2

When the Levee Breaks

Small Decisions and Big Floods at the End of the Last Ice Age

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At face value, the archaeological record of North America at the end of the last Ice Age appears to be a strange place to discuss human behavior at the scale of a single day. We cannot, for example, discuss "the Last Thursday of the Clovis Culture" for many reasons, the most obvious of which is that the archaeological data are much too coarse. In this chapter we argue that in order to shift the scale of Paleoindian period archaeology to examine "everyday matters" archaeologists have to grapple with the well-known "palimpsest problem" (Binford 1981) and reorient their theoretical positioning to include more "bottom up" models from complexity theory. Using three examples from the southeastern United States, we first discuss how Anderson et al. (2016) used a refit analysis at the Topper site to illuminate how people may have learned to make stone tools, which yields insights into how the learning networks that we can detect with archaeological data may have developed. Next we discuss how the everyday decisions regarding stone tool maintenance and discard can help us determine how people may have altered where they lived and what they ate in relation to climate change. Finally, we discuss how these decisions might have led hunter-gatherers during the Younger Dryas to target deer and other animals during spring floods so that taking advantage of short-term abundance led to increasing scarcity over the long term.

The Paleoindian Palimpsest Problem

Discussing Paleoindian "everyday matters" using the archaeological record is difficult and stems from the types of questions that are most often pursued by people studying this period. For one thing, Paleoindian period archaeologists remain obsessed with determining when the first people arrived in North

America and, as a legacy of evaluating the Clovis-First model, are preoccupied with residential mobility and subsistence (Meltzer 2009; Smallwood 2014). It is precisely because of this that archaeologists studying this period have gravitated to human behavioral ecology (e.g., Borgerhoff Mulder and Schacht 2005; Smith et al. 2001:128; Winterhalder and Smith 2000). At face value, the foundation for behavioral ecology is meant to model snapshot decisions with well-defined parameters as an analytical baseline to compare against the decisions that people actually make (Kelly 2013; Kennett and Winterhalder 2006:18–19).

However, archaeologists taking this theoretical perspective must grapple with the fact that archaeological datasets are averages of many decisions made over long periods by many people: the classic "palimpsest problem" (Binford 1981). Furthermore, in the case of the Clovis culture, the minimum estimate for its duration is approximately 200 calendar years (Waters and Stafford 2007). If the average generation span for ethnographic hunter-gathers is 28.6 years (Fenner 2005), then there are at least seven generations of individuals represented by the distribution of Clovis points across North America. In other words, drilling down from the archaeological record to the scale of a single day is impossible. Regarding everyday matters, we only can observe those averages of decisions for the most part.

Paul Martin's (1984) classic "Pleistocene Overkill" model best illustrates the disjunction in scale between the instantaneous decisions modeled by behavioral ecology versus the palimpsests of material accumulated over multiple centuries. One key component of the model is the assumption of high rates of mobility in order to move people across a continent in a few centuries. It is as if we must assume that Clovis people had a "plan" to colonize a continent quickly and that it is the job of the archaeologist to work backward from the data to envision the plan. That is like analyzing the movements of football players to determine the structure of the play called in the huddle. This is obviously problematic, as it is highly unlikely that the Pleistocene colonists of North America huddled up at the mouth of the Ice-Free Corridor and called a "Hail Mary" to scatter people to the far reaches of the continent as quickly as possible. Granted, subsequent attempts to model the colonization of North America, and in particular birth rates and residential mobility, are much more nuanced than our anecdote (e.g., Anderson and Gillam 2000; Barton et al. 2004; Hamilton and Buchanan 2007; Surovell 2000, 2003). Yet we contend that there is likely significant variability in the everyday decisions made by the earliest colonizers of North America versus subsequent generations that are masked by the coarse-grained nature of the Pleistocene archaeological record.

Complexity Theory, Archaeology, and Ant Hills

As a way to bridge the scalar gap between everyday matters and the archaeological record, archaeologists have increasingly drawn from complexity theory (e.g., Holland 1995; Kauffman and Johnsen 1991; Langton 1991; Lansing 2003; Wolfram 1984). As an example, J. Stephen Lansing (2003) studied how small local interactions could lead to much larger emergent patterns. He frequently used his research from Bali to show how small local meetings between rice farmers at Water Temples resulted in broad coordination in planting cycles and water distribution—all without a master plan. In fact, when a master plan was instituted as part of the Green Revolution, it undermined local coordination at the Water Temples and led to a brief increase in agricultural productivity, followed by a rapid collapse.

