Soils, Climate & Society

Archaeological Investigations in Ancient America

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Drought, Subsistence Stress, and Population Dynamics

Assessing Mississippian Abandonment of the Vacant Quarter

Scott C. Meeks and David G. Anderson

The idea that prehistoric agriculturally based chiefdoms underwent periods of emergence, expansion, collapse, and reemergence has received much attention in the archaeological literature of eastern North America (e.g., Anderson 1994, 1996; Blitz 1999; Cobb and King 2005; Hally 1993, 1996; Pauketat 2007; Steponaitis 1978; Williams and Shapiro 1996). In some instances, prehistoric Mississippian and subsequent early historic period chiefdoms in the southeastern and lower midwestern United States—dating from ca. AD 1000 to sustained European contact in the early seventeenth century—are known to have collapsed with no subsequent, or at least no fairly rapid, replacement or reemergence, as indicated by occupational hiatuses spanning several centuries.

An example of such a dramatic collapse is the apparent abandonment of large portions of the midcontinental United States by late-Mississippian populations. First termed the "Vacant Quarter" by Stephen Williams (1983, 1990), this pan-regional abandonment was centered on portions of the Mississippi, Ohio, Tennessee, and Cumberland River valleys and characterized by a marked decline in both occupation and sociopolitical complexity among remaining populations (figure 3.1). The Vacant Quarter hypothesis did not propose a complete depopulation of the region. Rather, it highlighted the apparent cessation in major mound-building efforts and the demise of ceremonial centers in the region. As Williams (1990, 173) noted, "Population relocation rather than wholesale decimation is posited as part of a likely explanation. The term 'vacant' is used; however, it should not be understood to suggest that the area was completely devoid of use by Native American peoples who hunted there and made use of other resources as well. The year-round settled villages are no longer there."

Although there has been some objection to the existence of the Vacant Quarter (e.g., Lewis 1986, 1990), a growing body of research in the region has provided support for Williams's hypothesis (Anderson 1991; Benson,

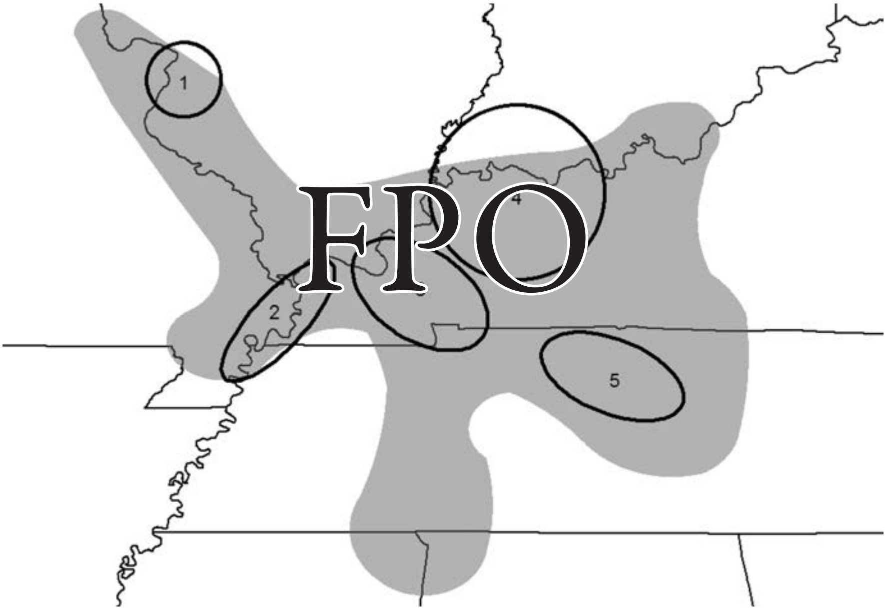

Figure 3.1. Map of the Vacant Quarter illustrating the locations of the five regions examined in this study: (1) American Bottom, (2) Ohio-Mississippi confluence, (3) Tennessee-Cumberland-Ohio confluence, (4) Ohio-Green confluence, (5) Middle Cumberland basin

Pauketat, and Cook 2009; Cobb and Butler 2002; Mainfort 2001; Meeks 2009; Milner, Anderson, and Smith 2001; Morse and Morse 1983; Nolan and Cook 2010a, 2010b; Smith 1992; Wesler 1991, 2001). Yet despite growing support for the archaeological reality of the Vacant Quarter, two important issues remain unresolved. The first concerns the timing of the abandonment of the region. Williams (1983, 1990) originally placed the date of abandonment between AD 1450 and 1550, based on the presence or absence of various protohistoric horizon markers known to occur in areas surrounding the Vacant Quarter. Charles Cobb and Brian Butler (2002) have posited a somewhat earlier date centered on AD 1450, based on examination of a suite of 14C-dates from sites in the southern Illinois uplands adjacent to the lower Ohio Valley, as well as an examination of 14C-dated sites from the valley proper. A similar date of ca. AD 1450 has also been proposed for abandonment of the Middle Cumberland Valley (Moore et al. 2006; Smith 1992). The earliest date range proposed for the abandonment of the Vacant Quarter is between AD 1350 and 1400 for portions of the central Mississippi Valley (Morse and Morse 1983) and the lower and western-middle Tennessee Valley (Meeks 2009). Taken together, these disparate abandonment estimates for the region suggest that abandonment was not synchronic but rather that it occurred over a period of 100 years. However, as we will illustrate, examination of a large corpus of 14C-dates from five regions encompassing the Vacant Quarter provides evidence suggesting that abandonment was in fact largely synchronic across the region.

