APPENDIX F

ARCHAIC PERIOD MACROBOTANICAL REMAINS FROM SITE 41KR621, KERRVILLE, TEXAS

LESLIE L. BUSH, PH.D., R.P.A., MACROBOTANICAL ANALYSIS
ARCHAIC PERIOD
MACROBOTANICAL REMAINS
FROM SITE 41KR621,
KERRVILLE, TEXAS

October 21, 2005

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Archeological investigations at site 41KR621 were conducted by SWCA in conjunction with a project to extend Spur 98 east of Kerrville, Texas. Evidence of prehistoric occupation at site 41KR621 spans the Early through Late Archaic periods. The most intensively occupied part of site, however, is represented by a Middle-to-Late Archaic burned rock midden located away from the river and partially buried by colluvium. Alluvial action is also apparent in much of the site. The burned rock midden contains the densest cultural materials and is completely buried by colluvium. Beneath the burned rock midden is a well-preserved Early Archaic component. There is also a component at the northern edge of the project area. The site is located on a terrace on the right bank of the Guadalupe River west of Kerrville, where the land rises gradually into the uplands. During the testing phase of the project, archeologists characterized site vegetation as a grassy field with a cedar elm, juniper, and shrubs growing along fence lines. Cedar elm leaves were observed in several flotation samples. Baldcypress trees were also noted along the riverbank.

Ecology
Many authors have divided Texas into vegetational regions, noting that different combinations of ecological factors (soil, topography, climate, etc.) give rise to different combinations of plants that interact in predictable ways (Diamond, et al. 1987; Gould 1962; Johnson 1931; Tharp 1939; Turner 1959). These plant communities may be in different stages of succession, climax, or even disclimax at any given time and their boundaries may not always be well-defined. The nature of plant communities has long been contested among researchers, with some experts holding, on the one extreme, that plant communities are discrete entities analogous to individual organisms (e.g. Whittaker 1953) and, on the other extreme, that they represent continua and have no actual boundaries in space or time (e.g. Gleason 1939). Still other critics point out, correctly, that descriptions of vegetation regions reduce or obscure significant local variation and overlook rare plant types (Gehlbach 1988). Nonetheless, the vegetation region concept has considerable value in many fields. Not least, it explains the differences in vegetation that even untrained observers notice while traveling between destinations in Texas. In archeology, vegetation regions can help reconstruct ancient vegetation expected near a particular site when combined with data on past climate.

Vegetation History
Although pollen evidence indicates the existence of plant associations (communities) during the Pleistocene that have no modern analogues (Bousman 1988:212), modern plant communities seem to be good analogues for earlier Holocene environments. From his examination of pollen data at Weakly bog in the oak woods and prairies in east-central Texas, Britt Bousman concludes that the area was a woodlands during the whole of the Late Holocene, as it remains today (Bousman 1998:212). Conditions on the Edwards Plateau would also have been similar to those today. Even during the Late Holocene, however, some fluctuations are apparent in the deposits at Weakly Bog, most notably spikes in grass pollen percentages that occur at roughly 500 BP and 1500 BP (Bousman 1998:207, 216). Bousman noted earlier fluctuations as well.
Michael Collins has also examined Weakly Bog, as well as data from Boriak Bog and Hall’s Cave microfauna, to reconstruct past conditions in central Texas (Collins 1995:Table 2). The two datasets, pollen and microfauna, show roughly (but not exactly) the same trends. Notably, a 1,500 year wet period peaking at approximately 1750 BP, a relatively dry period from about 9,000 to 3,000 BP with two peaks, at 8000 BP and somewhere between 5800 (microfauna) and 4300 (pollen) BP. Another wet period peaks at 12,000 BP, but this is beyond the temporal scope of the 41KR621 occupations. (Collins uses uncalibrated dates in his table; those used here are calibrated using CalPal online [Weninger, et al. 2002-2004].) A chronological ordering of dated flotation samples is shown in Table 1, with other samples from dated units added by stratigraphic level. Most of the flotation samples appear to come from the periods between 3000 and 9000 years ago. The samples dating to more mesic times (1000-2500 years ago) have fewer remains – and more indeterminable remains – than most other samples, indicating poor preservation of macrobotanical remains from this time period.

