Plant Remains from 2014 Excavations at the Spring Lake Site (41HY160) Hays County, Texas

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The Spring Lake Site (41HY160) is a stratified, multi-component prehistoric site located near the headwaters of the San Marcos River on what is today the Texas State University campus. Crews from the Center for Archaeological Studies, Texas State University conducted investigations at Spring Lake in 2014. Research questions focused on establishing the site chronology and environmental changes that occurred over the millennia of occupation. Fifty-six flotation samples representing 2.0 cubic decimeters ("liters") of matrix each were submitted for identification and analysis.

Site setting

Location

The San Marcos River arises from a series of springs that flow from the base of limestone cliffs where the Balcones Escarpment meets the Gulf Coastal Plain. In 1846, William McClintock gave the number of springs as "not less than 50 in a distance of 200 yards" (McClintock 1930:32). The San Marcos Springs are sacred to members of some Coahuiltecan tribes as the site of human emergence into the current world (Eckhardt 1995).

The modern Spring Lake, from which the adjacent Spring Lake Site takes its name, is a horseshoe-shaped body of water that was created in 1849 by General Edward Burleson, who built a dam across the San Marcos River to power his mills (Eckhardt 1995). Recent research by Jacob Hooge indicates that a body of water akin to Spring Lake existed at least one time in the past when a long drought resulted in levee formation along Sink Creek between the springs and the main channel of the San Marcos River (Hooge 2013:53-55). The period for which Hooge documented such a lake is the Late Archaic III (1645-1414 BP uncalibrated), but similar or smaller bodies of water may have been present at other periods and not detectable in these particular geological cores (Hooge 2013:55). The documented presence of a previous Spring Lake corresponds to a drought period identified by other researchers (Bousman 1998). Prior warm/dry periods have been identified with peaks around 5500 BP (Middle Archaic), 8000 BP (early Archaic) and 11,000 BP (PaleoIndian) (Bousman 1998; Hooge 2013:14).

Vegetation

Despite the climate fluctuations that have taken place over the last 12,000 years and large-scale disturbances by recent human settlements, modern equivalents exist for most Holocene plant communities in Texas (Diggs et al. 2006:87). Britt Bousman's reconstruction of past environments from bogs in the Post Oak Savannah vegetation region of east central Texas shows continual fluctuation but with generally woodland environments prior to 8,000 calendar years ago and grasslands after that time. Temperature and moisture are the determining factors in these reconstructions. On the Edwards Plateau to the west of Spring Lake, soil depth would also have played an important role in changing vegetation patterns. The Edwards Plateau was an erosional environment from approximately 21,000 to 5,000 BP (Cooke et al. 2003). The effects of loss of soil depth on plant communities in Texas are not well studied but probably included decreased productivity (that is, loss of aboveground biomass) and reduced numbers of forbs resulting in a either a patchier distribution of forb species or a reduction in the total number of forb species for the community as a whole (Dornbush and Wilsey 2009; Weaver 1958).

In more recent times, human activities have been a major driver of vegetation change. The most notable changes in central Texas since European settlement include an increase in woody vegetation and the loss of "bottom prairie" communities along major streams such as the San Marcos River (Diggs et al. 2006:115-116). In addition, more frequent fires in would have made the woody vegetation less prominent than during the last century or so (Diggs et al. 2006; MacRoberts et al. 2002). In particular, junipers (*Juniperus ashei* on the Edwards Plateau and *Juniperus virginiana* on the Blackland Prairie) would have been much less abundant, likely restricted to rocky outcrops and streams that afforded both light and protection from fire.

Vegetation in the immediate area of the Spring Lake Site would have been riparian and aquatic during Late Pleistocene and Holocene occupations, as it is today. Perhaps the most famous aquatic plant in the area is Texas wild rice (*Zizania texana*), a federally listed endangered species that currently grows only in the upper San Marcos River (Poole et al. 2008). It is one of three North American wild rice species. The other two North American species, *Z. aquatica* and *Z. palustris*, were used extensively by Native people of the Great Lakes region (Jenks 1977), and they continue to be economically and culturally important today. An Asian species, *Z. latifolia*, also apparently originated in North America but was dispersed across the Bering Land Bridge and separated from the other species some 70 million years ago (Xu et al. 2010).