The second major issue is why the Vacant Quarter was ultimately abandoned. A host of potential causes have been posited to explain the collapse of Mississippian polities in the region, including environmental deterioration associated with the onset of the Little Ice Age, extended periods of drought, environmental degradation, the adoption of new varieties of maize, disruption in the prestige goods economy, social strife, chiefly cycling/fluctuations in organizational complexity, and pandemics associated with European contact (providing abandonment occurred after contact) (e.g., Anderson 1991; Blitz 1999; Cobb and Butler 2002; Cook et al. 2007; Hall 1991; Lopinot and Woods 1993; Mainfort 2001; Pollack 2004; Rindos and Johannessen 1991; Williams 1990; Woods 2004). The processes leading to collapse in Mississippian chiefdoms were complex and multivariate and hence typically attributable not to a single cause but rather to a host of interrelated factors (Anderson 1994). From this perspective, it is highly probable that many of the possible causes cited here coalesced at varying times to strain the resiliency of Mississippian societies in the Vacant Quarter.

In keeping with the theme of this book, we employ an ecological perspective to examine one potential factor in the abandonment of the Vacant Quarter. Specifically, we examine the possibility that sustained droughts resulted in decreased maize yields and even catastrophic crop failures, which in turn fostered political instability by weakening the authority of Mississippian chiefly elites and in extreme cases led to the depopulation of large areas of the southeastern United States (with the caveat that drought was contributory but likely not the only factor operating, with warfare, internal factional competition, and other factors also important). A critical underlying premise of the argument presented here is that Mississippian chiefdoms were in part dependent on agricultural surplus not only to offset subsistence shortfalls but, most important, to underwrite the political structure through the production of goods, trade, communal projects, and ritual (e.g., Anderson 1994; Earle 1991; King 2003; Milner 1998; Muller 1997). That is, the production of crop surpluses above and beyond household needs by commoners and their appropriation or mobilization by elites, whether occurring willingly or through the use of force, was a fundamental characteristic of Mississippian chiefdoms in the region. It follows that regardless of how dynamic a chiefly leader may have been, political stability could not be maintained within the context of sustained shortfalls in crop yields, particularly of maize, the primary crop.

To accomplish this task, we employed tree-ring–based reconstructions of water availability from AD 1000 to 1500 in the southeastern United States, coupled with a suite of 14C-dates from five regions in the Vacant Quarter as a proxy for inferring population histories, to investigate the relationship among Mississippian agricultural production, storage capabilities, climate fluctuations, and population dynamics. Evaluation of the data documents a variety of societal responses corresponding to extended periods of drought-induced stress, including cessation in mound construction, center abandonment, population displacement, settlement reorganization, and collapse of centralized authority. Drought, we argue, while important, was not the sole causal factor in the demise of Mississippian polities in the region and the ultimate abandonment of the Vacant Quarter. Rather, we contend that aspects of droughts—such as duration, intensity, and spatial variation—and their impact on resources, specifically maize crop yields, were important in shaping the resiliency and hence the stability of Mississippian societies (see also Anderson 1994; Anderson, Stahle, and Cleaveland 1995; Benson, Pauketat, and Cook 2009; Nolan and Cook 2010a, 2010b). How societies reacted to stress, not simply the existence of the stress itself (i.e., drought), was what was critical.

ESTIMATING MISSISSIPPIAN AGRICULTURAL PRODUCTIVITY AND POPULATION HISTORIES

To explore the possible relationship between drought (and associated shortfalls in food reserves) and events witnessed in the archaeological record of the Vacant Quarter, we determined the volume of agricultural crops potentially available each year during a 301-year interval from AD 1200 to 1500. We derived these estimated crop yields from a grid of fifty tree-ring reconstructions of the summer Palmer Drought Severity Index (PDSI; Cook et al. 2007) covering the southeastern United States (figure 3.2). The PDSI incorporates temperature and precipitation values to measure the departure of soil moisture supply from normal based on a water balance model that incorporates moisture input, output, and storage (see Palmer 1965 for an in-depth discussion). PDSI values, generally ranging between +4.0 and −4.0, provide an estimate of how much soil moisture was available, with positive values indicating wet conditions and negative values indicating dry conditions.

The analysis is critically dependent on the relationship among the measure of drought employed, PDSI, and maize crop yields, which were important to the maintenance and stability of Mississippian societies. Maize has in fact long been known