**Prehistoric Vegetation**

Modern vegetation can thus be used as baseline for prehistoric vegetation ate site 41R621, but conditions would have usually been drier and perhaps warmer than present. These trends, however, would have been ameliorated for vegetation in immediate site area by the presence of Guadalupe River, which would have provided a ready source of water.

Kerr County lies on the Edwards Plateau, a southern extension of the Great Plains, where the more dissected Balcones Canyonlands begin to give way to the Plateau proper (Riskind and Diamond 1986). The mean annual precipitation in Kerr County today is 29.8 inches. Interannual variation in rainfall, however, can range from 40 to 200 percent of the average (NFIC 1987:10). Monthly rainfall averages between two and four inches, with peak rainfall in May and September. The growing season averages 216 days, from April 6 to November 6.

Streamsides in the region tend to be dominated by baldcypress and sycamore with some black willow and buttonbush (Riskind and Diamond 1986, 1988). Streamside communities are often very narrow, sometimes less than two meters for those associated with small channels. Cedar elms may predominate on very dry streamsides. Floodplains in the Canyonlands are often oak-elm-hackberry gallery forests. They may also include Arizona walnut, box elder, chittamwood, bumelia, soapberry, juniper, pecan, cottonwood, live oak, Texas oak, chinkapin oak, ash, elms, mulberry and basswood. Floodplain forests are usually two-layered with deciduous holly, rough leaf dogwood, elderberry, Mexican plum, and hoptree often present (Riskind and Diamond 1986, 1988). See Table 6 for botanical names of these plants and those recovered from the site.

About two and a half miles east of the site, the city of Kerrville maintains a green space where the Guadalupe River runs through the city under Highway 16 (Figure 1). The streambank trees here are dominated by baldcypress, but pecan, sycamore and elm are also common, as is the woody Virginia creeper vine. Mulberry and little walnut are also present. Mesquite and prickly pear begin to occur perhaps twenty yards away from the
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<th>Volume (L)-prior to float</th>
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<th>Heavy Fraction weight (g)</th>
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<th>Level</th>
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**More xeric than present**
**Considerably more xeric than present**
**More mesic than present**
Figure 1: South side of Guadalupe River in Kerrville, Texas near the Highway 16 bridge. View facing west.
stream, but little walnut also continues to grow in this zone. By forty to sixty yards away from the streambank, live oak, soapberry, American elm and hackberry are present, with frostweed, greenbriar, dewberry, velvetleaf and various aster family forbs growing in their shade. This is emphatically a modern, anthropogenic environment – as several non-native crepe myrtle trees vividly attest – but the plants present demonstrate the steep moisture gradient and attendant vegetation as one moves away from the stream, up the floodplain and onto the slope (L. Bush, personal observation, July 2005).

Uplands in the Edwards Plateau are rough and well-drained. Soils are underlain by limestone caliche, except in the Llano Uplift to the north of Kerr County, which is underlain by granite. Upland vegetation usually consists of a mosaic of grasslands and woodlands or shrublands, with trees or shrubs often occurring in motts. Because most grasslands of the Balcones Canyonlands have been grazed, sometimes heavily, it can be difficult to determine the composition of the original grass communities (Riskind and Diamond 1988). Important climax grasses include curly-mesquite, bluestems, gramas, Indiangrass, Texas winter-grass, wildrye, switchgrass, and buffalograss (Gould 1962). Rough, rocky areas typically exhibit a tall or midgrass understory and a brush overstory made up of live oak, shinnery oak, junipers and mesquite (Gould 1962, but cf. Turner et al. 2003, who do not record shinnery oak outside the Texas panhandle and adjacent counties). Elbowbush, privet, agarito, redbud, hackberry, kidneywood, sumac, Texas persimmon, condalia, and bumelia are also common (Riskind and Diamond 1988). Plateau live oak is the most common of the oaks, while fires probably limited juniper to protected ravines and limestone outcrops during prehistoric times (Fonteyn, et al. 1988). Juniper wood charcoal is present in low numbers at site 41KR621, however.

Mark Raab concludes that mesquite was also less common in prehistoric times (Raab 1983), as do Riskind and Diamond (1988:11). Prickly pear, another common plant in the area, may have been considerably less common in the past (Riskind and Diamond 1988:12). Both are absent from the archaeological macroremains recovered from site 41KR621.