As a nonhuman example of "emergent complexity," we recommend a documentary on the careers of Bert Hölldobler and Edward O. Wilson and in particular the segment showing the interior of a large ant colony. An ant nest was filled with concrete and then excavated, exposing intricate networks of tunnels and rooms that, if human-made, would suggest a small army of architects, engineers, and city planners involved in its creation (Thaler 2012). Instead, this structure was built by ants responding locally to pheromones produced by the queen in much the same way that rice farmers on Bali were adjusting to locally changing environmental conditions and the activities of their neighbors.

These examples provide case studies for how to reconcile the scalar disjunction between the extant Paleoindian archaeological record and considering everyday matters. In other words, rather than evaluating whether a plan like the Overkill Model (Martin 1984) matches the archaeological record, archaeologists should be looking for the types of small, everyday decisions that, when made in the same way over long periods, could generate patterns that are detectable with our coarse-grained archaeological data (Bentley and Maschner 2008; Kohler 2011). While most proponents of applying complexity theory to archaeology are heavily reliant on agent-based models (White 2015), we provide three heuristic examples to illustrate how archaeologists have worked backward from big patterns in archaeological datasets to the everyday matters that likely caused them.

Projectile Points and Learning Networks

Projectile points are the most ubiquitous and temporally diagnostic artifacts for the Pleistocene archaeological record (Meltzer 2009). This is especially the case in the southeastern United States, where surface finds are abundant and buried sites dating to the Late Pleistocene are rare (Anderson et al. 2015; Dunnell 1990; Goodyear 1999; Miller and Gingerich 2013). Instead, archaeologists in the southeastern United States heavily rely on sites associated with stone outcrops that have yielded information on how these, and other artifacts, are produced (Anderson et al. 2015; Smallwood 2012).

At the Topper site in South Carolina, Derek Anderson et al. (2016) found evidence for what this process may have looked like by reconstructing the production of a stone tool through a refit analysis. Anderson et al. argue that, based on the distribution of burnt flakes, it appears as if several people were sitting around a fire and the tool was passed among them with more difficult expert removals happening over and over in the same spot. In other words, less experienced knappers would work on the tool until they reached a point where they could not proceed any further then would hand it to the more experienced knapper. Today we would call this scaffolded learning (Wood et al. 1976). These kinds of everyday interactions made repeatedly over time are precisely those that allow us to detect social networks at larger regional scales (Eren et al. 2015; Thulman 2006). For example, Ashley Smallwood (2012) studied the way in which Clovis bifaces were produced in areas that David Anderson (1995) identified as staging areas and could identify subtle differences. Smallwood concluded that emerging divisions in learning networks were well underway during Clovis times and are more consistent with a stepped model of colonization (e.g., Anderson 1995; Meltzer 2004) rather than with a rapid pulse of people moving across the landscape (e.g., Kelly and Todd 1988).

Projectile Points, Hunting, and Landscape Use

With the onset of the Younger Dryas (ca. 12,800 cal B.P.), Clovis bifaces give way to full-fluted Cumberland bifaces in the Mid-South and fishtailed Suwannee points in Florida and the South Atlantic Coastal Plain (Anderson et al. 2015). The appearance of regionalized point styles is often cited as evidence of cultural reorganization spurred by environmental change, especially given the decrease in the frequency of these post-Clovis types (Anderson 2001; Anderson et al. 2011; Meeks and Anderson 2012). How does a consideration of everyday matters and daily microeconomic decisions inform us regarding sweeping changes that result in cultural reorganization?

These point types remain poorly dated at best (and in the case of the Cumberland not at all) (Tune 2015). Given a weak chronology plus the "cliff" in the radiocarbon calibration curve at the onset of the Younger Dryas, it may be nearly impossible to determine whether those people would have noticed the onset of the Younger Dryas, an event that may have spanned only a few decades, while projectile point types spanned at least several centuries (Fiedel 2015; Meltzer and Holliday 2010). Moreover, does a reduction in post-Clovis points mean fewer people or less time (Smallwood et al. 2015:26–27)? Again, the lack of chronological resolution makes it difficult to assess.