Other plants in the Spring Lake Site area today include the submerged aquatic plant fanwort (*Cabomba caroliniana*) and emergent plants such as yellow pond lily (*Nuphar advena*). Plants such as cattails (*Typha* spp.), arrowheads (*Sagittaria* spp.), rice cutgrass (*Zizaniopsis miliacea*), horsetails (*Equisetum* spp.), sedges (*Carex* spp.), rushes (*Juncus* spp.), bulrushes (*Scirpus* spp.), water willows (*Justicia* spp.), and buttonbush (*Cephalanthus occidentalis*) grow near the banks and on shore. Roots of baldcypress (*Taxodium distichum*) stabilize the stream banks along with black willow (*Salix nigra*), sycamore (*Platanus occidentalis*), palmetto (*Sabal minor*), and elderberry (*Sambucus nigra*). Herbacous plants on streambanks include edible species such as wild onions (*Allium canadense* and *A. drummondii*) and eastern camas (*Camassia scilloides*). Pecan (*Carya illinoinensis*), little walnut (*Juglans microcarpa*), and Arizona walnut (*J. major*) grow farther from water along with hackberry (*Celtis laevigata*, also called sugarberry) and cedar elm (*Ulmus crassifolia*). The potentially important fiber plant Spanish moss (*Tillandsia usneoides*) hangs on many trees (Fleenor and Tabor 2009; McClintock 1931:33).

Because Spring Lake lies near the juncture of two major vegetation regions, upland areas near the site are diverse. On the Edwards Plateau to the west of Spring Lake, the uplands are savannah landscapes where mixed grasses and forbs are dotted with mottes of live oak (*Quercus fusiformis*), gum bully (*Sideroxylon lanuginosum*, also called coma, wollybucket, and chittimwood), cedar elm, hackberry, Texas persimmon (*Diospyros texana*), yaupon (*Ilex vomitoria*), algerita (*Mahonia trifoliata*), and thorny canes such as dewberry (*Rubus* spp.) and greenbrier (*Smilax bona-nox*) (Gould 1962; Riskind and Diamond 1988). McClintock mentions live oak, post oak (*Quercus stellata*), and pecan (McClintock 1931:33). On Blackland Prairie landscapes to the east, trees are associated primarily with streams. Important economic forb species of the prairies include Indian breadroot (*Pediomelum* spp., also called scurfpea) and prairie camas (*Camassia angusta*) (Gould 1962; Diggs et al. 1999).

Preservation conditions

Charcoal preservation on open sites in central Texas is typically poor. Although charcoal itself is chemically stable and has high preservation potential compared to unaltered plant material, the absence or poor preservation of charcoal in alkaline environments similar to that of central Texas has long puzzled archaeologists (Braadbaart et al. 2009). Recent experiments have investigated the effects of alkaline environments on charcoal (Braadbaart et al. 2009). Although the interactions between temperature of carbonization, soil permeability, density, and wood charcoal anatomy are complex, it is clear that chemically mediated changes in macromolecular structure contribute to the physical processes that cause fragmentation of charcoal. Alkaline environments and wet/dry cycles, both characteristic of the Spring Lake vicinity, are among the factors that contribute to charcoal fragmentation (Braadbaart et al. 2009).

Methods

Flotation samples from Spring Lake were processed at the Center for Archaeological Research, Texas State University in a bucket flotation system where light fractions were poured into no-see-um mesh with triangular openings of 0.4 x 0.5 x 0.3 mm. Heavy fractions were poured through a 1.0 mm wire mesh. Flotation recovery was tested through the addition of carbonized seeds of the exotic species *Papaver somniferum* (poppy, purchased from the grocery store) in seven of the flotation samples. Recovery ranged from 86 to 99 seeds with a mean recovery rate of 94, which is comparable to results from SMAP-type flotation systems and is generally better than other systems where a 1.0 mm bottom mesh is used (see Bush 2004:Table 4.4; Hunter and Gassner 1998:Table 1; Wagner 1982: Tables 1-3). Recovery can be characterized as good to excellent.