Figure 3.2. Instrumental Palmer Drought Severity Index (PDSI) grid used for reconstructing potential agricultural food reserves and shortfalls, along with the location of the Vacant Quarter (shown in gray)

to be highly sensitive to moisture conditions; and a vast literature documents these relationships, given the importance of the crop to food production in the past, at present, and in the future—globally and in eastern North America (e.g., Baden and Beekman 2001; Burtt-Davy 1914; Jones and Kiniry 1986; Jones and Thornton 2003). Indeed, one of the advantages of the Northern Flint variety of maize widely used by Mississippian populations was that it was moderately resistant both to drought and to rot in overly wet conditions, important factors in a region characterized by appreciable variability in growing-season rainfall (e.g., Baden 2005; Hall 1991, 25). Although there are problems inherent in the use of PDSI, notably that it is a better measure of long-term conditions than of shorter-term fluctuations (e.g., Alley 1984; Guttman 1998; Hu and Willson 2000; Karl and Knight 1985), a number of studies from across North America have demonstrated the utility of using tree-ring reconstructed PDSI values as a proxy for maize crop yields and hence for exploring the potential impacts of drought on past societies where this crop was important (e.g., Acuna-Soto et al. 2002; Anderson 1994; Anderson, Stahle, and Cleaveland 1995; Benson et al. 2007; Benson, Pauketat, and Cook 2009; Blitz and Lorenz 2006; Cook et al. 2007; Nolan and Cook 2010a, 2010b; Stahle et al. 2000, 2007; Van West 1994).

Building on the assumption that Mississippian maize crop yields in the southeastern United States, based on rain-fed agriculture, were associated directly with variations in soil moisture conditions as reflected in the reconstructed PDSI data, we assigned the eleven moisture categories defined by Palmer (1965) to an agricultural productivity category, along with an associated numerical value of +1, 0, or −1, to calculate potential food reserves and shortfalls (table 3.1). Years in which reconstructed PDSI values were > −0.5 and < +4.0 (near normal to very wet) were considered to represent years of normal harvest, providing for normal annual consumption plus one year's surplus. Years in which reconstructed PDSI values were > −1.0 and

Table 3.1 Assignment of Palmer Drought Severity Indices (PDSI) to estimated crop yield production.

PDSI Value	*PDSI Category*	*Agricultural Productivity*
4.0 or more	Extremely wet	Failed harvest (−1)
3.0 to 3.99	Very wet	
2.0 to 2.99	Moderately wet	
1.0 to 1.99	Slightly wet	Normal harvest (+1)
0.5 to 0.99	Incipient wet	
0.49 to −0.49	Near normal	
−0.5 to −0.99	Incipient drought	Minimal harvest (0)
−1 to −1.99	Mild drought	
−2 to −2.99	Moderate drought	Failed harvest (−1)
−3 to −3.99	Severe drought	
−4 or less	Extreme drought	

≤ −0.5 (incipient drought) were assigned the value 0, representing a minimal harvest. Minimal harvests provided a crop yield that sufficed for one year's normal consumption but did not provide additional crops that could be stored as surplus. Years with reconstructed PDSI values ≤ −1 (mild to extreme drought) were assigned a value of −1, representing a year of complete crop failure in association with agricultural drought. Agricultural drought takes place when soil moisture is deficient to the point that plants are stressed and yield is diminished, with drought conditions generally occurring when PDSI values are ≤ −1.0. We have also designated extremely wet conditions (i.e., PDSI values ≥ +4.0) as potentially detrimental to Mississippian crop yields, in that periods of excessive wetness may represent unstable hydrologic conditions (flooding) not conducive to floodplain agriculture or periods in which crops rotted because of ground saturation. Similar to the mild-to-extreme drought years, extremely wet years would have resulted in a complete crop failure.

Our yearly estimates of potential food reserves and shortfalls were derived directly from each of the fifty grid-point PDSI reconstructions and, following Anderson (1994; see also Anderson, Stahle, and Cleaveland 1995), were based on the assumption that Mississippian populations in the southeastern United States were capable of maintaining a two-year storage capacity that included the current year's harvest plus the storage of one previous harvest. Each of the fifty grid points used in our analysis has PDSI reconstructions spanning the period from AD 1200–1500, although the PDSI reconstructions prior to AD 1300 are based on fewer tree-ring chronologies for the region and are less reliable in terms of their accuracy (Cook et al. 2007).

