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A PALEOETHNOBOTANICAL COMPARISON OF MORTUARY AND VILLAGE LANGFORD TRADITION SITES IN NORTHERN ILLINOIS

by

Tania Lee Milosavljevic

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Partial Fulfillment of the
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ABSTRACT

A PALEOETHNOBOTANICAL COMPARISON OF MORTUARY AND VILLAGE LANGFORD TRADITION SITES IN NORTHERN ILLINOIS

by

Tania Lee Milosavljevic

The University of Wisconsin-Milwaukee, 2023
Under the Supervision of Robert J. Jeske PhD RPA

Archaeologists working in northern Illinois have conducted research on Langford Tradition (ca AD 1100-1450) sites for more than a century. The last 40 years have seen increasing methodological sophistication providing for a relatively nuanced understanding of food technology and resource use. Paleoethnobotany has provided one way to observe the diversity of plant use among Langford site occupants. Using standard paleoethnobotanical practices, plant macroremain from the Robinson Reserve Site (11CK2) are analyzed. The results of the plant macroremain analysis are then compared to existing floral data from the Washington Irving Site (11K52). This research investigates whether site functionality is distinguishable between Langford tradition mortuary and village sites.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

ACKNOWLEDGEMENTS

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I would also like to thank my thesis committee members Dr. Jennifer Haas and Dr. Richard Wynn Edwards IV. Dr. Jennifer Haas introduced me to the field of paleoethnobotany and has always been generous answering my questions. Dr. Richard Wynn Edwards IV was with me during every step of my career as an archaeologist. He was the TA at my first field school and has served as a mentor and friend over the years. I am extremely grateful for the constant encouragement they both have shown me.

I would be remiss if I did not thank my fellow cohort. Without their comradery graduate school would have been far more difficult. Navigating graduate school during a pandemic is an extremely difficult feat and somehow, we have made it.

Last, I thank my friends and family. My sisters Tara and Natasha have been with me throughout this journey, and I am so appreciative of their endless love and support. I also thank my partner Eric for the constant love and encouragement during my graduate career. You three are my world. Thank you so much.

CHAPTER 1: INTRODUCTION AND BACKGROUND REVIEW

Research Problem

Archaeologists have long sought to identify and understand the indigenous groups who inhabited of the oak savanna environments of the Chicago area and northern Illinois region around Lake Michigan (Bird 1997; Birmingham 1975; Brown 1965; Early 1973; Edwards 2020; Egan 1985; Emerson 1999; Faulkner 1972; Fowler 1949; Griffin 1946; Hunter 2002; Jeske 1989, 1990, 2000, 2003; Langford 1927; Lurie 1992; McKern 1943). A critical component of that understanding is the recognition of differing site functions. One phenomenon of the region of great interest to archaeologists is the Upper Mississippian Langford Tradition (circa AD 1100-1450). Langford sites are located primarily in the watershed of the Upper Illinois River Valley and its northern tributaries, as well as the Rock and Kishwaukee River valleys in Northern Illinois. In recent years, several sites have been excavated and attempts have been made to examine site structure, mobility, subsistence strategies and landscape use (Berres 1998; Edwards 2020; Emerson et al. 2005; Jeske 2002; McTavish 2019; Wilson 2016).

The focus of this thesis is to use paleoethnobotanical analyses to investigate site function of two Upper Mississippian Langford tradition sites: an agricultural village and a mortuary site. This research will compare plant macroremain assemblages between the Robinson Reserve (11CK2) and Washington Irving (11K52) sites in northeastern Illinois and assess whether data reflect differences in site function (Figure 1.1). These two contemporaneous Langford tradition sites are located 39 km apart in the Fox and Des Plaines River Valleys (Jeske 2000; Lurie 1992).

Robinson Reserve is located on the banks of the Des Plaines River in Chicago, Illinois. Radiocarbon dates places this site at ca AD 1300 (Fowler 1949; Lurie 1992) (Table 1.1). The presence of two mounds and activities related to habitation behaviors such as stone tool manufacturing has led archaeologists to refer to this site as “two mounds and one village” (Fowler 1949) and as a “village or series of camps associated with a wide variety of activities” (Lurie 1992) or as a “village and burial mound site” (McTavish 2019). However, McTavish argues that Robinson Reserve is a mortuary encampment. Per McTavish (2019:198), “Given the narrow range of activities and the narrow range of fauna exploited at Robinson Reserve, these are likely connected to mortuary activities.”

The Washington Irving site is located on Jelkes Creek, a cut-off meander 1.5 km west of the Fox River (Figure 1.1). The presence of house structures, postmolds, pits, hearths, and a variety of botanical and faunal remains indicate that it is a sedentary village site occupied year-round (Jeske 2000). Radiocarbon dates provided a calibrated date of AD 1260- AD 1440, indicating that it is contemporaneous with Robinson Reserve (Table 1.1). The two sites are located approximately 40 km apart in parallel, adjacent river valleys, providing a unique comparison into site function and uses (Figure 1.1).

The sites will be compared using a Human Behavioral Ecology (HBE) theoretical perspective, which is a good way to understand the causal relationships between site function and plant macro remain assemblages (Marston et al. 2014). HBE is the study of how humans use adaptive strategies regarding social and environmental variables (Bird and O’Connell 2006; Marston et al. 2014). At its core, HBE is derived from Behavioral Ecology (BE). BE is a longstanding framework established in the 1960s and 1970s to study social, reproductive, and foraging behaviors of animals (Bird and O’Connell 2006). HBE investigates how adaptation, more specifically how behaviors emerge and how socioecological contexts contribute to adaptation. (Bird and O’Connell 2006; Smith and Winterhalder 1992).

Darwinian evolutionary theory lies at the core of the HBE theoretical outlook. Humans are shaped by natural selection, creating adaptive behaviors or strategies that contribute to survival in the long term (Winterhalder and Goland 1997). Humans are unique from other animals as they have behavioral flexibility which allows them to adapt to different environments. They also have culture which is a system of social transmission of information. Evolved cognitive mechanisms created traits such as plasticity of behavior and cumulative social learning. Due to the complex and varied nature of human behavior, we can expect complex and varied species-specific biases in decision making (Gremillion 2014:339-354).

If behavior displays adaptive design, then we should expect sites with different purposes to reflect certain biases in decision making. More specifically, we can generate expectations about what that looks like in the archaeological record.

Thesis Statement

If site function can be seen in the paleoethnobotanical record, we would expect that mortuary and village sites will have distinct floral assemblages. This thesis will address the following research questions: **1)** What is the nature of the floral assemblage at Robinson Reserve? **2)** Does the floral assemblage at Robinson Reserve provide insight on spatial patterning indicative of site function? **3)** How does the floral assemblage at Robinson Reserve compare to the floral assemblage of Washington Irving? **4)** Do the floral assemblages at Robinson Reserve and Washington Irving follow the perceived expectations of Langford mortuary and village site function?