Because heavy fractions frequently included some black material that could be either burned bone or charcoal, all heavy fraction material was examined under an illuminated magnifier. Potential plant remains and identifiable bone were confirmed under the microscope and added to light fractions. Light fractions were sorted according to standard procedures at the Macrobotanical Analysis laboratory (Pearsall 2015). Each sample was weighed on an Ohaus Scout II 200 x 0.01 g electronic balance before being size-sorted through a stack of graduated geologic mesh. Materials that did not pass through the No. 10 mesh (2 mm square openings) were completely sorted under a stereozoom microscope at 7-45 X. Carbonized and semi-carbonized botanical remains were counted, weighed, recorded, and labeled. Other materials, including uncarbonized rootlets, grass stems, leaf fragments, and gastropod fragments, were weighted, recorded and labeled as “contamination”. Materials that fell through the 2 mm mesh (“residue”) were examined for carbonized and semi-carbonized botanical remains and identifiable faunal elements. Identifiable botanical material was removed from residue, counted, weighed, recorded, and labeled. It is important to note that identifiable wood charcoal and nutshell were removed from residue. For this reason, results may not be directly comparable with analyses where only wood charcoal and nutshell that remained on a 2 mm mesh were identified, and readily identifiable wood taxa such as oaks and juniper may be over-represented in this analysis. Uncarbonized seeds, stems, and other non-root plant parts were recorded on a presence/absence basis on laboratory forms.

For each flotation sample, identification was attempted for all wood charcoal fragments, including those smaller than 2 mm. Fragments that could be snapped to reveal a clean transverse section were examined under a stereoscopic microscope at 28-180 X magnification. When necessary, tangential or radial sections were examined for ray seriation, presence of spiral thickenings, types and sizes of intervessel pitting, and other minute characteristics that can only be seen at the higher magnifications of this range. Wood charcoal fragments too small to be snapped in transverse section were examined in radial or tangential section and assigned as hardwood or softwood.

Botanical materials were identified to the lowest possible taxonomic level by comparison to materials in the Macrobotanical Analysis comparative collection and through the use of standard reference works (e.g., Core et al. 1979; Davis 1993; Hoadley 1990; InsideWood 2004; Martin and Barkley 1961; Musil 1963; Panshin and de Zeeuw 1980; Wheeler 2011). Plant nomenclature follows that of the PLANTS Database (USDA, NRCS 2016).

Results

Identification of material from Spring Lake samples is given in Tables B.1- B.4. Table B.1 shows uncarbonized (modern) plant parts on a presence/absence basis. Tables B.2 and B.3 show carbonized and semi-carbonized plant remains summarized by Analytic Unit by count and weight respectively. Recovery by sample (Lot #) is given in Table B.4.

Uncarbonized plant remains

By weight, most uncarbonized plant remains in the samples appeared in the form of roots and rootlets that are clearly modern and not reported here. Uncarbonized seeds, stems, and bark occur on most archaeological sites, but they usually represent parts of modern plants that have made their way into the soil on the boots of archeologists, through their own dispersal mechanisms, or by faunalturbation, floralturbation, or argilliturbation (Bryant 1985:51-52; Keepax 1977; Miksicek 1987:231-232). In all except the driest areas of North America, uncarbonized plant material on open-air sites can be assumed to be of modern origin unless compelling evidence suggests otherwise (Lopinot and Brussell 1982; Miksicek 1987:231). It is possible that uncarbonized plant material has been preserved below the water table at Spring Lake, but the investigations reported here did not encompass such depths. Rather, the distribution and species composition of uncarbonized plants are consistent with an interpretation of uncarbonized plant parts as naturally occurring seed rain and other plant parts that originated at the surface in modern times. Samples from the shallowest level represented (Level 4, 3 taxa) contain more plant taxa per sample than those from any other level (0.4-0.8 taxa per sample). In addition, three plants represented in uncarbonized form are Eurasian natives that would not have been present at Spring Lake prior to A.D. 1500 (*Ligustrum* sp., *Eleusine indica*, and *Trifolium* sp.).