Methods

Floitation

During testing and data recovery, 88 flotation samples and 37 point samples were collected and processed by SWCA. Floitation processing was carried out at SWCA Environmental Consultants facilities in Austin in a manual flotation machine (Pearsall 2000:29-44) that consisted of an 11.5-gallon tub with heavy fraction mesh suspended in the middle. The heavy fraction (bottom) mesh openings were approximately 1.0 x 1.0 mm, and light fraction openings were approximately 0.1 mm x 0.1 mm. Although a bottom mesh size of 0.6 mm or smaller is considered optimal, sand particles in some soils necessitate 1.0 mm openings (Hunter and Gassner 1998). Eighty samples representing 250.97 liters of soil matrix were sent to the author for analysis in June 2005. Seventy-two of these, representing 233.22 liters of matrix, are from the data recovery phase and eight, representing 17.75 liters, are from testing. An additional 37 samples of individual, larger items from data recovery were also submitted for identification.
Separation of carbonized botanical remains was poor, with 81.4% of all botanical remains, by weight, remaining in the heavy fraction (Table 2). The situation was even worse for nutshell, where 100% of all material by weight was found in the heavy fractions (Table 3). A few nutshell fragments were found in light fractions, but these pieces were so small they did not register on the scale. Wood charcoal separation was better, relatively speaking, with 77% of material remaining in the heavy fractions (Table 4). So little material other than nutshell or wood charcoal was recovered that it is not possible to evaluate light fraction recovery of these items. If present and smaller than 1.0 mm, some of these items may have fallen through the heavy fraction mesh. A variety of uncarbonized plant remains smaller than 1.0 mm was noted, however, indicating that at least some small material was recovered (see Table 7). The dearth of carbonized material recovered from the site is therefore not entirely due to the recovery methods employed. Heavy fractions were frequently still dirty when they arrived at the laboratory, indicating insufficient processing. Longer processing or perhaps reflootation of heavy fractions and the addition of an agent to increase the density of the flotation fluid (e.g., sugar) is highly recommended for further flotation efforts with this equipment (Kidder 1997; Ross and Duffy 2000). For situations where the clay content is moderate or high, deflocculation in a sodium bicarbonate solution is strongly recommended (Pearsall 2000; Ross and Duffy 2000). I have successfully used sodium hexametaphosphate (Calgon®) alone for both deflocculation and greater density. Sodium hexametaphosphate is usually considered a deflocculation agent, but its solution has a greater density than water; it is, however, more expensive than sugar or sodium bicarbonate. Addition of equipment to produce upward water pressure within the flotation tank, such as a showerhead nozzle installed below the heavy fraction receptacle, is also recommended. If none of these remediations prove practicable or successful, fine screening through graduated sieves may be an effective method of last resort for the recovery of macrobotanical remains from sites like 41KR621.

Sorting and Identification
Both heavy and light flotation fractions were sorted in the author’s laboratory in Austin. Heavy fractions were examined for carbonized botanical material. This material and identifiable bones and teeth were removed from the heavy factions and added to the light fractions for analysis. Uncarbonized plant taxa were noted but not removed from the heavy fractions. Each flotation sample was weighed on an electronic balance with a sensitivity of 0.01 g before being size-sorted through a stack of geologic mesh with openings of 2 mm, 1.4 mm, and 0.71 mm. Macrobotanical materials in the > 2mm size fraction were completely sorted, and all botanical remains except uncarbonized plants (usually rootlets) were counted, weighed, recorded, and labeled. Materials > 2 mm size category other than carbonized plants, bone, and gastropods are referred to as “contamination” in Table 11 and on laboratory forms. Materials that fell through the 2 mm mesh, referred to as “residue,” were examined under a stereoscopic microscope at 7-45 x magnification for charred botanical remains. Usually, only remains other than wood charcoal and nutshell are removed from residue in archeobotany laboratories, but given the small amount of charcoal in these samples, all carbonized remains were removed from residue. Wood charcoal and nutshell that fell through the 2mm mesh is reported here separately so that the results may be better compared with more traditional analyses.
where only wood charcoal and nutshell > 2mm is considered. (Although the shorthand notations “> 2 mm” and “< 2 mm” are used here for materials that fall or fail to fall through a 2 x 2 mm mesh, it should be noted that the diagonal of that mesh is actually 2.83 mm.) All plant material removed from the residue was counted, weighed, and labeled. Uncarbonized botanical taxa other than rootlets in the residue was also recorded on laboratory forms, but these materials were not usually removed from residue. Identifiable bones and teeth, however, were removed for review by another analyst (Table 5).