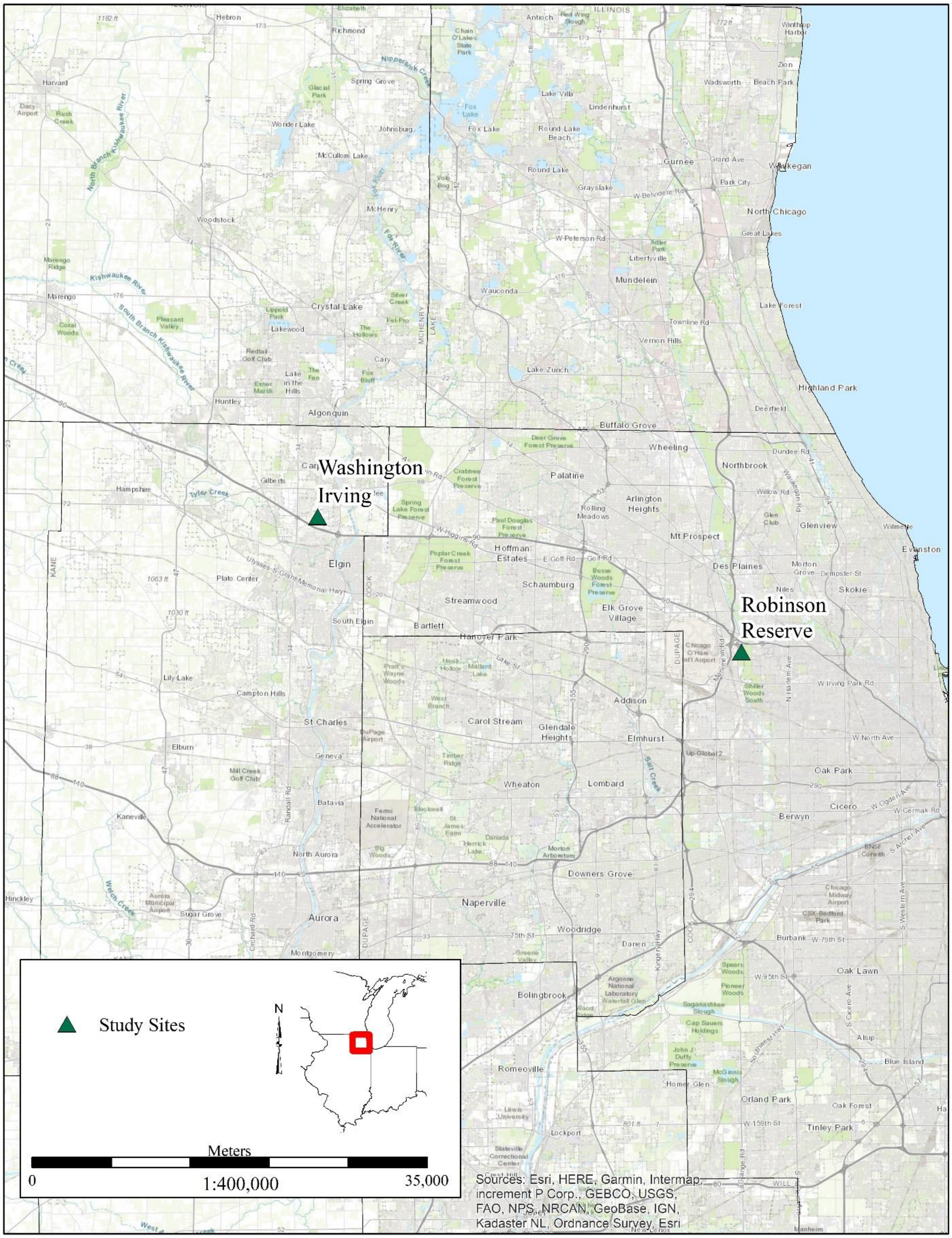


Figure 1.1. The Study Sites

Table 1.1. Radiocarbon dates from Robinson Reserve and Washington Irving

Site	Lab #	Age BP	Error Term	Calibrated 1 sigma	Calibrated 2 sigma	Reference
Robinson Reserve	Beta 23522	580	50	1353	1298-1427	Brown and Sasso 1992
Robinson Reserve	Beta 23523	620	60	1348	1281-1417	Brown and Sasso 1992
Robinson Reserve	Beta 23524	830	60	1207	1044-1282	Brown and Sasso 1992
Robinson Reserve	ISGS 2807	790	70	1233	1046-1386	Bird 1997
Washington Irving	Beta 12587	440	70	1412-1516 1596-1618	1328-1341 1395-1640	Jeske 1990a
Washington Irving	ISGS 1444	710	70	1225-1232 1244-1313 1357-1388	1189-1405	Jeske 1990a
Washington Irving	ISGS 1437	720	70	1223-1305 1363-1385	1169-1175 1181-1399	Jeske 1990a
Washington Irving	Beta 12588	420	70	1423-1521 1578-1582 1591-1620	1407-1642	Jeske 1990a
Washington Irving	Beta 19885	710	60	1252-1310 1360-1387	1213-1398	Jeske 1990a
Washington Irving	ISGS A1205	650	20	1291-1306 1363-1385	1284-1318 1352-1390	Richards and Jeske 2015
Washington Irving	ISGS A1201	655	25	1288-1306 1363-1385	1281-1320 1350-1391	Richards and Jeske 2015
Washington Irving	ISGS A1206	670	25	1283-1302 1367-1382	1277-1315 1356-1389	Richards and Jeske 2015
Washington Irving	ISGS A1202	800	20	1224-1256	1212-1269	Richards and Jeske 2015
Washington Irving	ISGS A1204	810	25	1218-1256	1182-1269	Richards and Jeske 2015
Washington Irving	ISGS A1080	880	20	1155-1209	1049-1084 1124-1136 1150-1217	Richards and Jeske 2015
Washington Irving	ISGS A1081	1005	20	998-1003 1012-1031	988-1041 1108-1116	Richards and Jeske 2015

Langford Cultural Background

The Langford Tradition

Langford is a ceramic tradition that is considered a regional manifestation of Upper Mississippian culture with dates that range from ca. AD 1100-1450. Langford ceramics are very similar to Fisher or Grand River phase Oneota ceramics (Jeske 2000), although they differ significantly in that Oneota ceramics are almost always shell tempered while Langford ceramics are almost always tempered with a fine, tabular, mafic grit (Fowler 1949; Griffin 1946; Lurie 1992). John W. Griffin coined the term Langford in his 1946 master's thesis. It was used as a descriptor of the ceramic style prevalent at the Fisher site (11W15), and to honor the work done by George Langford in the 1920s (Griffin 1946:13-25). James Brown later uses the term "Langford" to describe an archaeological tradition (Brown 1961). Over the past few decades, more work has been added to the definition. According to Jeske (2000:265), the Langford tradition is characterized by a mixed hunting-gathering agricultural subsistence strategy, multiseasonal or year-round settlements and dispersed winter camps, a lithic industry composed of triangular points and bipolar flakes, and a stylistically Oneota ceramic tradition on grit tempered pots.

Langford in the Archaeological Record

The Langford Tradition is distinguished by its unique mafic grit-tempered vessels, which makes them distinctive from Fisher and other Oneota vessels. Aside from temper, Langford ceramic assemblages are largely indistinguishable from other Oneota vessel styles (Jeske 2003) (Figure 1.2). They are dominated by olla shaped jars that are generally plain, although a minority are cordmarked. Vessels are often undecorated, although incised vessels exhibit both curvilinear and angular motifs, often in chevrons (Bird 1997; Jeske 1989).

The general lithic assemblage of the Langford tradition is virtually identical to that of Oneota triangular and bipolar flakes (Jeske 1989,1990). Other tools within Langford lithic assemblages include stemmed and general bifaces (humpback bifaces included), bifacial drills, unifacial scrapers and utilized flakes (Fowler 1952; Jeske 1989, 1990; Lurie 1992; Wilson 2016) (Figure 1.3).

Figure 1.2. Langford bold vessel examples (Jeske 2003)

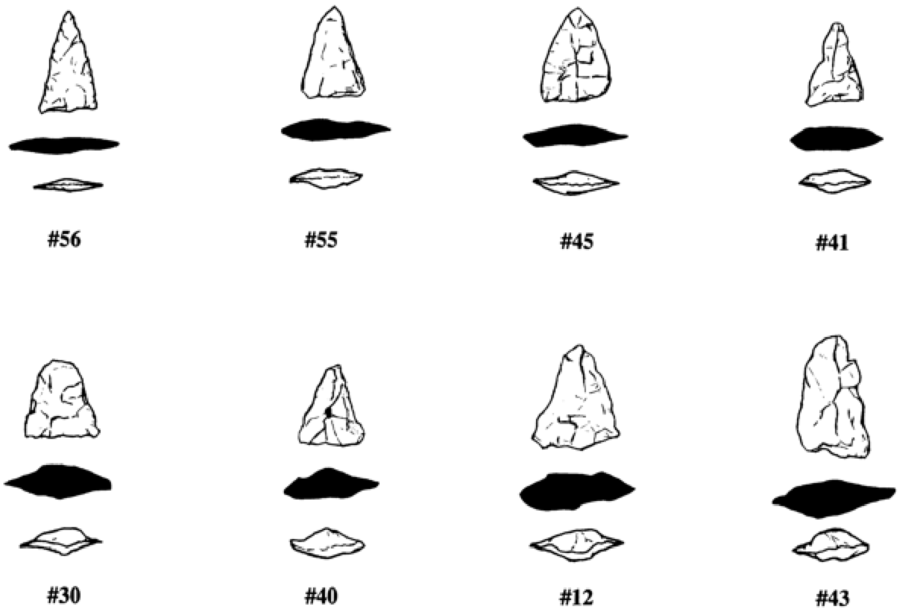


Figure 1.3. Lithic triangular bifaces from Washington Irving (Wilson 2016)

Langford Site Distribution

Langford sites are generally confined to northern Illinois. Specifically, they are found along the Upper Illinois River and its northern tributaries—the Fox, Des Plaines, and Du Page. There are also Langford sites in the Kishwaukee, and Lower Rock River Valleys (Birmingham 1975; Emerson 1999; Foley-Winkler 2011; Hunter 2002; Jeske 1989; 1990; 2000; Wilson 2016). Langford sherds are also found in adjacent areas such as northwestern Indiana (Faulkner 1972), and southern Wisconsin (Bird 1997; Brown et al. 1967; Gregory et al. 2000; Hall 1962; Jeske 2000, 2003). One outlier site is the Noble-Wieting site in east central Illinois (Schilt 1977),

Langford Settlement

Like contemporaneous Oneota occupations, people using Langford ceramics appear to have had a settlement system consisting of sedentary village life with some seasonal mobility (Jeske 2000, 2003). According to Jeske (2000:265), Langford tradition settlements vary from larger hierarchical permanent villages located in larger valleys, smaller seasonal occupations in smaller valleys and adjacent uplands, to small extractive camps found in inter-fluvial upland environments. Villages probably would have been occupied year-round. During the winter, groups likely dispersed into nuclear units, sought individual hunting grounds, and reunited in the spring to prepare for the upcoming seasons (Jeske 1990a:224). Mortuary sites containing mounds or mounded-over cemeteries are also associated with Langford habitations, however, size, complexity, and form varies (Emerson et al. 2010; Foley Winkler 2011; Jeske 2000: 266).

Langford Environment

Langford sites have been recorded in a variety of environments. They are often found near streams, rivers, or marshes. They are also found on terraces along smaller river valleys and adjacent upland and bottomland contexts (Birmingham 1975; Early 1973; Jeske 1990a). Although sites have been recorded in multiple environments, they are mainly found in drier ecozones. Based on General Land Office (GLO) data from the 1830s-40s, Langford sites are in areas designated prairie (Birmingham 1975; Early 1973; Hart and Jeske 1987; Jeske 1990a, b, Jeske and Hart 1988). Presuming historic survey data is similar to late precontact vegetation, Langford populations would have had access to mixed deciduous forests within several hundred meters (Jeske 1990b). It is important to note Langford sites are oftentimes found in proximity to prairie/forest boundaries. The intersections of different ecozones would have provided a large variety of soils and resources to exploit (Jeske 1990b).

Langford Subsistence

Subsistence data from floral and faunal analyses show Langford groups engaged in a mixed economy utilizing wild plant and animal resources, in addition to cultivated crops such as maize (*Zea mays*) and squash (*Cucurbita sp*.). The extent of maize (*Zea mays*) agriculture in Langford subsistence has been a topic of discussion over the last few decades (cf., Egan 1985, 2014; Emerson 1999; Emerson et al. 2005; Emerson et al. 2010; Jeske 1989,1992,2000).

Emerson (1999), suggests that the migration or intrusion of Middle Mississippian groups was a catalyst to the emergence of Langford lifeways (Emerson et al. 2005:72). Northward migrations would have created a disruption to Late Woodland lifeways causing "(1) coalescence of populations into larger aggregations, (2) increasing centralization of leadership, perhaps reflected in centralized rituals and activities, (3) escalated levels of violence, and (4) increased territorial boundedness" (2005:72). Similarly, Hart (1990) hypothesized a heavier reliance on maize agriculture was required to support large-scale populations. Langford populations with Mississippian influence would have had the appropriate economic, social, and political backing to uphold maize agriculture.

Looking at this phenomenon through a finer lens, Egan-Bruhy (2014) examines the role of subsistence patterns in the creation of social identity. Egan-Bruhy (2014) hypothesizes the adoption of maize agriculture by Late Woodland groups in the north as a result of the disruption or depletion of resources, thus subsequent acculturation (2014:56).