Semi-carbonized plant remains

Three fragments of semi-carbonized plants recovered from Unit 23 Level 13 (Feature 4, one of two Calf Creek flotation samples) are more difficult to interpret. Taxon overlap does not suggest an assignment as ancient or modern since one taxon (Juglandaceae nutshell) was recovered in both carbonized and uncarbonized forms and the other (flower scar) was recovered in neither form. A fragment of semi-carbonized Jugladaceae nutshell, if buried quickly enough, could possibly have survived from Early/Middle Archaic times, but flower scars are less dense and tough plant parts, correspondingly less likely to survive in semi-carbonized form. These three semi-carbonized specimens are included with carbonized plants in Tables B.2 and B.3 to facilitate comparison with the ancient remains, but it is not certain that they are archaeological plants.

Carbonized plant remains

Identifiable plant remains in the **Paleoindian** sample (Unit 24 Level 14) consisted of wood charcoal fragments, of which three could be identified as live group oak.

Nine **Early Archaic** samples yielded two fragments of herbaceous stems (Unit 28 Level 12) and at least three types of wood charcoal: hickory/pecan, live group oak, unspecifiable oak, elm, and a latewood fragment that could be either elm or hackberry.

Two **Early/Middle Archaic** samples produced the earliest seed recovered (chenopodium), the questionably ancient semi-carbonized plant remains discussed above, and juniper, oak, and coma wood charcoal.

Six **Middle Archaic** samples yielded the earliest nutshell that is clearly archaeological in the form of a walnut fragment from Unit 24 Level 11. Seeds consisted of two chenopodium, one hackberry, and two wild peas. A fragment of a gall, a common growth on oak and hackberry trees, was also recovered. As in the Early/Middle archaic samples, identifiable wood charcoal was oak (live and unspecifiable), juniper, and coma.

With 26 samples, the **Late Archaic I** is the best-represented period in the analysis. Two types of nutshell (pecan and walnut) and four types of seeds (hackberry, chenopodium, stick-tight, and purslane) were recovered. All types of wood charcoal recovered in these investigations are present in the Late Archaic I samples, excepting only a single piece of unidentified hardwood that is present in a Transitional Archaic sample but not these Late Archaic samples. The wood taxa include not only typical Blackland Prairie and Edwards Plateau species but also bluewood (*Condalia* sp.) and knockaway (*Ehretia anacua)* that, while present in Hays County today, are more characteristic of the South Texas Plains. All knockaway fragments were from a sample associated with Feature 5 (Unit 41 Level 9).

One of the three **Late Archaic II** samples (Unit 36 Level 5) included the only cattail specimens recovered. Oak, juniper, and legume family wood charcoal fragments were also present in Late Archaic II samples, as was a single fragment of Jugandaceae nutshell.

Wood charcoal was the only identifiable plant type in two **Late Archaic III/Transitional Archaic** samples. One fragment from the Feature 6 sample (Unit 34 Level 13) could be identified as a live group oak.

The four **Transitional Archaic** samples are notable for the first appearance of tuber fragments, in a sample from Feature 5 (Unit 41 Level 5). They also include a hackberry seed, two fragments of an indeterminable fruit, and wood charcoal fragments of live group oak, white group oak, knockaway, juniper, hackberry or elm, and an unidentified hardwood.

Three **Late Prehistoric** samples produced camas bulb scale fragments (Unit 37 Level 5) and wood charcoal from white group oak, unspecifiable oak, coma, legume family, and juniper.