Because the number of wood charcoal fragments recovered was small, identification was attempted for all fragments that did not fall through a 2 mm screen. Fragments were snapped to reveal a transverse section and 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 (Hoadley 1990).

Botanical materials were identified to the lowest possible taxonomic level by comparison to materials in the author’s comparative collection and through the use of standard reference works (e.g. Davis 1993; Hoadley 1990; Martin and Barkley 1961; Musil 1963; Panshin and de Zeeuw 1980; Schopmeyer 1974). In some cases botanical remains could be identified to the level of the species (e.g. little walnut). Most commonly botanical materials were identified to the level of genus, but sometimes only family identification was possible. Botanical nomenclature and common names follow the PLANTS national database (USDA, NCRS 2002) except in the cases where the common name in local or archeological use differs significantly from the common name given in the database.

**Results**

Identifications of macrobotanical remains from site 41KR621 are shown in Tables 7, 10, 11, 12, and 13. Table 7 shows uncarbonized macrobotanical remains from flotation samples. Tables 10 and 11 show carbonized macrobotanical remains from flotation samples by count and weight, respectively. Tables 12 and 13 show identifications from the point samples by both count and weight. Table 6 shows the common and botanical names of plants mentioned in the text and tables.

**Uncarbonized macrobotanical remains**

Most uncarbonized remains at site 41KR621 appear in the form of rootlets and are included with the “contamination” in Table 11. The 88 flotation samples contained an average of 1.77 types (taxa) of other uncarbonized botanical remains, usually seeds. These are recorded on a presence/absence basis in Table 7. Uncarbonized seeds are a common occurrence on most archeological sites, but they usually represent seeds of modern plants that have made their way into the soil either through their own dispersal mechanisms or by faunal turberation, floral turberation, or argil turberation (Bryant 1985:51-52; 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). The site has offered no such evidence, and only carbonized plant remains are believed to be ancient, with the important exception of hackberry. Again excepting hackberry (discussed below), the uncarbonized taxa recovered represent weedy plants that colonize disturbed areas such as that along the Guadalupe River near Kerrville. Further, a strong negative relationship between depth and uncarbonized plant remains can be observed, indicating the modern (surface) origin of the uncarbonized plants. Flotation samples were taken in columns of five or more samples from four contexts at site 41KR621. Correlations between depth and number of uncarbonized taxa are shown in Table 8. The longest column, from BHT-4 Column D, consisted of 14 samples and had the greatest (negative) correlation between depth and uncarbonized plants. It is shown in Figure 2.

Table 8: Correlation between Depth of Sample and Number of Uncarbonized Plant Taxa Present, for columns with five or more samples

<table>
<thead>
<tr>
<th>Context</th>
<th>Number of samples</th>
<th>Correlation</th>
</tr>
</thead>
<tbody>
<tr>
<td>BHT-18 CS-1</td>
<td>5</td>
<td>-0.84</td>
</tr>
<tr>
<td>BHT-18 CS-2</td>
<td>5</td>
<td>-0.62</td>
</tr>
<tr>
<td>CT-3 CS-3</td>
<td>10</td>
<td>-0.20</td>
</tr>
<tr>
<td>BHT-4 Column D</td>
<td>14</td>
<td>-0.64</td>
</tr>
</tbody>
</table>

Hackberry, the most common type of uncarbonized seed present in the samples, was noted in 28 of 88 flotation contexts (32%). Hackberry (also called sugarberry) is a common tree of stream bottoms and slopes, likely present along the Guadalupe in both modern and prehistoric times. Three species of hackberry grow in Kerr County today: sugar hackberry, spiny hackberry, and netleaf hackberry (Turner, et al. 2003a). Hackberry’s high resistance to decay presents particular interpretive difficulties on archeological sites. What archeologists typically recover is the hackberry endocarp, the thick white seedcoat from under the thin fleshy layer of the fruit. The endocarp has a high mineral content: It contains 40-70% aragonite, a crystalline form of calcium carbonate (Wang, et al. 1997; Yanovsky, et al. 1932). The carbonate helps hackberry endocarps preserve unusually well in the soil. The organic carbonates make hackberry endocarps excellent candidates for dating of the sediments in which they originated. Yang Wang and colleagues argue that dating of sediments by hackberry inclusions is preferable to other methods since the carbonates form over a single growing season, their initial $^{14}$C content is the same as that in the atmosphere, and they can be tested for reliability before dating (Wang 1997:342). Hackberry endocarps are surprisingly common in geological and archeological strata (Wang 1997:337) – but they are not necessarily archeological in origin. The difficulty for archeobotanists is determining whether the hackberries represent the traces of human hackberry use or merely the presence of hackberries on the location where the site sediments originated or where archeological materials were redeposited.
Figure 2: Excavation level v. Uncarbonized Plant Taxa
BHT-18 Column 4, Site 41KR621