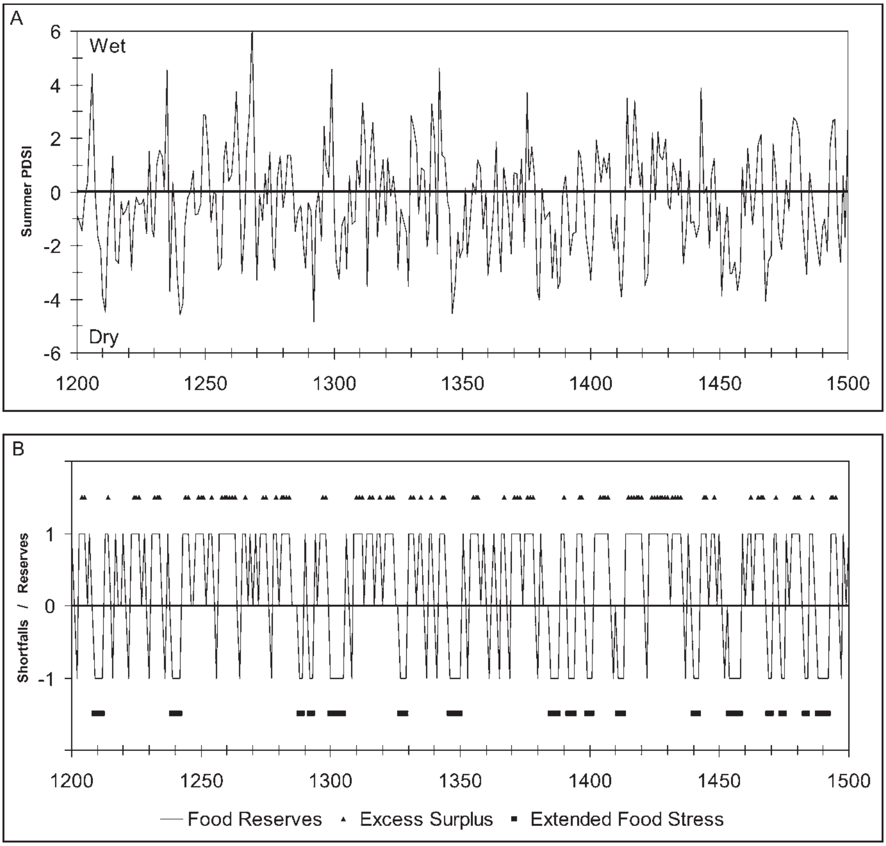

FIGURE 3.3. Palmer Drought Severity Index (PDSI) reconstruction (A) and reconstructed potential agricultural food reserves and shortfalls (B) for the Vacant Quarter region (time series for grid point 210)

Beginning in AD 1200 and assuming that one year's worth of crops was in storage, the harvest and cumulative stored food reserves and shortfalls were calculated for each successive year using the transformed reconstructed PDSI values. Figure 3.3 provides an example of the reconstructed PDSI values from Cook and his coauthors' (2007) data for the region of the Vacant Quarter, along with our reconstructed potential agricultural food reserves and shortfalls based on transformations of the PDSI values.

During the calculations, values were not allowed to fall below −1 (total crop failure) or above +1 (maximum stored reserves) for any given year. The shortfall range was limited to −1, because numbers below this would imply that more crops failed than were actually planted. Shortfall years occurred when a year of crop failure followed a year of minimal harvest (no reserves in store) or when two consecutive years of complete crop failure depleted stored reserves. Excess surplus occurred in years of consecutive normal harvests when stored reserves were at capacity from the previous year. When the surplus was greater than the storage capacity (i.e., > +1.0), it was coded as excess surplus and excluded from calculation of the food reserve estimates. Excess surplus would have to be consumed to avoid spoilage and could be mobilized by a chiefly leader to fund feasting, prestige goods exchange, monumental construction, and other public activities. In addition, excess surplus could support larger populations in the vicinity of a given polity or be used to attract additional followers from adjacent regions.

In addition to calculating cumulative food reserves and shortfalls, we identified periods of extended food stress resulting from repeated crop failures that produced food reserve deficits spanning two or more consecutive years (figure 3.3). Extended food stress years were calculated for each of the fifty grid points used in our analysis, allowing us to investigate the spatial extent of prolonged drought periods and associated food stress (figure 3.4). Although any year with a shortfall in agricultural food reserves would have been potentially stressful, brief periods of food stress would likely have been offset by using wild plant or animal resources, including starvation foods (Moerman 1998; Yanovsky 1936); acquiring foods through exchange; seeking assistance from neighboring polities; or through military conquest. However, it is doubtful that such measures would have sustained a large Mississippian polity for any length of time, especially if multiple periods of food stress occurred within a relatively short time. Protracted periods of food stress would not only have impacted the population in terms of their subsistence but would also have constrained a chiefly leader's ability to mobilize the necessary surplus to enhance status or promote polity growth.

To investigate how prolonged periods of drought and agricultural shortfalls may have influenced the distribution and abundance of Mississippian populations in the Vacant Quarter in both time and space, we compiled a suite of 557 uncalibrated 14C-dates spanning the period 1100 BP to 300 BP from 113 sites in the American Bottom, the Ohio-Mississippi confluence region, the Tennessee-Cumberland-Ohio confluence region, the Ohio-Green confluence region, and the Middle Cumberland basin (figure 3.1; table 3.2). We employed a dates-as-data approach that uses changes in the summed probability distribution of a group of 14C-dates as a proxy for inferring population history (e.g., Anderson et al. 2011; Blackwell and Buck 2003; Buchanan, Collard, and Edinborough 2008; Erlandson et al. 2001; Gamble et al. 2005; Hunt and Lipo 2006; Nunn et al. 2007; Shennan and Edinborough 2007; Surovell and

