

# Natural and human-induced prehistoric and historical soil erosion and landscape development in Southwestern Tennessee, USA



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## ABSTRACT

Eastern North America has seen widespread soil erosion in recent centuries. While the impact of soil erosion and feedbacks to the environment have been recognized for the period of European settlement, the period of prehistoric cultivation by Native Americans and its effect on soil erosion are largely unexplored. At the Dogwood gully system, a 820,000 m<sup>2</sup> watershed located along the Chickasaw Bluff in southwestern Tennessee, extensive geoarchaeological investigations, which include historical data, have enabled a detailed examination of soil erosion history. The results yield insight into the relative influence on soil erosion of human activities (both prehistoric and historical) versus natural geomorphodynamic processes controlled by climate and neotectonics. Three relatively short phases of geomorphic activity occurred throughout the Holocene. In the mid-Holocene climate changes caused a change or decline in the protecting vegetation cover which triggered fires, runoff, and soil erosion. The influence of Archaic and early Woodland peoples on the landscape has remained elusive. The loss of at least 12 cm of topsoil during the Mississippi period (~900–1400 CE) may have influenced land abandonment in the 14th century. After the introduction of European agricultural techniques, a similar amount of soil was eroded but within a period of only 80 years. In the 1930s the area was reforested but runoff and gullying are still active on bare surfaces. The research shows that the impact of prehistoric land use patterns on the geomorphic system was likely generally much more important than previous studies has suggested.

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## 1. Introduction

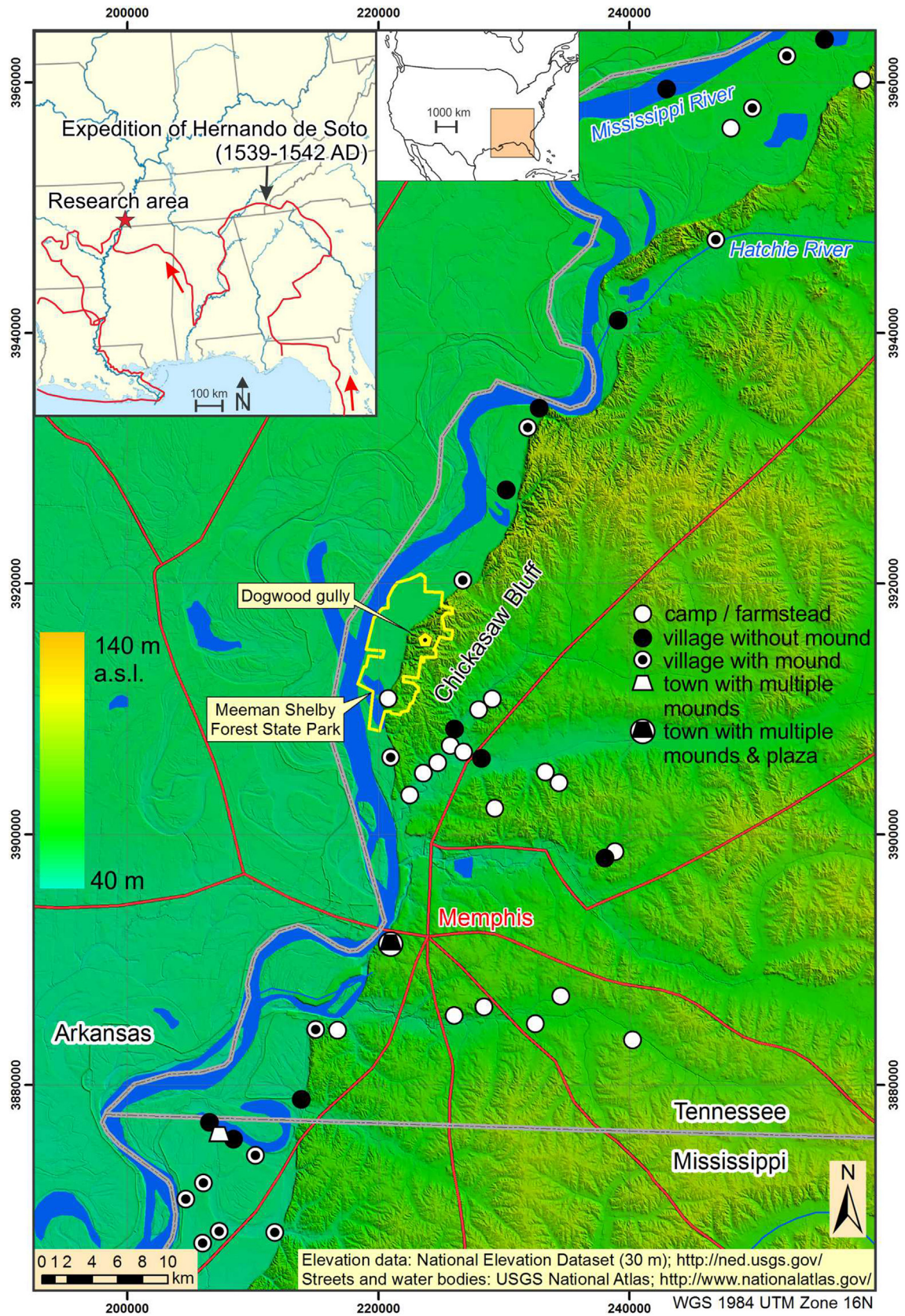
Anthropogenic alteration of landscapes can be traced as far back as the Paleolithic period, when woody vegetation was cleared to improve hunting and gathering opportunities (Williams, 2003; Ellis et al., 2013), and later to provide agricultural cropland. During the Holocene, agriculture was established on nearly all continents and led to the widespread modification of terrestrial ecosystems. In most areas of the world, many phases of agricultural expansion and regression occurred, together with associated land clearing and reforestation since the Neolithic revolution (Price, 2000; Williams, 2003; Hughes, 2011). As a result, human impact has strongly altered

biodiversity as well as matter and energy fluxes (Berglund, 1991; Bouma et al., 1998; Huntley et al., 2002; Kaplan et al., 2009). This long history of anthropogenic activity has had significant implications for environmental systems at different scales, from regional hydrology (Benito et al., 2008; Macklin et al., 2010) and sediment flux (Hoffmann et al., 2007; Dotterweich, 2008) to global climate patterns (Kaplan et al., 2010) and socio-economic feedbacks (Fraser, 2010). The analysis of such complex, long-term human–environment interactions offers crucial lessons to better understand the principles of environmental sustainability (Dearing et al., 2015). In order to demonstrate how people and their surrounding environment interact over longer periods of time, research is necessary to explain more precisely the impact of agricultural practices on the environment at different spatial and temporal scales.

This paper presents a case study which elucidates the relationship between land use patterns and soil erosion during prehistorical and historical times. The study site is located at the Chickasaw Bluff in southwestern Tennessee, USA (Fig. 1). We

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**Fig. 1.** Research area, location of the Chickasaw Bluff and the Meeman-Shelby Forest State Park. Mississippian settlements adapted from Smith (1990) and Barker (2005). Expedition of Hernando de Soto adapted from Swanton (1939).

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