$r = -0.64$
Two findings are particularly relevant to the status of hackberries recovered from site 41KR621. First, the endocarps are almost exclusively white or tan and therefore have not been exposed to the cultural agent of fire as the other ancient plants have. Three exceptions may be present in BHT-18 Column D. Levels 10, 11, and 12 contain hackberry seed fragments whose carbonized status is uncertain (Table 9). It is possible these are incompletely carbonized ancient fragments that survived because of the high levels of calcium carbonate in hackberry endocarps. They may also be grey or even black as a result of a natural process. The presence of uncarbonized hackberry fragments in most of these and surrounding levels, plus the presence of uncarbonized rootlets as deep as level 13 indicate non-cultural and/or surface origins for at least some of the plant material even this deep in the column. The grey hackberry fragments are treated here as uncarbonized and possibly ancient but of natural rather than cultural origin. Paul Gardner has also noted grey hackberry endocarps from the McLelland site in Bossier Parish, Louisiana and failed to reach a firm conclusion about their status, although he is dubious about their inclusion in the Caddoan diet (Gardner 1994:208).

Table 9: Grey Colored Hackberry Endocarp Fragments from BHT 18 Column D, site 41KR621

<table>
<thead>
<tr>
<th>Level</th>
<th>Number</th>
<th>Weight (grams)</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level 9</td>
<td></td>
<td></td>
<td>all hackberry fragments white or tan</td>
</tr>
<tr>
<td>Level 10</td>
<td>5</td>
<td>.03</td>
<td>also includes white or tan hackberries</td>
</tr>
<tr>
<td>Level 11</td>
<td>2</td>
<td>.01</td>
<td>also includes white or tan hackberries</td>
</tr>
<tr>
<td>Level 12</td>
<td>6</td>
<td>.01</td>
<td>all hackberry fragments white or tan</td>
</tr>
</tbody>
</table>

More importantly for the interpretation of the 41KR621 hackberry endocarps, most recorded uses of hackberry involve grinding or pounding the hackberries, which would not leave the whole endocarps and large fragments observed at site 41KR621 (see discussion below). The presence of hackberry endocarps at the site clearly indicates that the trees grew nearby at some time(s) in the past. Hackberries are thus a candidate for ancient plant exploitation, and given their known uses among modern and ancient people, they were probably used by at least some of the site inhabitants. The particular remains observed in the samples, however, most likely do not represent the archeological traces of this activity.

**Carbonized Botanical Remains**

**Wood charcoal.** A total of 235 fragments of wood charcoal > 2mm were recovered from the 88 flotation samples (Table 10). Of these 180 (77%) could be identified to the level of species, genus, or family. The remaining samples were either indeterminable woods (n=3), or identified as indeterminable hardwood (n=43), ring-porous hardwood (n=2), or diffuse-porous hardwood (n=7). Of the 180 identifiable specimens, a full 62% were oaks, and 60% were live oak (n=143).
Herbarium records for Kerr County show five oaks collected in the county: live oak, two red oaks (blackjack oak and buckley oak) and two white oaks (post oak and white shin oak) (Turner, et al. 2003a). Live oak is the most common oak today, and it was probably the most common oak during occupations at site 41KR621. Its relatively low moisture requirements would have made it well adapted to more xeric periods in the prehistoric past. Still, live oak is probably overrepresented in the archeological record at site 41KR621. Live oak is the most dense of oak woods (specific gravity 0.88) and its charcoal is often tough and durable as well. Its cellular structure (Figure 3) explains the characteristics that contribute to the qualities of live oak wood charcoal: small, even pore sizes, with the remainder of the growth rings composed largely of dense fibers and parenchyma tissue. The large rays, which appear as vertical lines in Figure 3, are the main points of structural weakness in the charcoal, and these are the planes on which it tends to break. Other woods, those less dense (diffuse-porous woods and softwoods) and those with larger pores in the earlywood portion of the ring (other oaks), tend to break up in the soil more than live oaks do.