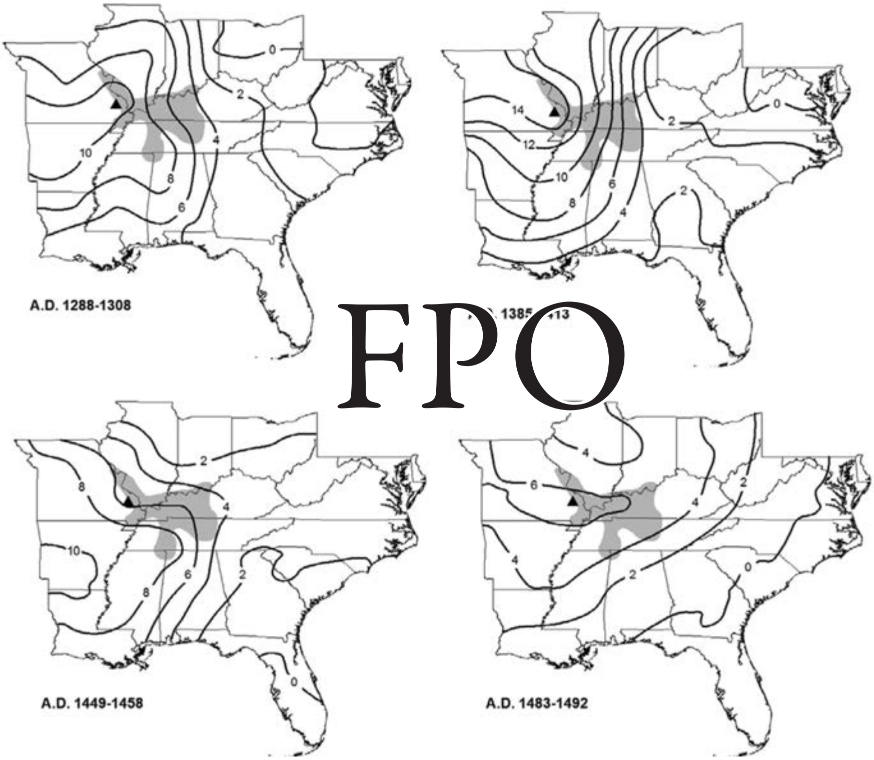

Figure 3.4. Reconstructions of the number of moderate/severe food stress years for four intense droughts encompassing the southeastern United States in the thirteenth, fourteenth, and fifteenth centuries, along with the locations of the Vacant Quarter (shown in gray) and grid point 210 (denoted by triangle). Positive values reflect the magnitude of food stress.

Brantingham 2007; Surovell, Waguespack, and Brantingham 2005; Thomas 2008).

The uncalibrated 14C-dates in our database were calibrated in the CALIB 5.0.1 program using the Intcal04 curve (Stuiver and Reimer 1993). Following the calibration of the dates, CALIB 5.0.1 was used to sum the probabilities to produce probability distributions for each of the five regions in the Vacant Quarter (figure 3.5). We assume that the major peaks and troughs in the summed probability distributions for each region in the Vacant Quarter reflect fluctuations in population size and/or level of occupational intensity. This is admittedly a tenuous task, as the use of 14C-dates as a proxy for estimating population histories is hampered by a host of problems

Table 3.2 Summary data of 14C-dates from the Vacant Quarter, by region.

Region	*Number of 14C-Dates*	*Number of Sites*
American Bottom	166	17
Ohio-Mississippi confluence	123	31
Tennessee-Cumberland-Ohio confluence	88	20
Ohio-Green confluence	69	16
Middle Cumberland	111	29
Total	557	113

(e.g., Rick 1987; Surovell and Brantingham 2007; Thomas 2008), including old wood effects, dates with large statistical errors, plateaus and wiggles in the calibration curve, time-dependent taphonomic processes, variation in the comprehensiveness of 14C-dates reported for both individual sites and regions, and the fact that the 14C record is more a reflection of archaeological investigations than a record of the totality of human occupation in a region. Despite these problems, the position taken here is that the 14C database (a total of 557 dates from 113 sites) used in our study is robust enough to obviate these concerns, allowing general trends in Mississippian population histories in the Vacant Quarter to be investigated.

POSSIBLE EFFECTS OF DROUGHT AND AGRICULTURAL PRODUCTIVITY ON MISSISSIPPIAN POPULATION TRAJECTORIES IN THE VACANT QUARTER

Our reconstruction of potential food reserves and shortfalls for the Vacant Quarter indicates that maintaining one year's reserves would have provided Mississippian populations in the region with adequate or better food supplies during approximately three-quarters (n = 222; 74%) of the years between AD 1200 and 1500, with periods of favorable climate in AD 1200–1287, 1309–84, and 1414–48 (figure 3.3). This included ninety-five years of excess surplus that chiefly leaders would have mobilized to finance feasting, prestige goods exchange, monumental construction, and other public activities and that would have provided the surplus necessary to support larger populations and attract additional followers. It is probably not coincidental that the summed probability distributions of the calibrated 14C-dates indicate stable or expanding populations throughout the region during the periods AD 1200–1287 and 1309–84 (figure 3.5). The absence of any noticeable population in the Vacant Quarter during the period of favorable climate from 1414–48 suggests that a major change in the landscape had already occurred in the region.