Jeske (1992) takes an economic approach to the adaptation of maize agriculture in Upper Mississippian foodways. Environmental or geographic boundaries do not necessarily result in the creation of ethnic or social boundaries (Jeske 1992:63). If anything, population size and subsequent economic maximizing strategies play a larger role. For example, larger population size would constrain environmental responses. Additionally, a disadvantaged smaller group may rally around ethnic identity as a means of preservation when faced with a larger political entity. Similarly, if a group is not negatively affected by the larger entity, we might see acculturation and assimilation of cultural markers (Jeske 1992:63). Jeske argues the environment although important, was not essential to creating differences in Middle and Upper Mississippian foodways. If anything, population size and resource management decisions were pivotal in this (Jeske 1992:65).

Emerson et al. 2005 and Emerson et al. 2010 provide archaeobotanical, paleopathological, and isotopic evidence to further support the idea of Langford maize dependency. Floral data compiled over the last few decades have found maize to be ubiquitous at Langford sites yet found in lower densities in comparison to Middle Mississippian maize production (Egan 1985, 1988; Emerson 1999; Jeske 1989, 2000, 2003). Paleopathological expectations for maize-agriculturist groups include an increased mortality rate, a higher rate of infectious disease, iron deficiency anemia, arrested growth, and an overall increase in dental disease. (Emerson et al. 2005). Paleopathological data show an increase in nonspecific boney lesions, dental carries, reduced growth, and increased mortality rates compared to pre-maize populations in the same regions. (Emerson et al. 2005:89).

Emerson et al. (2005) used a combination of bone apatite carbonate, collagen carbon isotope ratios, and collagen nitrogen data to reconstruct protein and non-protein components of precontact Langford diet (2005:95). Overall, there was a strong C_4 component to the diet. C_4 plants in the diet of midwestern populations include maize, and possibly chenopods and amaranths. This indicates a significant amount of maize consumption. Isotope data further showed a moderate meat consumption in Langford diets making up 53% of dietary protein in comparison to the 70% derived from C_4 resources (Emerson et al. 2005:94).

In summary, Langford tradition populations consumed quantities of maize comparable to that of the American Bottom Mississippians. Data show the populations that inhabited Langford tradition sites were primarily maize agriculturalists who supplemented their diet with wild floral and faunal resources.

Unlike Oneota and Middle Mississippian occupations, Langford sites typically do not include cultigens of the Eastern Agricultural Complex (EAC) (Egan 1985; Egan-Bruhy 2014; Jeske 1990a, 2000, 2002). Although EAC plants are found in Oneota contexts, there is little evidence of these taxa at Langford tradition sites. McTavish (2019) hypothesizes the differentiation could be attributed to a faster and impactful reliance on maize agriculture, a cultural preference, or the need for a somewhat reliable food source that is nearby due to territorial conflict (Edwards 2017; Egan-Bruhy 2014).

CHAPTER 2: THE STUDY SITES

Robinson Reserve (11CK2)

The Robinson Reserve Site (11CK2) is located on a terrace above the east bank of the Des Plaines River in the Cook County Preserves east of the O'Hare airport in Chicago, Illinois (Lurie 1992) (Figure 2.1). It encompasses about 8 hectares. The geographic location is in the Leyden Township at T40 N, R10 E, section 10, NE ¼ (Redmer 1989).

Environmental Setting

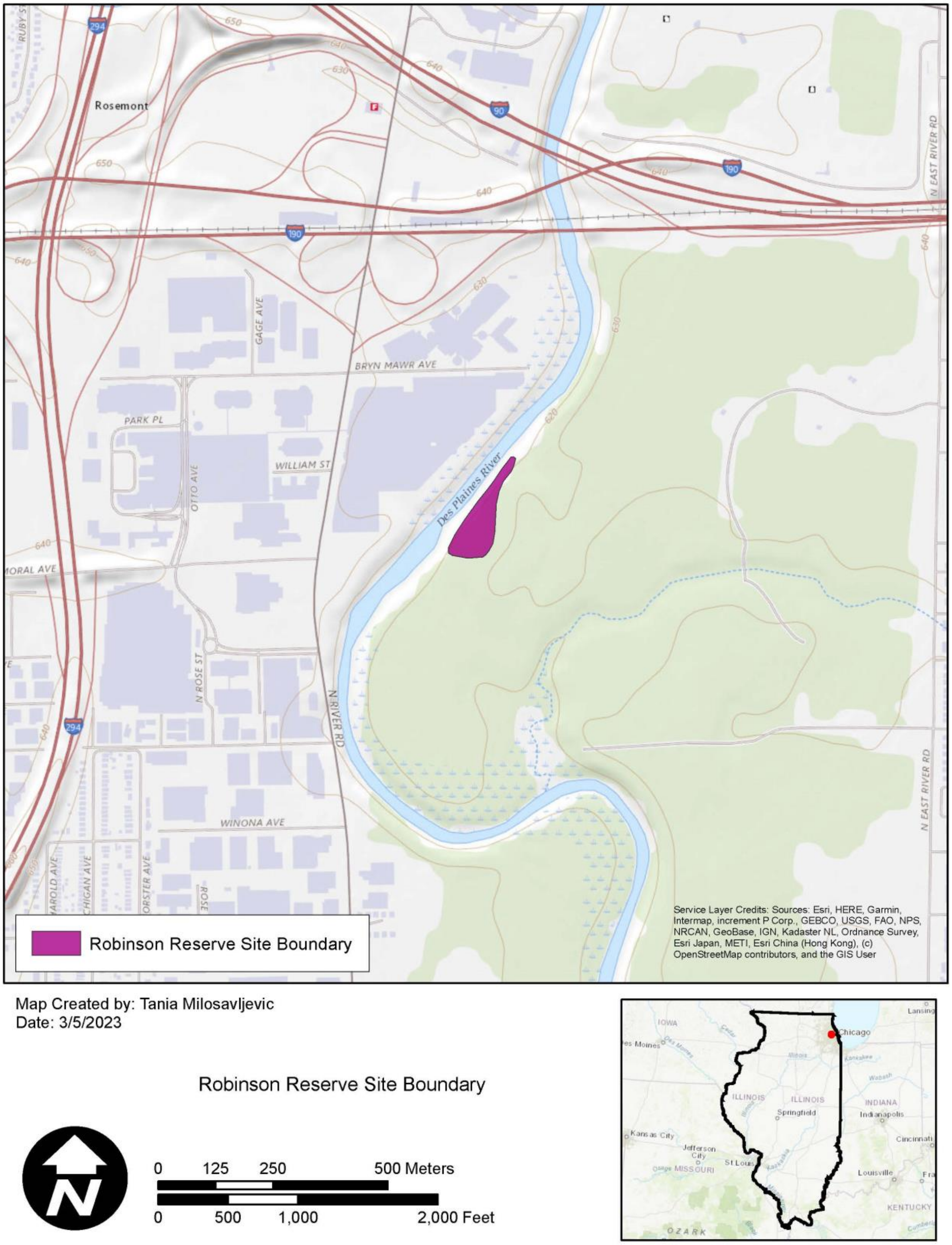
Robinson Reserve is located within the Fox/ Des Plaines River locality (McTavish 2019). These two watersheds are about 40km from the site and have a similar distribution of ecozones (Figure 2.2) including wetlands, prairie, savannas, and forested areas (McTavish 2019). Both river valleys in northern Illinois display similar geological characteristics with well-developed floodplains and upland areas. Environments within the Fox/ Des Plaines locality include wetland/riverine lowlands to upland mixed forest/prairie/wetlands (Jeske 1990b; McTavish 2019). Both upland and lowlands are characterized by large proportions of oak openings, which appear to have been important draws for late pre-contact occupations (Jeske 1990b). The numerous microenvironments provide excellent conditions for biodiversity of plants and wildlife, and for Langford habitations.

Archaeological Investigations

The site was identified in 1937 by two boys who stumbled upon a human skull while playing near the prairie-covered riverbanks of the Des Plaines River (Fowler 1949). The University of Chicago was notified of this find and professional excavations were conducted between 1938-1949. Investigations by University of Chicago students later disclosed the site was composed of two small burial mounds separated by a habitation area. Based on the artifacts and features present, the south mound was designated as CK 2, the north mound CK3, and the habitation area CK4 (Figure 2.3). Excavations were opened in CK 2 and CK 3 by 1939. No materials were recovered in CK 3. Excavations continued CK 2, with a test trench dug just north of the mound (Fowler 1949: 6). This was later designated as CK 4. By the end of the 1941 field season, three-fourths of the mound (CK 2) was excavated, leaving out the northwest corner. Five burials were recovered and removed from the mound during this time (Figure 2.4).

Robinson Reserve was revisited after WWII in the fall of 1948 by Dr. Kenneth Orr. This time excavations focused on excavating the habitation area (CK 4). Another burial was excavated from CK 2. Melvin Fowler's 1949 master's thesis describes the materials from these early excavations, including both habitation and mound areas. According to Fowler (1949:17), six burials were exposed and excavated from 1937-1949. Unfortunately, all material from the excavations, including the human remains, appears to be lost. A common belief among Chicago area archaeologists is that everything from the site was discarded by the University of Chicago during the 1960s (R. Jeske, personal communication).

Fowler's 1949 thesis had two purposes: to describe the excavated artifact assemblage at Robinson Reserve, and to place the ceramic assemblage into a chronological order with similar wares found in northern Illinois (Fowler 1949; Jeske 2000). Fowler's work at Robinson Reserve is integral to our basic understanding of the Langford Tradition, and ultimately paved the way for reinvestigation during the second half of the twentieth century.