After oaks, the next most common identifiable wood on the site was juniper (n=20) Fourteen of these fragments come from a single context, however, so the wood is less common than indicated by a simple count. Few species of conifers are present in the region today, juniper and baldcypress being the primary trees. Joint-firs are conifers that are present on the Edwards Plateau, but they tend to be more shrub than tree. One species of pine, papershell pinyon, occurs on the Edwards Plateau (Riskind and Diamond 1988), but it does not grow this far east, at least in modern times (Turner, et al. 2003b). All coniferous specimens were re-checked to be sure of the juniper identification. No resin canals were present, easily eliminating identifications of pine and ephedra (also eliminating Douglas-fir, spruce and larch, although these would be extremely unlikely in central Texas). The fine texture separates the juniper specimens from baldcypress and other woods without resin canals. Individual cells were barely visible at x magnification. Ashe juniper is the only juniper recorded in herbarium records for Kerr County and it is extremely common on the Edwards Plateau, making it the most likely identification. Pinchot juniper (also called redberry juniper) is recorded in counties to west and north of Kerr County, however, so it could easily have grown in the area, especially during xeric periods. Similarly, eastern redbedar is recorded as far west as Comal County, two counties east of Kerr, so it could have grown in the immediate site area, especially during mesic times. Juniper, of whatever species, is not likely to have been a terribly common wood outside of limestone outcrops and protected valleys, however. As noted above, fire is the limiting factor in juniper propagation in central Texas (Fonteyn, et al. 1988). Junipers burn quickly and thoroughly in fire, and they do not regenerate quickly through suckers, as many other trees do. Both lightning strikes and native hunters are likely to have introduced fire regularly onto the Edwards Plateau in the past. Juniper would thus have been relatively rare. Their presence in the archeological record at 41KR621 may therefore represent more than expedient use of the plant for firewood—although the presence of the burned rock midden suggests that a great deal of firewood was used. Various parts of the juniper tree have a plethora of uses among native people, ranging from food to medicine to basketry and cordage to ritual uses (Moerman 282-292).
Figure 3: Anatomy of live oak wood tissue: schematic drawing (left) and archeological specimen C-48 from site 41KR621 (right).
the red wood of the plant and its distinctive odor had ritual value for many groups. Junipers were frequently burned in purification rites, and ritual structures were constructed from redcedar during Mississippian times in the American Bottom region (Simon 2003).

Other woods in the flotation samples included yaupon or holly (n=4), elm/hackberry/mulberry (n=9), and an unknown wood that probably represents a liana or wood vine (n=2, both from the same sample). All of these woods are common near the Guadalupe River today.

The 37 point samples contained only three taxa of determinable wood. Like the flotation samples, they were dominated by live oak (n=19), but juniper (n=1) was also present, as was madrone (n=1). Madrone is sparse in central Texas today, but it is present and would have been during pre-settlement times as well. Although the fruits are edible, they are tiny and moderately bitter. The wood is heavy and often used among native people for axe handles and wooden pestles (Cheatham, et al. 1995:432-433). Another reported use is particularly interesting in light of the burned rock midden at site 41KR621: the Tepehuan used madrone wood as a protective layer when cooking sotol in earth ovens (Cheatham, et al. 1995:433).

**Nutshell.** Nut remains were sparse in the flotation samples, with a total of only 26 fragments > 2 mm recovered. More walnut fragments (n=11) were identified than hickory fragments (n=3), but even more were small, thin fragments that simply could not be identified except to the hickory/walnut family. Of the walnut fragments, 8 were from a single sample. Among nutshell fragments < 2mm, only one could be identified to genus; the remainder (n=32) belong to the hickory/walnut family. No acorn and no pecan were recovered, although both are present in Kerr County today (Turner, et al. 2003a). Although it is likely that these thinner-shelled nuts were exploited by ancient people at 41KR621—even if only opportunistically when using the site for other purposes when the nuts were ripe—the thin carbonized shells would have succumbed to mechanical forces such as freeze/thaw cycles that break up charcoal in the soil or alluvial action that washes away small, thin nutshell fragments more easily than walnut fragments or oak wood charcoal.