Discussion

Wood charcoal was the most common plant part recovered, with at least some fragments present in each sample. Despite the site's proximity to river, springs, and at times, a lake, oak species are the most common woods for most, if not all, time periods. Oaks, especially the live oaks that are most common in these samples, are trees of the uplands and would not likely have been the nearest available fuel sources. Oaks are excellent fuel woods that burn at high heat and produce long-lasting coals (Collier and Turner 1981, Marcouiller and Anderson n.d.), benefits that apparently outweighed the costs of transporting fuelwood the short distance from the bluff to Spring Late proper. In addition to fuel uses, the trees represented as wood charcoal in the samples can be important sources of dye (walnut hulls), caffeine (yaupon leaves), and bark cloth (elms) (Moerman 1998).

All but one of the **non-wood plants** recovered from Spring Lake have known food uses among Native people. Pecan and walnut nutshell indicate use of resources that must have been valuable for their fat content (Hall 2000). Like nuts, wild peas also provide a plant source of protein. The edible fruits of hackberry offer important vitamins and minerals, notably calcium if the hard, hollow seed is consumed. The fragmented condition of the hackberry seeds recovered suggests that people at Spring Lake typically ground hackberries into a paste, seed and all, as historic Comanches did (Carlson and Jones 1940:521). Chenopodium, a weedy plant that thrives near human settlements, provides both edible seeds and greens. The seeds are analogous to those of quinoa, a South American member of the same genus, and the greens are similar to spinach. Some species of purslane have edible greens, including the most common species in central Texas today, *Portulaca oleracea*, whose cooked greens are known as “verdolaga”. Young cattail stems are edible, as are the starchy rhizomes. Their more important use, however, may have been as a fiber for making mats to sit on and incorporate in shelter construction.

The bulb and tuber fragments probably reflect food use of these geophytes. Western camas (*Camas quamash*) is a traditional food in the northwestern United States, and camas bulbs and fragments (presumably *C. scilloides* or *C. angusta*) have been identified previously on central Texas archaeological sites, including Wilson-Leonard, Camp Bowie, Armstrong, and sites on Fort Hood (Collins 1998; Weston and Mauldin 2003; Thoms 2008; Thoms et al. 2015). Long, slow cooking in moist-rich earth ovens transforms the indigestible inulin in camas bulbs to more readily accessible, sweet carbohydrates such as fructose and glucose (Konlande and Robson 1972; Wandsnider 1997). The tuber fragments could not be identified to genus, but yellow pond lily and arrowhead would have been aquatic tubers available in the immediate site area, while terrestrial possibilities for edible tubers include catbrier (*Smilax bona-nox*), Indian breadroots (*Pediomelum* species), winecups (*Callirhoe species*), nutsedges (*Cyperus* species), and gayfeathers (*Liatris* species).

The only non-food seed recovered, stick-tight (*Galium* sp.), is a bur that grows in abundance on riverbanks and elsewhere. It may be an incidental inclusion in the archaeological record, but it may also represent the disposal by fire of a troublesome sticker pulled from clothing or the hide of a game animal or domestic dog.

All of the nutshell and nearly all of the seeds and fruits are present only in Early though Late Archaic II samples. The distribution could reflect late-season use of Spring Lake during this time period, but it could also reflect sampling error given how sparse plant remains are in general and the relatively large number of Late Archaic I samples examined. Geophytes are present only in Transitional Archaic and Late Prehistoric samples, consistent with increase in burned rock midden features in central Texas during this time (Westin and Mauldin 2003).

Conclusions

Macrobotanical preservation in these samples was not good, but the sparse remains do show some interesting trends. Oak wood was common, and probably the preferred fuel in all time periods despite the likelihood that most oak trees grew in more upland areas away from the immediate vicinity of the Spring Lake Site. A variety of fruits, nuts, and greens were recovered from Early to Late Archaic. Bulbs (camas) and tubers were recovered only from Transitional Archaic and Late Prehistoric samples.

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