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Map Created by: Tania Milosavljevic
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Figure 2.1. The Robinson Reserve Site in Cook County, Illinois

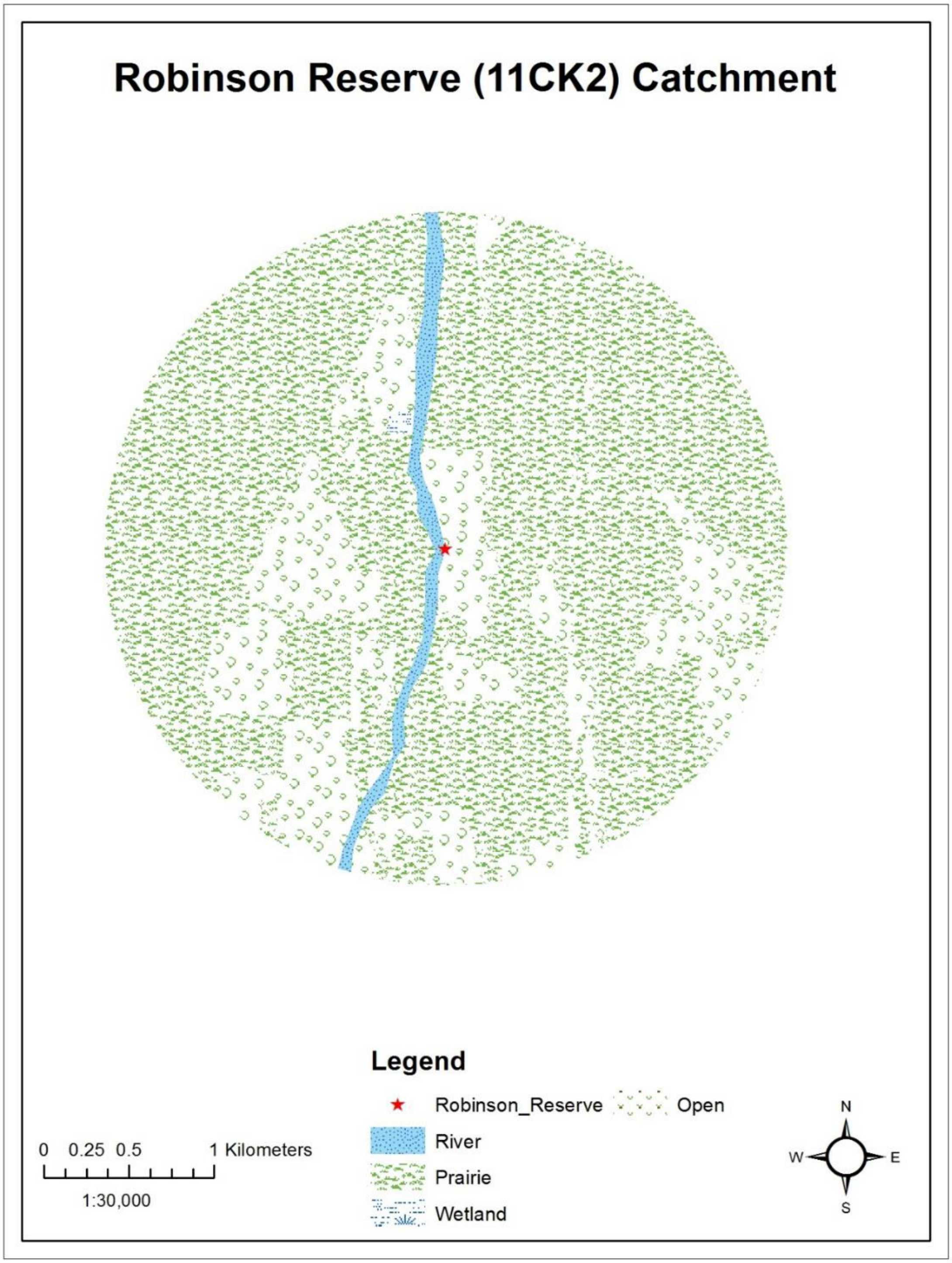

Figure 2.2. Robinson Reserve Catchment Model (McTavish 2019)

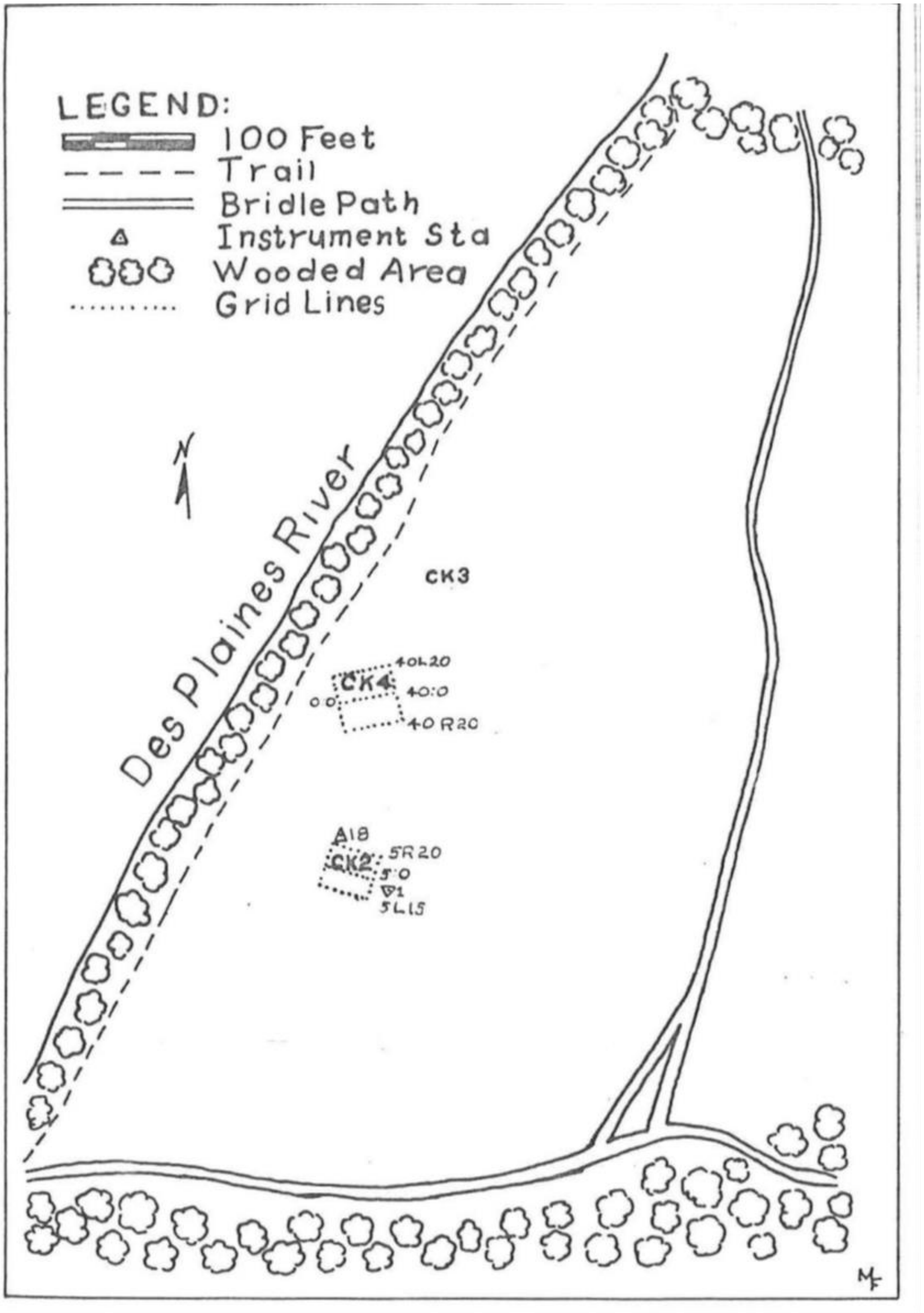

Figure 2.3. Robinson Reserve 1938-1949 Excavations (Map IV) (Fowler 1949)

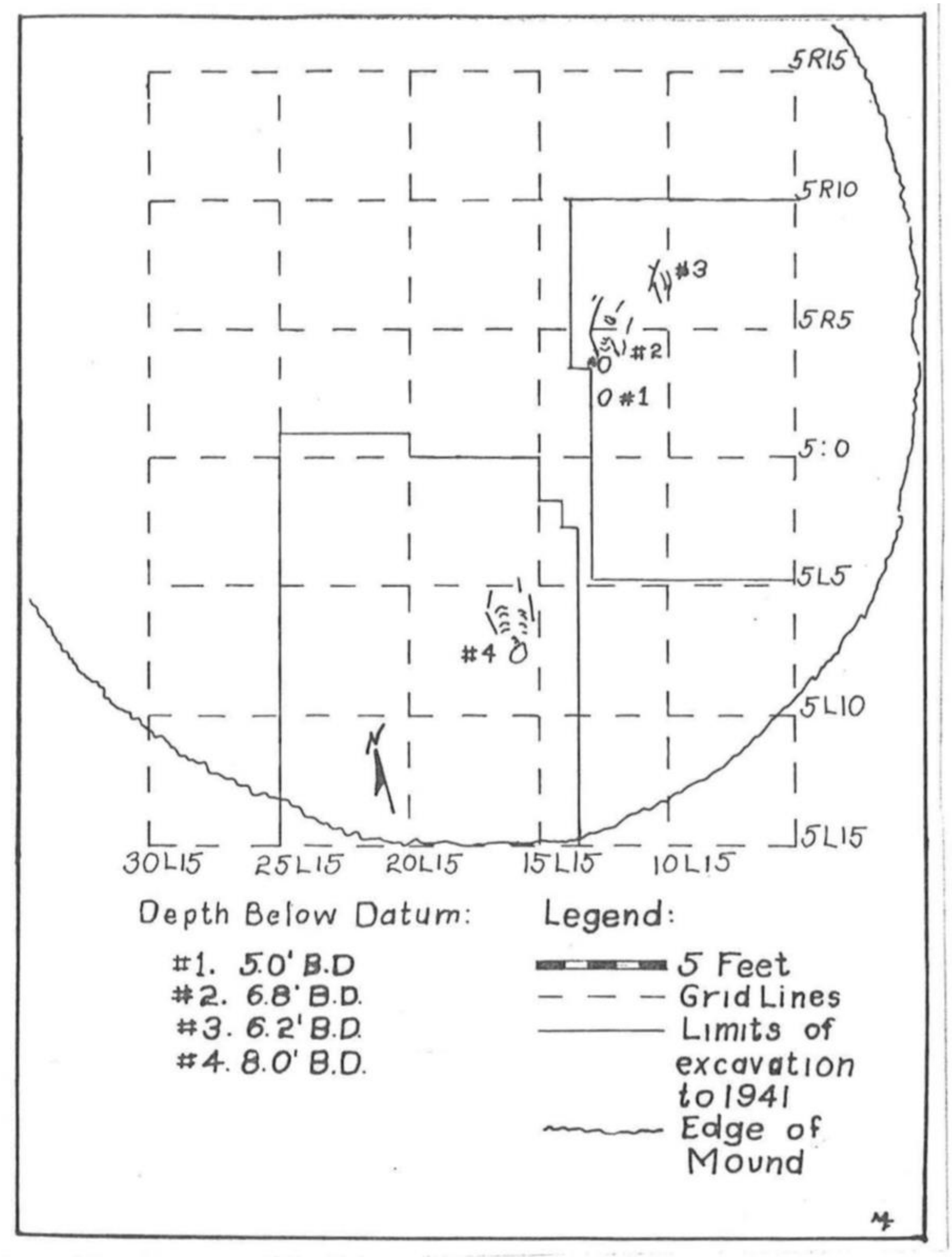

Figure 2.4. Robinson Reserve South Mound Excavations (Map II) (Fowler 1949)