The most straightforward way to eat nutmeat is to crack open the nut with some sort of hammerstone and pick out the nutmeat. Following historically recorded Creek and Yuchi practices, Talalay and colleagues (1984) found that hickory nuts may be processed after drying by crushing the shell and meat together and heating them in water, where the oil can be skimmed off, the nutmeat retrieved from suspension, and the shells allowed to sink to the bottom. This process yields a much larger number of calories per labor invested than does cracking and picking (Talalay, et al. 1984:353). Even today, traditional Cherokees process hickories in a similar manner (Fritz, et al. 2001). How walnuts are most effectively exploited is not as clear. Talalay and colleagues found that eastern walnut hulls do not separate well from the shells and impart a bitter flavor to the resulting products (Talalay, et al. 1984:354). Ethnographic accounts also indicate that cracking and picking was the preferred processing method for walnuts. Although little
walnut shells are much smoother than that of eastern black walnuts and separate more easily from the hulls, they are extremely thick and tough, making them unusually difficult to crack for either hand extraction or boiling. Daniel Moerman’s survey of plant uses of 291 native groups failed to locate any recorded uses of little walnut, but some are recorded for the closely related Arizona walnut (Moerman 1998). Arizona walnut meats were eaten by Apaches, Navajos, Yavapais, and Hualapias. Nutshells and hulls were also used by the Hualapia, Navajo and Apache to make black or brown dye (Moerman 1998:280).

**Other plant remains.** Plant remains other than nutshell and wood charcoal in the flotation samples consisted of one panicoid grass seed, two herbaceous stems, two fragments of grape family seeds, five indeterminable seeds, and one unidentified seed.

Grasses are the plant family most exploited by humans. Today, they constitute many of the planet's major crops (rice, corn, wheat, sugarcane, rye, barley), and they were equally important in the past. Not only are the seeds of most grasses edible when cooked, but the stems of grasses are valuable for use in thatching, mats, brooms, baskets, cordage and other uses. Panicum, in particular, is edible (one species was probably domesticated in eastern North America), and Tewa people are known to have used it for making small brooms with which to clean metates (Moerman 1998:377).

Grape family seed fragments were recovered from two flotation samples. In central Texas, the plants in this family are peppervine, Virginia creeper, and grape. All three have similar uses for medicine, construction and crafts, and food. Leaves, stems, and roots were used in medicine, often for urinary and dermatological problems (Moerman 1998:70, 378-379, 598-600). The flexible vines were valuable in house construction, basketry, fashioning ropes and cordage, and to make hoops such as the "roll bars" on cradleboards. The fruits were used in pink and purple pigments, but their more important use was for food. The berries could be eaten fresh off the vines or dried into raisins for future consumption. In light of the burned rock midden at site 41KR621, one record concerning use of the California wild grape plant by Karok Indians is particulary interesting. According to Schenck and Gifford, grape leaves were placed over bulbs to conserve moisture while the bulbs cooked in earth ovens (Schenck and Gifford 1952:386).

**Discussion**
The scarce macrobotanical remains at site 41KR621 indicate some of the plant uses by site inhabitants, but they may reveal more about conditions of preservation. The macroremains recovered consist of wood charcoal from dense woods, thick nutshells, and a smattering of other plant parts. As flotation processing was becoming an established technique in North American, Patrick Munson and colleagues proposed a three-part division of plant macroremains according to how well they are likely to be preserved in the archeological record (Table B.14).

Table 14: Classification of Plant Remains according to how likely they are to become Preserved on Open Archeological Sites (Munson, et al. 1971).
<table>
<thead>
<tr>
<th>Group</th>
<th>Description</th>
<th>Examples</th>
<th>Probability of Carbonization and Preservation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Plants with dense, inedible parts</td>
<td>nutshell, fruit pits, corn cobs</td>
<td>Deliberately added to fire for fuel; best preservation</td>
</tr>
<tr>
<td>2</td>
<td>Dense plant parts normally ingested in their entirety</td>
<td>small seeds (wildrice, chenopodium, grasses, etc.), acorn meats, corn kernels, squash seeds</td>
<td>Carbonized by accident during parching (if applicable) or cooking; moderate preservation</td>
</tr>
<tr>
<td>3</td>
<td>Non-dense plant foods with high water content</td>
<td>bulbs, tubers, greens, pulpy fruits without pits</td>
<td>Carbonized by accident during cooking; especially delicate; poor preservation</td>
</tr>
</tbody>
</table>

Hickory nutshell and oak wood, by far the most common plants recovered from site 41KR621, are in Group 1. Bulbs, tubers, and succulents – which findings from other sites indicate would have been processed in the burned rock midden – are Group 3. Thus the conditions of preservation at 41KR621 appear to have favored only the toughest, most durable plant remains used by site inhabitants.