Rather than tracking the frequency of projectile points to make inferences about demography, D. Shane Miller (2014) and Jesse Tune (2015) examined the economic decisions that people made in regard to resharpening their projectile points and where on the landscape they discarded them. In other words, by analyzing patterns in projectile point resharpening and discard, archaeologists have at their disposal a time-averaged reflection of many everyday decisions made, presumably, when hunting. For example, Steven Kuhn and Miller (2015) examined how Clovis and Cumberland bifaces varied in terms of resharpening in the Tennessee Fluted Point Survey (e.g., Broster et al. 2013), where both types were discarded, on average, with very strong correlations between length and width. This pattern is indicative of very little resharpening, which would differentially affect the length relative to the width. On the other hand, Beaver Lake and Dalton types that occur during the latter half of the Younger Dryas are extensively resharpened, as indicated by the lack of correlation between length and width. Miller (2014) was able to replicate this pattern with a sample of projectile points from Benton and Humphreys Counties on the Tennessee River, and Tune (2015) found the same pattern with a larger regional sample from Kentucky, Tennessee, and Alabama.

Moreover, when Miller (2014) examined the distribution of archaeological sites across physiographic sections along the Duck River using data from the Tennessee Division of Archaeology and the Tennessee Fluted Point Survey, Clovis and Cumberland sites were distributed along the confluence with the Tennessee River, whereas over the course of the Younger Dryas points were discarded in increasing numbers at higher elevations. Leon Lane and Anderson (2001) have also replicated these findings in the Appalachian Highlands, as have Greg Maggard and Kacy Stackelbeck (2008) on the Cumberland Plateau in Kentucky. Miller and Stephen Carmody (2016) argue that the lag in the sustained presence of people at higher elevations likely coincides with the lag in the replacement of boreal with deciduous forests at higher elevations and that boreal forests would have been a deterrent to hunter-gatherers due to their lower biodiversity.

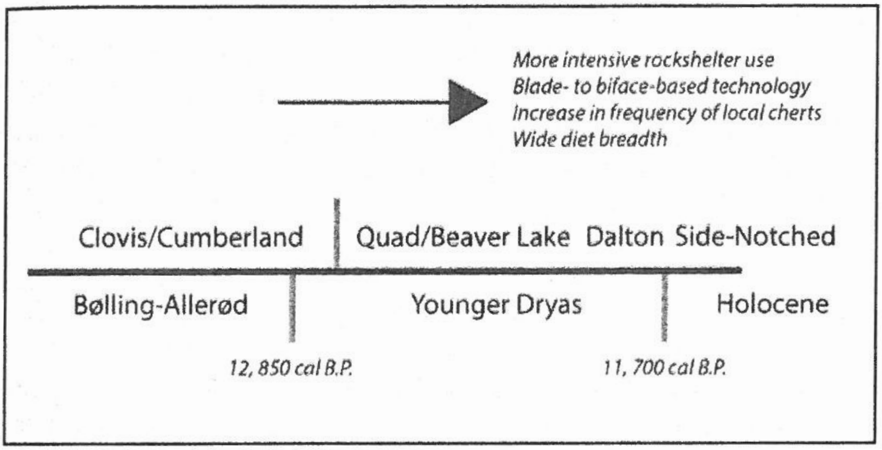

Figure 2.1. Major cultural trends during the Late Pleistocene in the Mid-South.

Consequently, rather than a break in the archaeological record between Clovis and Cumberland that we would expect with a dramatic depopulation or reorganization at the onset of the Younger Dryas, we would put the break between the early and later parts of the Younger Dryas (Figure 2.1). More broadly, this break coincides with the increase in the use of rock shelters (Walthall 1998), a shift from blade to biface-based technological organization (Sherwood et al. 2004:541), an increased focus on local stone resources (Jones et al. 2010; Koldehoff and Loebel 2009; White 2014), and a surprisingly wide diet-breadth, as exhibited at Dust Cave and other Late Younger Dryas sites in the region (Carmody 2009; Hollenbach 2007; Styles and Klippel 1996; Walker 2007). Although making comparisons with Clovis and Cumberland is hampered by a complete lack of sites with preserved flora and fauna in the Mid-South (Anderson et al. 2015; Miller and Gingerich 2013). While these are all broad trends that span several centuries, they are ultimately a reflection of daily microeconomic decisions about everyday matters: what to eat, where to live, and how to make stone tools accomplish those goals.