The Robinson Reserve site was subject to additional excavations between 1986-1988 by Northwestern University field schools. Excavations were directed by Rochelle Lurie in 1986 and 1987, while the 1988 excavation was directed by Robert Jeske. During the 1986-1988 field seasons, a total of 161 square meters of midden were excavated. A series of 1x1m units were dug in 10 cm levels with an average of 35 cm below surface. Seventy-one features were recovered including small, medium, and large pits (Lurie 1992:94). Two pit features were located while testing the north burial mound in 1987 (Lurie 1992:101). One pit was excavated enough to confirm it was a burial. The burial contained an adolescent individual, who was reburied in situ. No associated burial objects were removed from the burial. The 1988 excavations focused on obtaining materials for radiocarbon dating and small-scale recovery of plant and animal remains (Jeske 2000; Lurie 1992).

Results of the Northwestern University Field School Investigations

Robinson Reserve dates to the 13th-14th century. The four calibrated dates (using Oxcal 4.4) show that with a two-sigma uncertainty, the highest probabilities of the dates range between ac AD 1150-1430 (Table 2.1, Figure 2.5). Two dates tail off to the 11th century, but they have relatively low probabilities. All four dates overlap at circa AD 1300.

Table 2.1. Robinson Reserve Radiocarbon Dates

Site	Lab #	Age BP	Error Term	Calibrated 1 sigma	Calibrated 2 sigma	Reference
Robinson Reserve	Beta 23522	580	50	1353	1298-1427	Brown and Sasso 1992
Robinson Reserve	Beta 23523	620	60	1348	1281-1417	Brown and Sasso 1992
Robinson Reserve	Beta 23524	830	60	1207	1044-1282	Brown and Sasso 1992
Robinson Reserve	ISGS 2807	790	70	1233	1046-1386	Bird 1997

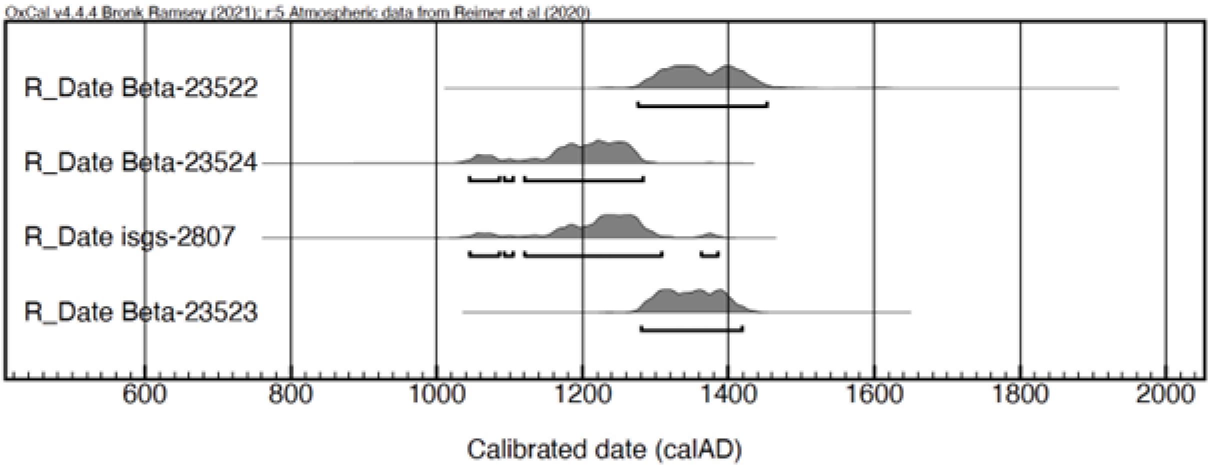

Figure 2.5 2σ Calibrated dates from Robinson Reserve.

The density and variety of tools and debitage within the lithic assemblage at Robinson Reserve shows that stone tool manufacture was important. The assemblage comprises 347 shaped tools/tool fragments, 59 cores, 164 utilized flakes, and circa 45,800 pieces of debitage. Like Washington Irving, small triangular points showed up frequently throughout the site, although there were other types, such as six stemmed bifaces (Lurie 1992:96). Lurie (1992) notes a high number of piercing and graving tools in the lithic assemblage at Robinson Reserve (Jeske 2000).

The ceramic assemblage at Robinson Reserve comprises 16,800 body sherds and 314 rim sherds (Lurie 1992:100). Although most of the sherds were typical of Langford tradition grit-tempered pottery, there was a notable amount of variation in paste, temper type and size, lip treatment, and decoration. Some sherds may have been from Late Woodland vessels, although no Late Woodland types have been identified. Interestingly, most woodland-like pottery was found in the northern and southern parts of the site, including the north burial mound (Lurie 1992:100). The north burial mound yielded a Langford vessel with an unusual, heterogeneous grit temper (Lurie 1992:101). The vessel was not associated with a burial, but came from feature fill.

Faunal data recovered from Robinson Reserve indicate a focused subsistence strategy (McTavish 2019). Locally available large mammals were targeted rather than a wide array of animals of different sizes. About 85% of medium to large faunal remains came from terrestrial/ upland animals, (*Cervidae*). McTavish (2019) notes a relatively high proportion of fawns and yearlings compared to mature animals in the faunal assemblage. Due to the low abundance of fish, McTavish (2019) concluded very few were utilized. Previous faunal data show fish are present; however, they were recovered from the southern part of the site only (Fowler 1949; Lurie 1992:101).

Previous floral data from Robinson Reserve generally align with Langford subsistence strategies. Tropical cultigens such as maize and squash are present. Wild resources include nuts such as hickory, walnut, and acorn. Charred wood taxa present in the assemblage include oak, ash, and honey locust (Redmer 1989). Based on previous analyses, the seed assemblage at Robinson Reserve was sparse.

Previous Interpretations

According to Lurie (1992), analysis of site data indicate Robinson Reserve is a multi-seasonal camp centered around mortuary and lithic reduction activities (Lurie 1992). Other lines of evidence contribute to this theory. First, Lurie (1992) notes the unusually high number of piercing and graving tools in the lithic assemblage. Second, McTavish (2019) data indicates that locally available larger mammals were targeted. According to McTavish (2019) deer remains show the potential of local hunting and butchering, with a majority of deer bones burned or calcined. For the sake of energy efficiency, marrow extraction may have been utilized to obtain more protein from the deer. There is a relatively high proportion of fawns and yearlings identified at Robinson Reserve. The Robinson Reserve faunal assemblage may represent seasonal activities, possibly associated with the burial mounds (McTavish 2019:122). Last, there is no evidence of permanent structures at Robinson Reserve. Overall, these data indicate Robinson Reserve is a mortuary camp with mounds. Plant macroremain data from this thesis will further test this theory.

Washington Irving (11K52)

The Washington Irving site (11K52) is the second site type in the Langford tradition. Washington Irving is in the Fox River valley in northern Illinois. It is located on a glacial outwash terrace inside an old meander scar of the Fox, called Jelkes creek (Jeske 2000) (Figure 2.6). The village site encompasses about 4 hectares. The geographic location is in the Dundee township, T42N, R8 E, sections 28 and 33.

Environmental Setting

The geology and topography of the area was heavily impacted by glacial advances and retreats, creating geological features composed of glacial till, outwash sands, and glacial lake deposits (Jeske 2000). Soils on the site are well-drained (Jeske 2000:271). According to the GLO map of 1838, the surrounding habitat comprised dry prairies, wetlands, oak-hickory forests, and barrens, with the addition of nearby wetland ecozones (Jeske 2000) (Figure 2.7).

Two catchment analyses have been conducted on Washington Irving. Both Hunter (2002) and Wilson (2016) used catchment analysis to observe environmental variation between Langford and Oneota settlement patterns. Both analyses sought to understand Upper Mississippian lifeways with regards to agriculture. In Hunter's (2002) catchment analysis, data show Washington Irving is situated on a ridge near a small creek and associated with wet prairie. Hunter (2002) found Washington Irving's resources had 47.5% woodland, 25.5% prairie, 23.5% wet prairie, and 4% wetland within 1 km. This analysis focused more on environmental exploitation. Conversely, Wilson (2016) provides 1km and 2km catchment analyses. Wilson (2016) found Washington Irving had 82% savanna and 16% wetland with no prairie in 1km

(Table 2.2). In comparison to Hunter (2002), Wilson focuses on the convergence of microenvironments or ecotones. In the 2km catchment model, 69% of the land is represented by ecotones. The 2km catchment analysis comprises 77% near savanna ecozones, 13% near wetland ecozones, and 9% prairie ecozones (Wilson 2016). Wilson (2016) catchment data show Washington Irving is mostly savanna whereas Hunter (2002) catchment data show Washington Irving has mostly woodland resources, in addition to prairie and wet prairie. Overall, both analyses show there are numerous environments to exploit within the vicinity.