Although most of the years between AD 1200 and 1500 were favorable for

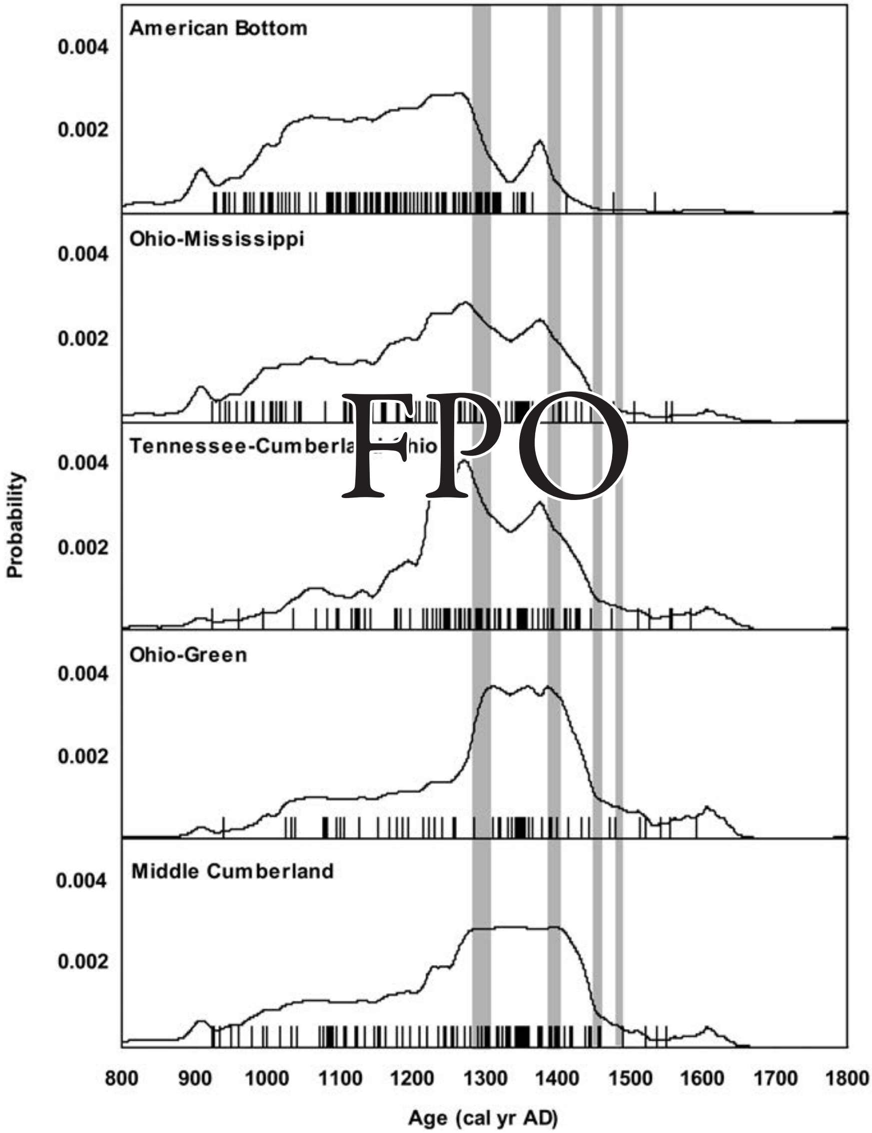

Figure 3.5. Summed probability plots of calibrated 14C-dates for each of the five regions in the Vacant Quarter. Gray bars denote extended periods of drought-induced agricultural shortfalls identified in figures 3.3 and 3.4. Black vertical lines denote calibrated median dates of individual age determinations.

Mississippian agricultural populations throughout the Vacant Quarter, our reconstruction of potential food reserves documents four periods of drought-induced stress: 1288–1308, 1385–1413, 1449–58, and 1483–92 (figure 3.3). Although the severity of these four periods of drought-related stress varied spatially across the southeastern United States, all four would have impacted the Vacant Quarter (figure 3.4). These extended periods of drought would have quickly depleted Mississippian stored food reserves, thereby threatening the stability of chiefdoms by limiting the surplus the elites needed to sustain their authority (Anderson 1994; Anderson, Stahle, and Cleaveland 1995; Benson, Pauketat, and Cook 2009; Blitz and Lorenz 2006). This would have had the potential to promote political change. As Adam King (2003, 22) suggests, "Anything that impacts the production of surplus, a leader's ability to mobilize surplus, a leader's ability to perform his/her specified duties for society, or the ideological structures that justify the leader's position and ability to mobilize surplus has the potential to bring about political change." To explore how the sociopolitical landscape of the Vacant Quarter may have changed in response to these periods of climatic perturbations, we examine the archaeological record of the Vacant Quarter within the context of the four major drought events that impacted the region.

Drought Event 1 (AD 1288–1308)

The potential food reserve and shortfall reconstructions for the period AD 1288–1308 indicate that a severe downturn in climate occurred, with food shortages indicated for eleven of the twenty-one years, including an extended period of constant crop failure during the six-year period 1300–1305. During this period the summed probability distributions indicate major shifts in population structure throughout the Vacant Quarter; however, these shifts vary among the five regions (figure 3.5).

The most dramatic population event occurred in the American Bottom ca. AD 1280, as the summed probability distribution indicates a major population decline across the region. This drastic decline in population also occurred at Cahokia during the same period (figure 3.6). The small peaks in the probability distributions illustrated in figures 3.5 and 3.6 are related to a wiggle in the curve used to calibrate the dates and do not represent increases in population in the late 1300s. Given the sharp decline in the probability distribution, coupled with the near absence of dates post-AD 1300, it appears that population levels at Cahokia and over the surrounding region declined rapidly sometime between AD 1280 and 1310. This collapse occurred during a period of social and political unrest near the end of the Moorehead phase (1200–1275) (Emerson 2002; Emerson and Hargrave 2000), suggesting that drought-induced agricultural shortfalls may have exacerbated problems in a political system