When the Levees Break

What stays constant? Archaeologists and artifact collectors have long recognized that the natural levees along the Cumberland River, and particularly the lower and central Tennessee River, have historically produced an enormous number of bifaces (Anderson 1995; Anderson et al. 2015). Famous sites such as Quad (Cambron and Hulse 1960; Soday 1954), Nuckolls (Lewis and Kneberg 1958; Norton and Broster 1992), Carson-Conn-Short (Broster and Norton 1993, 1996), Kirk Point (McNutt et al. 2008), Widimeier (Broster et al. 2006), Johnson (Barker and Broster 1996), Puckett (Norton and Broster 1992:), and the recently published Parris Collection from the Lower Tennessee River (Tune et al. 2015) are all found on natural levees. Jefferson Chapman (1985) and Larry Kimball (1996) argued that Early Holocene sites in the river bottoms in the Little Tennessee River drainage in East Tennessee were base camps, and there has been a tendency to push this interpretation back into the Late Pleistocene. We pose an alternative explanation, rooted in complexity theory and everyday decisions, for why there were so many points found on the levees of these rivers.

Based on paleoethnobotanical data, Kandace Hollenbach (2007; Hollenbach and Carmody, Chapter 5) argues that Late Pleistocene and Early Holocene hunter-gatherers followed a seasonal cycle that was largely dictated by the availability of gathered resources. People would leave the uplands during the late winter/early spring once mast resources were tapped out and gravitate toward river bottoms to take advantage of early ripening plants. However, if this is indeed the time when people were using levees, there is a big problem with situating a base camp on a levee—spring floods.

Our own everyday experiences with rivers in the Mid-South are shaped by the Army Corps of Engineers and the Tennessee Valley Authority, which have preemptively flooded bottomlands in rural areas to prevent catastrophes in more populated ones, like Chattanooga (Lewis et al. 1995). Floods obviously still happen today, but they only really affect areas along rivers that are not flood controlled, like the Doe River flood in upper east Tennessee, where snowmelt coupled with heavy rains caused an estimated $20 million in damage in 1998 (Gorey 2013). We also only notice incidences where precipitation and runoff overwhelm dams and other infrastructure, like the May 2010 flood that affected the Cumberland and Duck Rivers, which resulted in 30 counties in Tennessee being declared disaster areas by the federal government (National Weather Service 2010).

Based on limited geomorphological data, some evidence supports the hypothesis that flooding could have been much more prevalent prehistorically, especially during the Late Pleistocene and Early Holocene. In the Duck River, G. Robert Brackenridge (1984) observed that sedimentation occurred faster than soil formation after a Late Pleistocene down-cutting event throughout much of the Early Holocene. Along the Middle Tennessee River, this same general pattern is seen in the stratigraphy at Dust Cave, where a major down-cutting event on the Tennessee River dropped the base level of the river, which helped flush sediments from Coffee Slough and the cave entrance (Sherwood et al. 2004). Then, over the course of the Younger Dryas and early Holocene, overbank flooding in conjunction with slopewash and anthropogenic sediments began filling the cave once more. In the Little Tennessee River, classic Early Holocene sites like Ice House Bottom and Rose Island are buried under meters of sediment (Chapman 1985). While the episodes of flooding would have been more random in headwaters, the main channels of the Tennessee and Cumberland Rivers would have averaged the flooding for a region, which may have included greater amounts of spring snow melt during the Late Pleistocene and Early Holocene. However, data for the region are admittedly sparse, with Eric Grimm et al. (2006) arguing that the lower southeastern United States became warmer and wetter and David Leigh (2008) demonstrating that Late Pleistocene rivers of the region displayed much larger meanders as a result of larger flood discharge. At a human scale, the shift from snow to rain and warming temperatures served as a seasonal cue that flooding was likely on the way.

Why would people be drawn to river bottoms that were prone to flood in the winter and spring? A clue may come from an unlikely place and a remarkable photo. In May 2011 holes were blown in the New Madrid levee to alleviate flooding along the Mississippi River and in the process inundated the area around the platform mound at the Towosaghy site, where deer, turkey, and coyotes took refuge (see photographs at https://footprintmag.wordpress.com/2011/05/23/animals-cling-to-dry-spots-during-mississippi-river-flood/). More broadly, modern floods appear to prompt white-tailed deer to leave low-lying areas for high ground via established migration routes. Floods also appear to cause an increase in mortality and lower body weights the following year, especially among fawns (Jacobson et al. 2011; MacDonald-Beyers and Labisky 2005). Following a flood, deer have a tendency to return to the same home area. Perhaps one of the consequences when levees adjacent to rivers break during late winter and early spring floods is that they leave animals, particularly white-tailed deer, stranded and clustered on areas that are high and dry (Figure 2.2).