Table 2.2. Environmental Zones within Washington Irving Catchments (Wilson 2016)

Washington Irving	**Savanna**	**Prairie**	**Wetland**	**Lake**	**Creek**	**Total**
1 km - Total Area (m^2)	2,620,388	0	507,799	0	11,392	3,139,579
1 km - Proportion	83%	0%	16%	0%	<1%	100%
2 km - Total Area (m^2)	9,694,211	1,144,574	1,641,318	0	71,378	12,551,481
2 km - Proportion	77%	9%	13%	0%	1%	100%

Archaeological Excavations

According to Jeske (1990, 2000), Washington Irving first came to the attention of archaeologists in 1982, through an 1838 GLO plat map. The site was listed as “27 ancient mounds are all within dotted lines”. Landowners allowed a brief survey, noting that the mounds were likely plowed over. In 1983 a reconnaissance survey was conducted by students at the Elgin Community College as part of an undergraduate field school. The survey showed an approximately 4-hectare cultural scatter. James Brown noted the mounds were more likely earth lodges, a hunch supported by historic research (Bird 1989; Jeske 1990a). A research project was created to investigate the possibility of *in situ* house floors at Washington Irving.

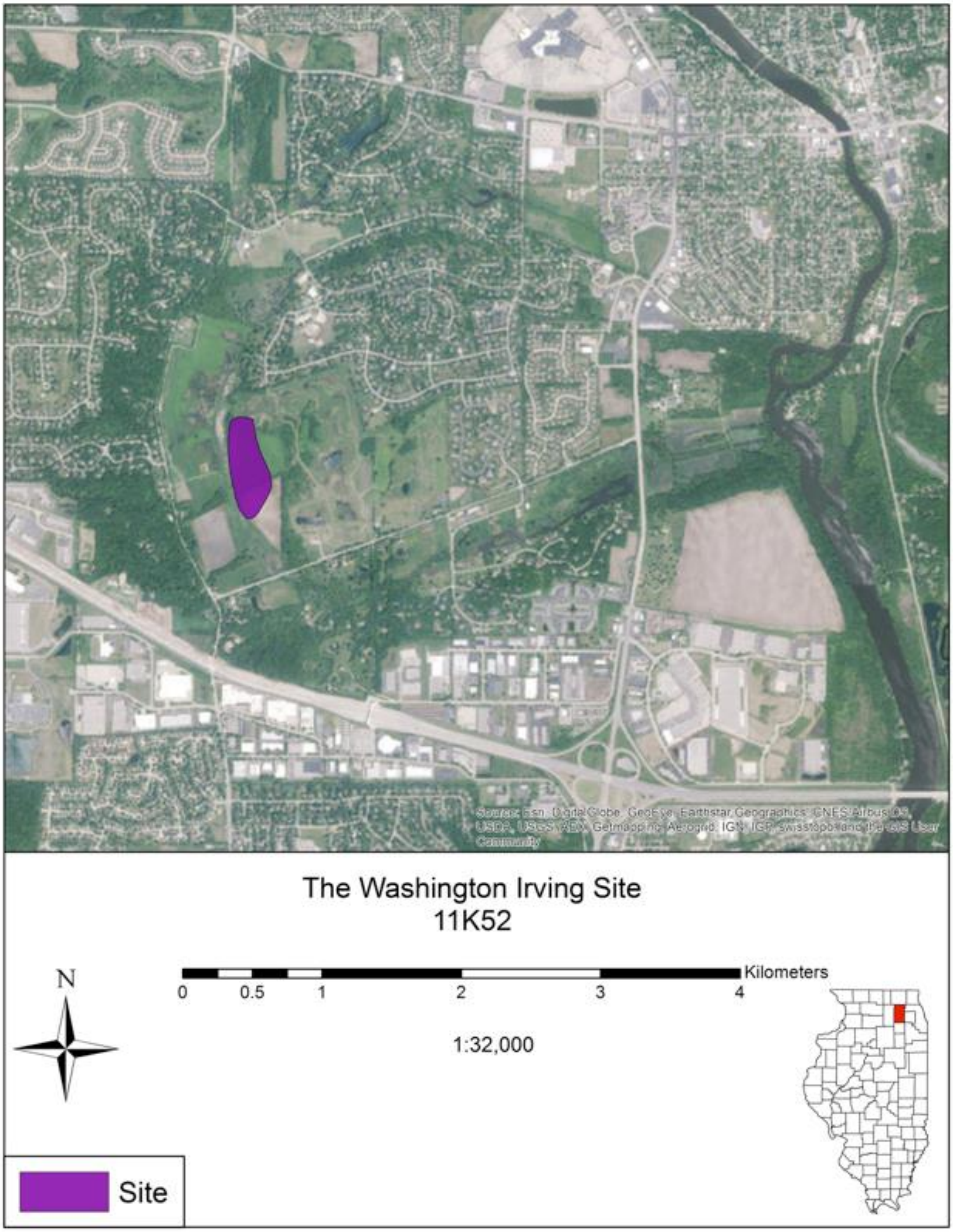

Figure 2.6. The Washington Irving Site in Kane County, Illinois (Wilson 2016)

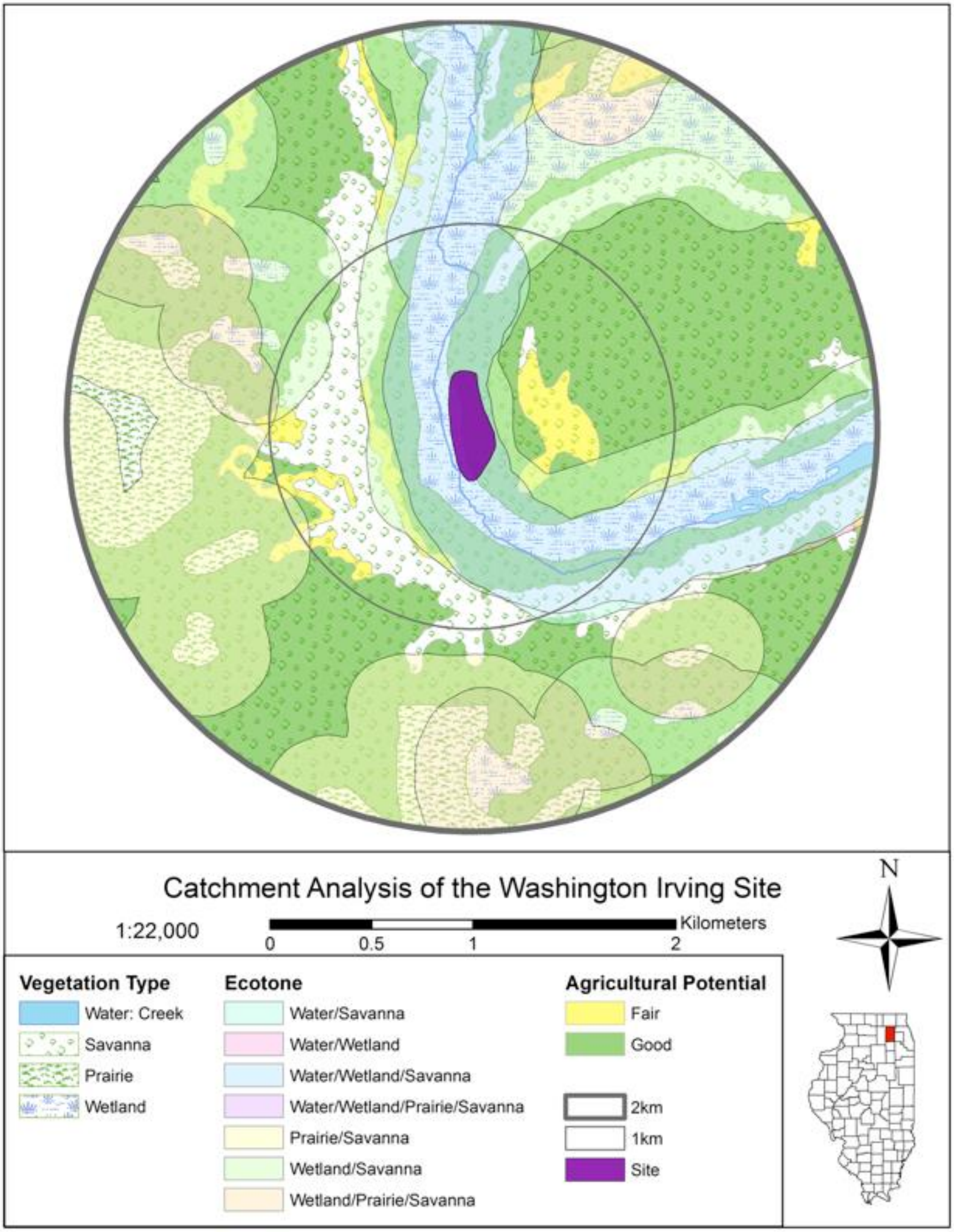

Figure 2.7. Washington Irving Catchment Model (Wilson 2016)

Over the next year, field students from the Fox Valley Campus of the Center for American Archaeology conducted pedestrian survey on the southern and central 1.41 hectares of the site (Figure 2.8). In the summer of 1984, a field school was conducted by students from Elgin Community College, Judson College, and Harper College, directed by Robert Jeske. Thirty-eight 2m square test units were placed in areas with high densities. Due to heavy erosion, cultural material was found mostly within the plow zone, however twelve pit features and four post molds were defined. Of the sixteen features defined, eleven pit features and one post mold feature were excavated.

The 1985 field season was directed by Northwestern University graduate students John F. Doershuk and April Sievert, with Robert Jeske as the Principal Investigator (Figure 2.8). According to Jeske (2000: 273), an additional 59 units were excavated north and adjacent to the 1984 excavations. Seventy-eight square meter test units were opened as a block to investigate spatial distribution of features and possible house floors. Overall, 26 2x2m test units were excavated in 1985. Twenty-one features and post molds were excavated (Figure 2.9).