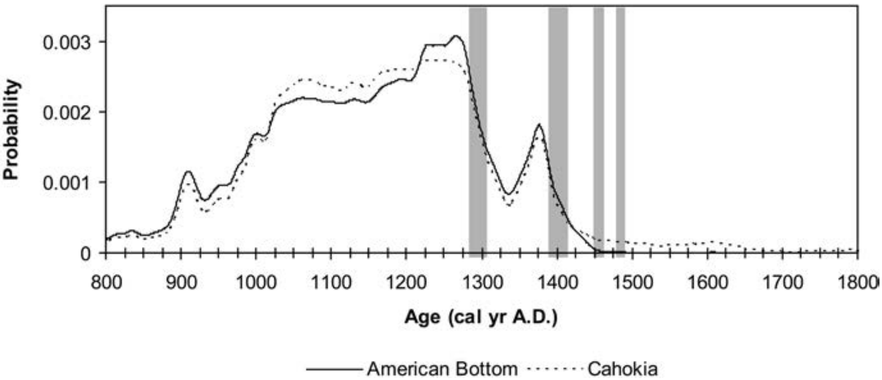

FIGURE 3.6. Comparison of summed probability plots of calibrated 14C-dates for the American Bottom (82 dates) and Cahokia (84 dates). Gray bars denote extended periods of drought-induced agricultural shortfalls identified in figures 3.3 and 3.4.

already in a state of decline. Larry Benson and his colleagues (2009), in fact, argue that a series of decadal-scale droughts were playing a role in the decline of Cahokia from the mid-twelfth century onward, with abandonment occurring after ca. AD 1250 and complete by no later than ca. AD 1350. Corresponding with the collapse of Cahokia and the virtual abandonment of the American Bottom by all but a few people during the Sand Prairie phase (1275–1350), evidence indicates that Oneota peoples moved into the northern portion of the American Bottom during the fourteenth century, albeit in small numbers (Jackson 1998).

To the south of the American Bottom, evidence indicates that populations in both the Ohio-Mississippi and Tennessee-Cumberland-Ohio confluence regions were undergoing significant sociopolitical upheavals, although at a scale much smaller than that witnessed to the north. The summed probability distributions for both regions appear to indicate a contraction in population beginning around AD 1280. As was the case for the American Bottom, both of these probability distributions are influenced by a wiggle in the calibration curve. Given the large number of dates between AD 1300 and 1400, we speculate that both regions were characterized by a period of population stasis post-AD 1310 rather than actual declines in population. However, evidence suggests that major changes were occurring across the landscape. In the Ohio-Mississippi confluence region, many of the large, fortified mound centers in the Cairo Lowland—including Lilbourn, Beckwith's Fort, Crosno, and Matthews—appear to have been on a decline by AD 1300 (Lewis 1990; Morse and Morse 1983). A similar pattern is witnessed across the Mississippi River in western Kentucky. Mound centers such as Wickliffe and Turk appear to have been declining by the late 1200s, while other mound sites experienced periods of emergence or reemergence, including Adams, Sassafras Ridge, and Twin Mounds (Kreisa 1995; Lewis 1990, 1996; Mainfort 2001; Wesler 2001, 2006).

In the Tennessee-Cumberland-Ohio region, Kincaid—which had emerged as a major mound center around AD 1000—had witnessed a cessation in mound building and was waning in political influence by 1300 (Butler 1991; Cobb and Butler 2002). The Jonathan Creek site appears to have experienced its primary occupation between 1200 and 1300 (Schroeder 2006). At the same time Kincaid and Jonathan Creek's political fortunes were lessened, other smaller mound sites appeared on the landscape, including renewed mound construction at Rowlandtown (Wesler 2006). There also appears to have been an expansion of Mississippian populations in the uplands of southern Illinois during the late 1200s, representing migrant populations that splintered from the lower Ohio Valley during the political unrest that followed the demise of mound centers in the Tennessee-Cumberland-Ohio confluence region (Cobb and Butler 2006).

To the east, in the Ohio-Green confluence region and the Middle Cumberland basin, another pattern is evident (figure 3.5). The summed probability distributions for both regions indicate rapid increases in populations between AD 1250 and 1310, followed by a period of population stasis but still high overall populations that lasted until approximately 1380. The peaks in populations for the Ohio-Green confluence region and the Cumberland basin occurred about the same time Cahokia collapsed and many of the major mound centers to the west, in the Tennessee-Cumberland-Ohio and Ohio-Mississippi regions, were on the decline. The Angel site witnessed its most intensive period of occupation during this interval (Hilgeman 2000), and the Andalex site experienced a renewed period of occupation and construction (Clay 2006). In the Middle Cumberland region, numerous mound centers were established throughout the region during the Dowd period (AD 1050–1250), including Mound Bottoms and Pack along the Harpeth River and Castalian Springs, Brock Church Pike Mounds, and French Lick along the Cumberland River (Smith 1992, 1994; Smith and Moore 1999; Smith, Stripling, and Moore 1993). Beginning in the mid-thirteenth century, there appears to have been a major change in the occupation of the Middle Cumberland region. The dispersed settlements witnessed during the Dowd period shifted to a focus on nucleation with the establishment of large, fortified villages during the Thruston period (AD 1250–1450). Also during this period, most of the lower and central Harpeth River basin appeared to undergo rapid depopulation, with a concomitant population increase in the Nashville basin along the Cumberland River. Mississippian populations also appear to have expanded their settlements into the upper Harpeth River basin during this time, including the establishment of the mound sites DeGraffenreid, Fewkes, and Old Town (Smith 1992, 1994; Smith and Moore 1999).