Actual food resources available to the site inhabitants would have been vastly richer than the remains that have survived. Based on the resources available today on the Edwards Plateau, several types of succulents, cacti, and geophytes would have been available, as would nut mast and various fleshy fruits.

Beargrasses grow in Kerr and surrounding counties. Both their flowering stalks and their seeds are edible. Their flower stalks are reported to have been baked in earth ovens (Hodgson 2001). Sotol, another member of the beargrass family, is also available today in the area. It has a fleshy leaf base that also could have been cooked in the site’s earth ovens, as it was in the Lower Pecos (Dering 1999). Yuccas, too, may have been important resources. Young yucca flower stalks are edible, either raw or cooked. Some yuccas in southwest Texas have edible, fleshy fruits, but central Texas yuccas tend to have dry, capsular fruits (Hodgson 2001). The five Kerr County yucca species recorded in Texas herbaria are Arkansas yucca, buckley yucca, plateau yucca, twist-leaf yucca and torrey yucca (Turner, et al. 2003a). The first four certainly have dry fruits; I have not been able to establish whether torrey yucca does or not. In addition to their food uses, yuccas plants contain valuable fiber, which has uses in cordage, basketry, and the construction of other items such as brooms and sandals.

As noted above, hackberry trees would also have been available in the vicinity of site 41KR621. Ethnographically, hackberry trees were exploited primarily for food, although the wood makes good handles and was used for such by Navajo, Tewa, and Havasupai.
peoples. Navajos used hackberry leaves and branches to make dark brown or red dye. Hackberry fruit can be eaten fresh by using the teeth to scrape the thin layer of flesh off large nutlet. Modern foresters use wet maceration to remove pulp from the seeds (Schopmeyer 1974:298), and this process may also have been used in the prehistoric past. Many accounts of hackberry consumption among Native people, however, indicate that the fruits were ground or crushed in preparation. Comanches, Yavapais, Apaches, Navajos, Dakotas, Meskwakis, Pawnees and Kiowas are all known to have prepared hackberry fruits by grinding, pounding, or crushing (Moerman 1998:147). The resulting paste was shaped into cakes and dried or roasted. This particular use would leave few archeological traces, but the high calcium carbonate concentration in the hackberry endocarps would have made an excellent source of calcium given proper conditions for calcium absorption (e.g. sufficient magnesium and vitamin D).

Other plants available for food by inhabitants of site 41KR621 would have been nuts such as pecans and acorns (especially white oak acorns, which generally require less preparation than the red [Petruso and Wickens 1984]); bulbs such as wild garlic and wild hyacinth; berries such as dewberry, grapes, persimmon, and agarito; and various small seeds, including those of small grasses and forbs. Pricklypear and mesquite both have important food uses, and they are common in the area today. Pricklypear tunas are edible raw, as are the young pads. Older pads may also be used, like grape leaves, to retain moisture in earth ovens. Mesquite beans and/or pods were widely used by southwestern groups for food. It is not clear, however, how common pricklypear and mesquite plants were prior to European settlement (Raab 1983; Riskind and Diamond 1988). A wide variety of other plants could have been used for medicine, crafts and general building.

Although the archaeological macroremains from site 41KR621 indicate only a very small fraction of what must have been the actual plant exploitation practices of its inhabitants. Two of the plants recovered, madrone and grape plants, have ethnographic uses in association with earth ovens, as does the wood charcoal recovered. In addition, the macrobotanical remains indicate something of the ancient environment (through the hackberry endocarps), the effectiveness of recovery methods, and the conditions of preservation for delicate remains on the site. I hope the resulting discussion proves interesting in itself and useful in the interpretation of other aspects of the archeology of site 41KR621.

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