Results of Investigations

The ceramic assemblage at Washington Irving yielded over 4,187 sherds, mainly from plow zone contexts. No vessels were reconstructable from this assemblage. This being so, all sherds characterized typical Langford tradition ceramics. Despite the fragmentary nature of the pottery, 392 sherds were able to be analyzed. A total of 31 rim sherds were recovered (Jeske 2000:279)

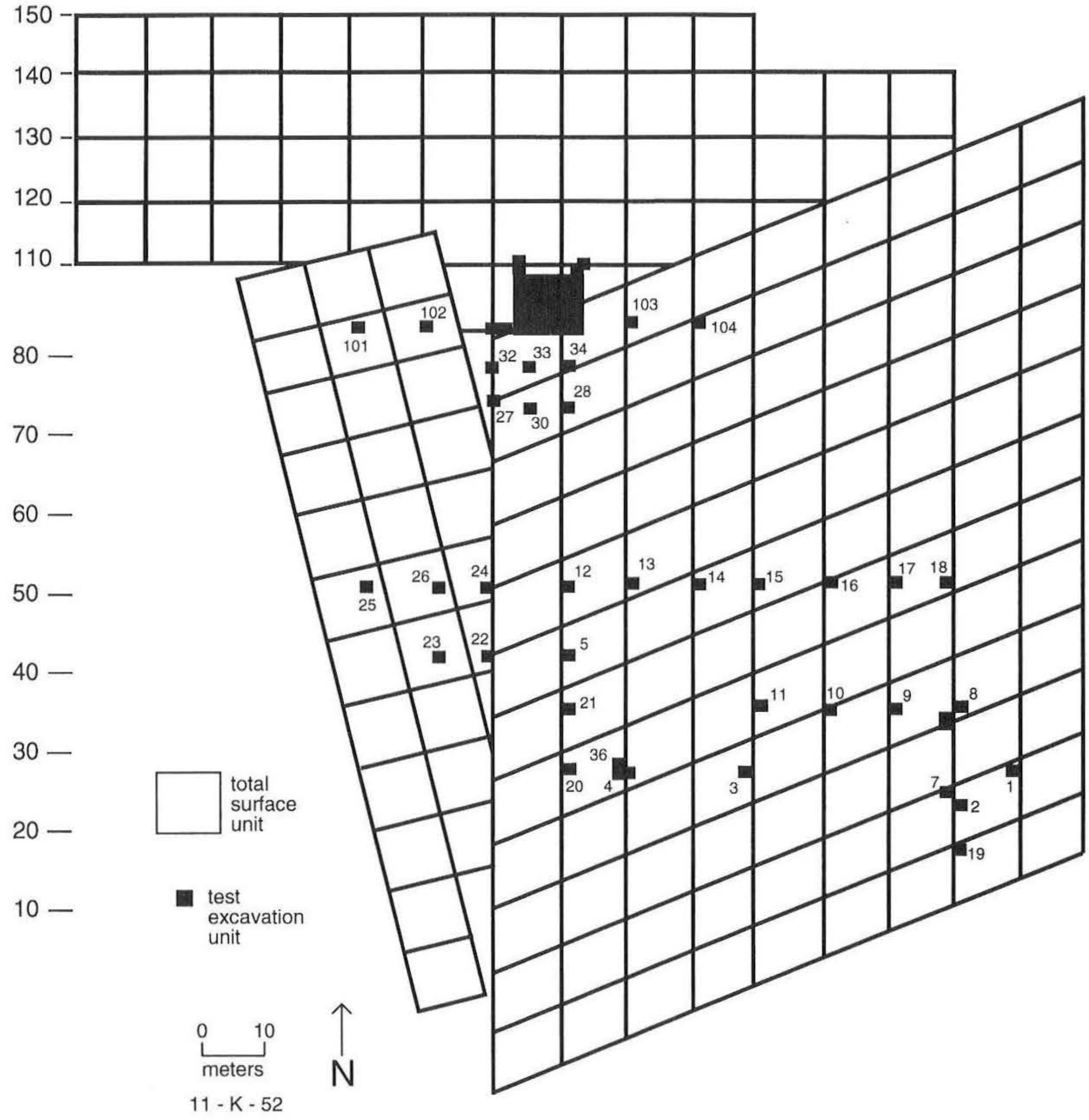

Figure 2.8. Location of 1984 and 1985 Excavation Units (Jeske 2000)

The lithic assemblage at Washington Irving showed a variety of tools and manufacture. Bifaces composed 56% of the tool assemblage. Of the hafted bifaces, 66 of 73 (90%) were either Madison triangular or humpback forms. One contracting stemmed biface was also recovered. Drills and bifacial drill tips are also present in the assemblage (Jeske 2000:279). Another 19% of the assemblage was composed of bipolar cores. Unifacial scrapers made up 16% of the assemblage. Jeske used Washington Irving to provide evidence that a controversial tool form unique to southern Lake Michigan region sites, humpback bifaces, were a product of bipolar manufacture rather than a truly functional tool type.

Fauna recovered from Washington Irving are indicative of the diverse exploitation of different ecozones. Altogether, 24,393 bone fragments were recovered. Due to heavy burning and fragmentation, only 3,200 (13%) could be identified (Jeske 2000:283). Mammals composed 44% of identifiable specimens, fish 32%, birds 14%, and the rest was composed of mollusks. Mammal identifications include deer, squirrel, fox, canid, beaver, and muskrat. Birds included mallard, teal, egret, hooded merganser. A variety of turtle species and freshwater mussel types were also recovered (2000:283).

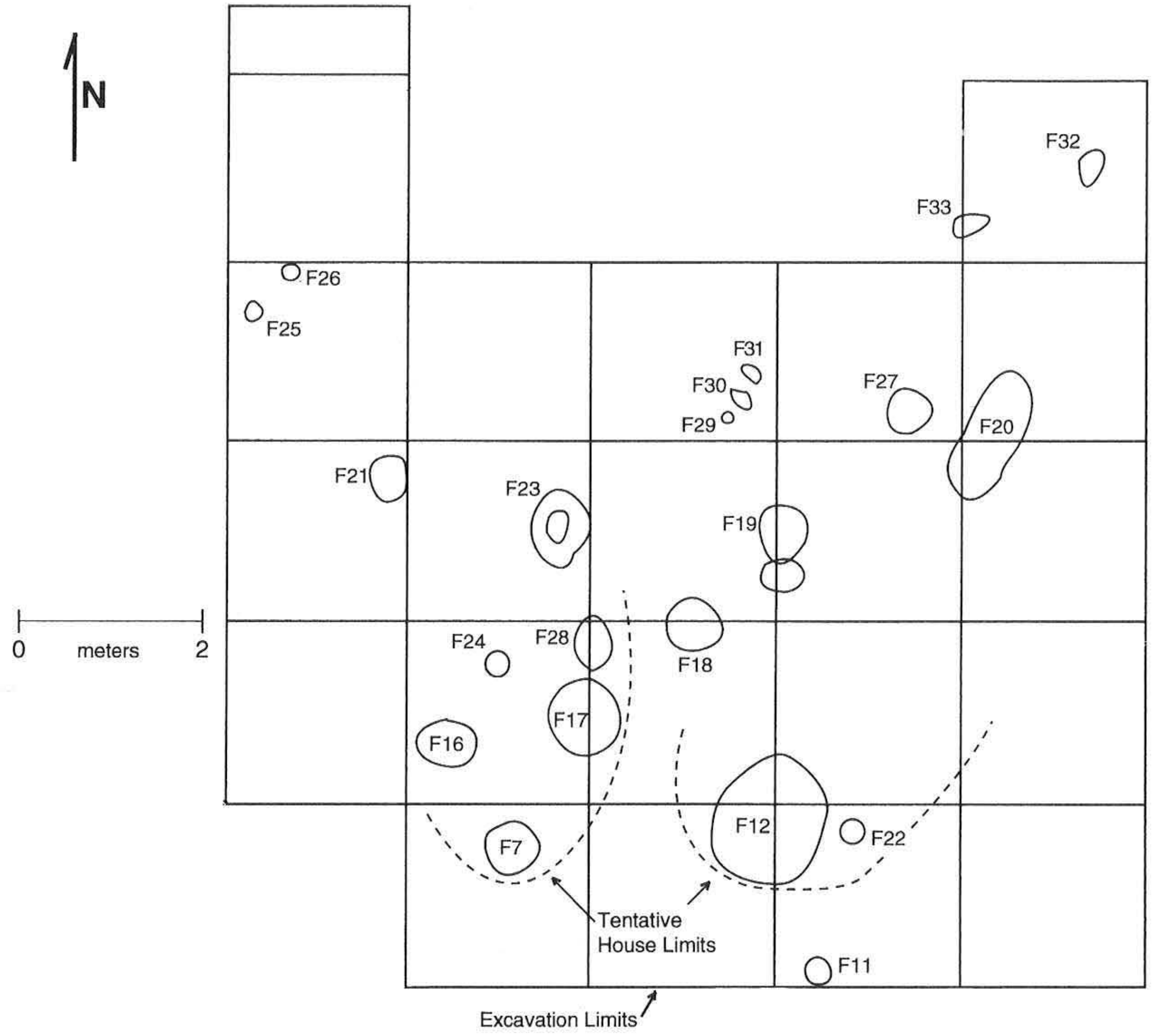

Figure 2.9. Plan view of 1985 block excavation (Jeske 2000)

The floral assemblage from Washington Irving shows a variety of plant macro material, including tropical cultigens such as maize *(Zea mays*) and squash (*Cucurbita pepo*). These tropical cultigens were ubiquitous in relatively small amounts. Kernel and cupule fragments were recovered, indicating maize processing on or near site (Egan 1985). Most wood charcoal from the site (76%) came from the white oak group. Hickory (*Carya*) represented 5%. Other wood taxa present include maple (*Acer*), sycamore (*Platanus*), red oak group (*Quercus*), mulberry (*Morus*), ash (*Fraxinus*), pine (*Pinus*), and black walnut (*Juglans nigra*). Of the nut assemblage, hazel was the most prevalent (45.7%), followed by acorn (42.6%), pecan (9.3%), and walnut (2.4%). The seed assemblage from Washington Irving is notably small, but includes blueberry (*Vaccinium sp*.), grape (*Vitis sp*.) and a very small amount of American lotus (*Nelumbo*). The lack of Eastern Agricultural Complex plants is characteristic of Langford tradition subsistence patterns.

Previous Interpretations

Based on the material culture present, Washington Irving is considered a horticultural or agricultural village site utilized from spring to fall, although a year-round occupation cannot definitively be ruled out (Jeske 2000:286). Radiocarbon dates place the occupation of Washington Irving between AD 1100-1440 (Jeske 2000) (Table 2.3. See Wilson 2016:47).

