after ca. 2780 cal yr BP. Following this event, the Jaketown site and the eastern Yazoo Basin witnessed a period of landscape stability that lasts to this day. These archaeological data demonstrate how climate change and natural disasters can lead to socio-political dissolution and reorganization even in relatively small-scale hunter-gatherer populations.

Keywords Rapid climate change, Hunter-gatherers, Flooding, Mississippi River Valley, Poverty Point, Jaketown site

1. Introduction

Floods are among the most deadly and expensive natural disasters on a global basis. Throughout history, floods have caused massive physical damage to landscapes, disrupted societies, and have, in some cases, changed history (e.g., Dong et al., 2017; Wu et al., 2016). Most studies of major floods and their effects focus on their consequences for large-scale agrarian civilizations, especially where significant populations live in floodplains or are dependent on resources from floodplains. The repercussions of flooding for agricultural societies are obvious: crops are ruined, productive land is damaged, and surpluses are diminished or spoiled. In addition, communities and important infrastructures (e.g., houses, public buildings, roads) in the path of floods are often damaged or require costly repairs. In total, the effects of flooding on civilizations are great, largely because civilizations tend to

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invest heavily in highly valuable immobile resources located in floodplains.

This emphasis on creating landesque capital (Håkansson and Widgren, 2014) in floodplains means that civilizations have considerable sunk costs invested in floodplain contexts. Because of these sunk costs, important infrastructure and resources cannot be abandoned and must be protected from flooding, which leads to major investment in flood control infrastructure and water resource management. Even today, however, flooding cannot always be controlled or halted. This means that it is not a matter of if a flood will happen in an active floodplain; instead, it is always a matter of when and on what scale a flood will occur, and how bad the damage will be. These elements combine to increase the short- and long-term costs of flooding because significant amounts of time, labor, money, and other resources are committed to ensuring the productivity of floodplains.

But what of societies that have fewer sunk costs invested in floodplains? In theory, smaller-scale societies, such as tribal or hunter-gatherer communities, should naturally be more resilient in the face of flooding. These communities have lower population densities, relatively higher mobility, have fewer fixed resources, and thus, far less investment in landesque capital improvements. In addition, they devote little to nothing towards the active management of floodplains. In practice, however, there is a growing body of data showing that these small-scale societies were actively engaged in a variety of intensive and extensive forms of landscape alteration (Thompson, 2016; Rodning and Mehta, 2016). Thus, though there are different scales of landscape management and infrastructure commitment between hunter-gatherer societies and more sedentary agricultural societies and civilizations, even the least complex small-scale society still had substantial investment in place, and thus considerable constraints on their resilience.

In this paper, we explore the consequences of flooding among hunter-gatherer communities in the Late Archaic (ca. 4200–3000 cal yr BP) and Early Woodland (ca. 3000–2200 cal yr BP) periods in the lower Mississippi Valley (henceforth, LMV) of Eastern North America. Using data from the Jaketown site in west-central Mississippi, we argue that flood-related natural disasters are scale-dependent, with local consequences being related to the size and magnitude of the flooding more than the nature of human land use and resource investment. In the period ca. 3300–2750 cal yr BP, a massive flood, or series of floods, affected much of the Mississippi River drainage basin. The unprecedented scale of these floods caused major population movements, and created a context where cultural transformations had a dramatic effect on human societies throughout this vast watershed (Kidder, 2006). Human resilience in the face of these ecological and economic disruptions wasn’t solely a condition of the social structure. Therefore, responses to natural disasters must be measured by both social and natural reactions that contextualize the scale of individual events and their resulting perturbations.

2. Geography
The Mississippi River basin encompasses roughly 2981076 km² and includes much of the Eastern United States and parts of southern Canada. The climate is temperate, with average rainfall ranging from 406 mm in the northern and western source areas to 1450 mm at the river’s mouth. Precipitation is higher in the east and north, and lower in the west.

The LMV begins at the mouth of the Ohio River and extends to the Gulf of Mexico (Figure 1). The Mississippi River has migrated multiple times within its alluvial valley, resulting in the formation of a series of named basins reflecting changing fluvial histories through time (Kidder et al., 2008; Sauzier, 1994). The Yazoo Basin in modern-day west-central Mississippi is the largest subdivision of the LMV (Figure 1). The Yazoo Basin is roughly leaf-shaped and is bordered by the Mississippi River on the west and low alluvial hills to the east. At different times the Mississippi River has flowed within the basin, leaving behind a complex landscape of abandoned channels, oxbow lakes, and undercut drainages (Figure 2a).

3. Chronology and culture history
Across Eastern North America there are a variety of different cultural groups that are documented in the Late Archaic period (Anderson and Sassaman, 2012; Marquardt and Watson, 2005; Randall, 2015; Sassaman, 2010; Thomas and Sanger, 2010). These groups lived in different environments, used distinctive artifacts and technologies, and exploited varying types of food. However, these cultural groups shared some basic characteristics. Hunting, fishing, and gathering wild foods was the overwhelmingly predominant subsistence practice. Some plants had been domesticated or were being intensively managed, but tropical cultigens were not being grown.

The term Poverty Point culture (Webb, 1982) is applied to sites dating from ca. 4000–3200 cal yr BP over an area approximately 128000 km² centered on the type site and extending up and down the LMV from southeast Missouri south to the Gulf Coast and east and to a lesser extent to the west along the coast. Poverty Point “culture” refers to the use of shared material traits, most notably clay cooking balls (widely known as Poverty Point Objects or PPOs) and certain forms of hafted knives or projectile points. Subsistence studies demonstrate that the inhabitants of Poverty Point and contemporary sites in the Mississippi Valley were almost exclusively dependent on consumption of wild plants, animals, and fish (Jackson, 1989, 1991; Ward, 1998).