Humans taking advantage of such a situation could have had a devastating effect on deer, the most abundant large mammal targeted as prey by humans (Moore and Jefferies, Chapter 7), who were also likely moving to rivers once upland mast resources diminished. If stranded by spring floods, their primary defensive strategy—running—would be limited and hunters could corner entire

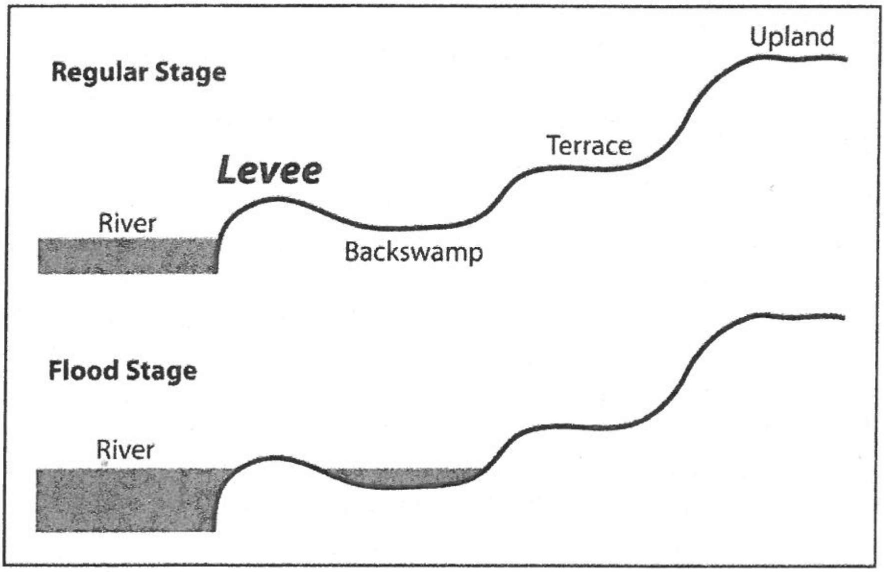

Figure 2.2. A schematic of a levee system at regular and flood stage.

groups of does and fawns—the very reason why it is illegal to hunt during the spring now (McShea et al. 1997). However, we argue that hunters in the Mid-South likely employed the same strategy that other Paleoindian groups have been inferred to have used: ambushing large animals in clusters, as at Blackwater Draw (Boldurian and Cotter 1999), Fin del Mundo (Sanchez et al. 2014), Lehner Ranch (Haury et al. 1959), Wally's Beach (Kooyman et al. 2006; Waters et al. 2015), Vail (Gramly 1982), and Folsom bison kills in the western United States like Casper (Frison 1974) and Folsom (Meltzer 2009). The effect of competing with deer for limited mast resources and then ambushing them (with their young) in the early spring might not have been noticeable at a human scale, but employing this strategy over many centuries could go a long way toward explaining why 84 percent of the deer at Dust Cave were juveniles—a pattern that Renee Walker (1998) argues could be indicative of overhunting. Even if people did notice a change in the availability of hunted resources, the response seems to have been a broadening of diet, adjusting toolkits to hunt smaller, faster prey, and to lay claim to resources within sections of the drainage—a Pleistocene example of everyday decisions leading people down the path that Garret Hardin (1968) described in "The Tragedy of the Commons," where short-term decisions lead to long-term consequences over the duration of the Younger Dryas.

Conclusion

Discussing everyday matters during the Paleoindian period is not exactly a straightforward task. However, at second glance, despite a record that encompasses many centuries and millennia, archaeologists do it quite regularly. More specifically, by employing complexity theory, we attempt to make sense of big patterns by trying to discern what kinds of small everyday decisions could have lasting effects if repeated with sufficient frequency. As examples, several studies have argued that variation in how people learn to knap at quarry sites could lead to regionalization of projectile point styles and that everyday microeconomic decisions about what to eat, where to live, and what tools to use generated macro-scale patterns that give us insights about people adapted to climate change and in particular the Younger Dryas. Finally, we argue that decisions made by hunters to take advantage of species clustered and stranded by floods could have altered their long-term availability during the Younger Dryas. To echo the theme of this volume, everyday matters *really matter*, and the Pleistocene archaeological record is no different.

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Investigating the Ordinary

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