Drought Event 2 (AD 1385–1413)

During the twenty-nine-year period AD 1385–1413, Mississippian populations in the Vacant Quarter would have been under a considerable amount of stress as a result of repeated failures in agricultural production. In fact, the reconstructed food reserves and shortfalls indicate total crop failure for fourteen years, including extended stress years from AD 1385–88, 1392–94, 1399–1401, and 1411–13. Based on the summed probability distributions, this period represents the most significant period of population decline in the Vacant Quarter, as all regions appear to have reached a critical population threshold between 1380 and 1420 (figure 3.5). This is clearly illustrated by the precipitous decline in the probability distributions and the low number of post-AD 1420 dates.

In the American Bottom, the last remaining Mississippian populations, although few in number, appear to have left the region. In the Ohio-Mississippi confluence region, it appears that virtually all the major mound centers were abandoned at this time (Mainfort 2001; Morse and Morse 1983; O'Brien 2001). A few sites in the region contain possible evidence indicating post-AD 1450 occupations, including Sassafras Ridge in western Kentucky and the Callahan-Thompson and Hess sites in southeastern Missouri. However, the Hess site is problematic as the 14C-dates and artifact assemblage are not compatible, the former suggesting post-AD 1500 occupation and the later indicating an occupation spanning AD 1250–1350 (Mainfort 2001). Evidence for Mississippian occupation in the Tennessee-Cumberland-Ohio confluence region is also lacking, as sites such as Kincaid, Tinsley Hill, and Rowlandtown appear to have been vacated sometime between AD 1400 and 1450 (Clay 1997; Cobb and Butler 2002, 2006; Wesler 2006).

Sites in the southern Illinois uplands, including Millstone Bluff and Hayes Creek, appear to be the latest occupations in the region, but even their abandonment dates (Cobb and Butler 2002) fall close to our proposed AD 1420 date for the abandonment of the Vacant Quarter. To the east, sites in the Middle Cumberland basin appear to have been abandoned in the early 1400s, including both mound (East Nashville Mounds, Fewkes, and Gordontown) and non-mound (Arnold, Averbuch, and Gainer) sites (Moore et al. 2006; Smith 1992, 1994). Lastly, the Ohio-Green confluence region exhibits abandonment by Mississippian peoples in the early 1400s, including the two principal mound sites in the region, Angel and Andalex. However, occupation did continue in the region with the establishment of Caborn-Welborn phase (AD 1400–1700) populations near the mouth of the Walbash River (Pollack 2004, 2006).

Drought Events 3 and 4 (AD 1449–58; 1483–92)

The second half of the fifteenth century witnessed a modest deterioration in climate, with potential food shortfalls occurring in eighteen of the years between AD 1449 and 1500. Food shortfalls were most severe during two ten-year periods, 1449–58 and 1483–92. Cook and his colleagues have suggested that the drought from 1449–58 may have contributed to the abandonment of the Vacant Quarter (Cook et al. 2007). As discussed earlier, abandonment of the region appears to have been completed no less than three decades prior to this period. Thus, we suggest that the drought-induced stress occurring during the 1450s was not related to the abandonment of the Vacant Quarter. However, this period of climatic deterioration, as well as the drought years 1483–92, likely affected Caborn-Welborn populations residing in the region.

SUMMARY AND CONCLUSION

Our analysis of tree-ring–based reconstructions of water availability from AD 1200–1500 in the Vacant Quarter region of the midcontinental United States identified several periods of extended food stress resulting from repeated drought-induced crop failures. When these stress periods were compared against the archaeological record, it was evident that several large-scale social changes occurred at roughly the same time. Although caution must be exercised in interpreting climate-culture relationships, the results of our study indicate that drought and agricultural shortfalls impacted the historical trajectories of Mississippian societies throughout the Vacant Quarter, fostering declines in sociopolitical structure and large-scale abandonments. Unfortunately, the importance of the effect of environmental factors on cultural processes is often minimized in modern archaeology, as such an approach is often viewed as too simplistic and overly deterministic. However, the environment is more than a simple backdrop to human activities. Placing the archaeological record of cultural change within the context of climatic records presents opportunities to examine how people responded to both short- and long-term changes in the environment. In this regard, the environment should be viewed as a significant piece of the puzzle in the reconstruction of the archaeological record and the elucidation of prehistoric lifeways.

But our analysis also makes it clear that climate alone cannot explain the totality of the archaeological record. The collapse of Cahokia illustrates this point. It appears that population levels at Cahokia, as well as in the American Bottom region, declined very rapidly during the period 1280–1310. The fact that this collapse corresponded to a period of drought-induced resources stress is certainly intriguing and suggests that the two are linked in some fashion. However, the fact that much of the remainder of the Vacant Quarter, which was also affected by severe drought, was not depopulated (at least not until some time later) illustrates that climate change was not the sole causal factor in Cahokia's collapse. The decline of Cahokia, scholars have argued, apparently had deep roots, extending back into the Stirling phase (AD 1050–1150) when the abandonment of nearby upland communities occurred, as did the construction of a great palisade around the central portion of the site (Benson, Pauketat, and Cook 2009; Pauketat 2009). Over the next century or so, continued social and political unrest came to a head during the late Moorehead phase. Drought did not cause Cahokia's decline and collapse or similar abandonments elsewhere in the region, leading to the creation of the "Vacant Quarter," but it probably did contribute to the collapse and help push at least some societies over the edge.

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