Table 2.3. Washington Irving Radiocarbon Dates

Site	Lab #	Age BP	Error Term	Calibrated 1 sigma	Calibrated 2 sigma	Reference
Washington Irving	Beta 12587	440	70	1412-1516 1596-1618	1328-1341 1395-1640	Jeske 1990a
Washington Irving	ISGS 1444	710	70	1225-1232 1244-1313 1357-1388	1189-1405	Jeske 1990a
Washington Irving	ISGS 1437	720	70	1223-1305 1363-1385	1169-1175 1181-1399	Jeske 1990a
Washington Irving	Beta 12588	420	70	1423-1521 1578-1582 1591-1620	1407-1642	Jeske 1990a
Washington Irving	Beta 19885	710	60	1252-1310 1360-1387	1213-1398	Jeske 1990a
Washington Irving	ISGS A1205	650	20	1291-1306 1363-1385	1284-1318 1352-1390	Richards and Jeske 2015
Washington Irving	ISGS A1201	655	25	1288-1306 1363-1385	1281-1320 1350-1391	Richards and Jeske 2015
Washington Irving	ISGS A1206	670	25	1283-1302 1367-1382	1277-1315 1356-1389	Richards and Jeske 2015
Washington Irving	ISGS A1202	800	20	1224-1256	1212-1269	Richards and Jeske 2015
Washington Irving	ISGS A1204	810	25	1218-1256	1182-1269	Richards and Jeske 2015
Washington Irving	ISGS A1080	880	20	1155-1209	1049-1084 1124-1136 1150-1217	Richards and Jeske 2015
Washington Irving	ISGS A1081	1005	20	998-1003 1012-1031	988-1041 1108-1116	Richards and Jeske 2015

CHAPTER 3: METHODOLOGY

In this chapter I discuss the methodological framework for the research project. First, caveats of working with legacy collections are discussed in paleoethnobotanical methods. Methods of field and lab processing between Robinson Reserve and Washington Irving are also discussed. Sample and preservation biases between the two sites are also included in this section. This is followed by a discussion of quantitative methods and sample selection. The rest of this chapter explains the research expectations using an HBE theoretical framework.

Paleoethnobotanical Methods

Legacy Collections

Both Robinson Reserve and Washington Irving's data come from legacy collections. Legacy collections are generally older archaeological collections that do not meet modern curation standards (MacFarland and Vokes 2016:161). These collections come with a considerable number of challenges. According to MacFarland and Vokes (2016)," management of legacy collections include inventorying, accessioning, labeling and cataloging, evaluating and documenting, and storing and maintaining a collection under appropriate environmental conditions and physically secure controls" (2016:162).

The Robinson Reserve collection was recovered more than 30 years before this analysis was undertaken. The collection required rehousing as it was in poor condition. Once archival standards were met, the sample choosing process began. This required going through and cross-checking information from the field and collection paperwork, flotation logs, and old bag tags. Overall, this project took multiple semesters to get into shape where I could finally choose samples. Thankfully Washington Irving floral data was already available (Egan 1985). The work that went into curating and properly inventorying was tedious, however it was worth it to conduct this research.

Field Processing

The Robinson Reserve samples chosen for this thesis come from flotation samples taken during the 1986-1988 field seasons by Northwestern University field students. Data recovery techniques were chosen with special interest in taking samples for radiocarbon dating and the recovery of small-scale plant and animal remains (Lurie 1992:95). During the first two field seasons all midden was water screened through1/4-inch (6.33mm) or 1/8-inch (3.17mm) hardware cloth. During the third season, all midden was dry screened through 1/4-inch (6.33mm) cloth. All feature fill was retained for flotation.

Washington Irving data comes from flotation samples taken during the 1984-85 field seasons. The 1984 flotation samples were taken by zones in features. According to Jeske (2000), features were bisected by trench in 5 cm levels. Once the trench was excavated below the feature they were profiled. The remaining material was excavated by natural or cultural stratigraphy. All soil matrix was saved for flotation laboratory processing.

Laboratory Processing

Laboratory processing for Robinson Reserve samples was conducted from 1986-1988. According to archival notes, all unit and feature midden flotation samples were processed. Flotation samples were processed using a SMAP flotation machine. All 1986 materials were scanned, counted, weighed, and stored for later.

For this thesis, only feature flotation samples were chosen for analysis. All samples were processed and analyzed per the UWM Archaeological Research Laboratory (UWM-ARL) Plant Macroremain Analysis protocols (Appendix A). Plant macroremains were identified with the aid of comparative specimens from the UWM-ARL. Reference manuals also assisted with seed identification (Martin and Barkley 1961; Minnis 2003; Montgomery 1977). Morphological characteristics such as size, shape, seed coat surface texture, placement of the embryo and placement of the endosperm assisted in identifying seeds (Minnis 2003; Pearsall 2016) The comparative collection was especially useful with identifying nut, squash, and maize. In some cases, plant specimens lacked diagnostic features or were difficult to differentiate. Where taxonomic identification was not possible, specimens were labeled as unidentified or unidentifiable. A "cf" was placed in front of taxonomic designations where identifications were probable yet not definitive.

Each flotation sample within the same context was combined and passed through a 2.0-millimeter brass geologic sieve. Although only carbonized materials were considered for analysis, partly noncarbonized materials were also present. Partly noncarbonized materials were noted and tabulated separately, however they were included in absolute counts and weights. To see tabulations, separate from the rest of the carbonized material, see Appendix B. All carbonized botanical materials > 2.0mm were sorted into wood, nut, squash rind, maize, and other categories. All botanical materials were identified to family and genus if possible. Maize was sorted into kernel, cupule, glume, and cupule/glume when possible. All material <2.0mm was scanned under a binocular microscope (10X-30X). During this process, carbonized seeds and seed fragments were removed, identified, and tabulated. Seed fragments were not separated from seed counts. The presence of wood, nut, resin, maize, and other anomalous fragments were recorded, however they were not removed and examined further. Wood identifications are also a part of this thesis. Twenty wood-charcoal fragments were randomly selected as a subsample from each context and identified. Counts and weights of wood charcoal and nutshell are solely from >2mm materials. Robinson Reserve wood identifications can be found in Appendix C. Some samples were too large and had to be riffle-sorted. This information can be found in Table 3.1 and Appendix C.

Washington Irving materials underwent the same standard laboratory procedures as Robinson Reserve; however, flotation procedures were somewhat different. The 1984 flotation samples were processed using the Kampsville method. During this process, samples were dropped into buckets with mesh bottoms and agitated in a pool of water. Light fraction was collected using hand-held sieves. The 1985 flotation samples were processed using the SMAP machine. After flotation, samples were hand sorted into bone, charcoal, lithic, ceramic for future analysis. Kathryn C. Egan did the botanical analysis for Washington Irving (Egan 1985). According to Egan (1985), flotation samples were analyzed by feature. They were sieved through 2.0-millimeter and 0.5-millimeter geologic sieves. Like Robinson Reserve, all carbonized botanical materials > 2.0mm were sorted into wood, nut, sees, tropical cultigen, and other. All material <2.0mm was scanned under a binocular microscope (7X-30X). During this process, carbonized seeds and seed fragments were removed, identified, and tabulated. Seed fragments were not separated from seed counts. All plant macroremain fragments were identified when possible. Counts and weights of wood charcoal and nutshell are solely from >2mm materials. Egan (1985) also did wood identifications. Like Robinson Reserve, twenty wood-charcoal fragments were randomly selected from each sample and identified.

Preservation and Sample Biases Between Robinson Reserve and Washington Irving

Reconstructing past plant- people interrelationships is difficult due to differential preservation in the paleoethnobotanical record. Plant macroremain assemblages are subject to numerous cultural and natural processes prior to excavation. These processes in turn create biases in what is recovered. What we see in the paleoethnobotanical record varies depending on how people used, processed, stored, prepared, and disposed of plant remains (Pearsall 2016; Popper 1988). Although carbonization is the most common mode of preservation, not all remains have an equal chance of being incorporated into the archaeological record (Pearsall 2016:41).

For example, plant remains associated with fire are more likely to be charred. Additionally, some plant parts are preserved better than others. Dense nutshells and seeds are better preserved than fleshy fruits (Pearsall 2016; Popper 1988). Further natural processes such as environmental conditions (soil type, temperature, moisture) and bioturbation (erosion, root growth, insects, rodents) impact the assemblage after deposition (Popper 1988:58). These are all examples of potential preservation biases within a site. This thesis compares two sites which create more challenges for comparison. Both sites are subject to differential preservation with a unique set of environmental factors.

Aside from differential preservation, biases in excavation and sampling methods further impact the record. Both Robinson Reserve and Washington Irving flotation samples included in this thesis were chosen with consideration to the research design when excavated. This was about forty years ago. There have been many technological advancements in the field, thus modern data recovery methods look a lot different than decades ago. Other factors such as excavation and laboratory processing techniques further skew sample comparability between the sites. For example, flotation was done differently at both sites. At Robinson Reserve, flotation samples were processed with a SMAP flotation machine. Conversely, at Washington Irving flotation samples were processed using the Kampsville method (R. Jeske, personal communication). The Kampsville method was not ideal for small-scale recovery of faunal and floral materials. A larger mesh size likely created a bias against small seeds. This is a notable caveat between the two assemblages. Different processing techniques impact the scale of recovery, and further create biases in the plant macroremain data. It is also important to note the contribution of sample choice to biases in data. For this thesis, fifteen features from Robinson

Reserve are being compared to thirty-three features from Washington Irving. Overall, these are preservation and sample biases between the two sites.

Quantitative Methods

Quantitative methods included in this thesis were chosen with regards to site function. This includes abundance measures, ubiquity values, ratios, and diversity indices. All of these are useful tools to better understand patterns in the plant macroremain assemblages at both sites.

Abundance

The most common method in quantification is the use of absolute counts and weights for each taxon. (Marston 2014). Further quantitative methods must be used due to preservation biases and unevenness of data. Despite this, absolute counts and weights are essential to paleoethnobotanical analyses (Pearsall 2016). For this thesis, a summary of counts and weights for each taxon is included in Appendix B. Abundance is expressed as the percentage of a taxon relative to the entire assemblage. This will allow for standardization to account for differences in density (Pearsall 1988). With this method, all specimens must add up to 100 percent, thus changes in percentages may add to biases (Pearsall 2015).

Ubiquity

Ubiquity is another measure of standardization utilized in this thesis. Ubiquity or presence analysis measures the number of samples in which a taxon is present rather than the number of specimens of each taxon (Marston 2014; Pearsall 1988, 2016; Popper 1988). Ubiquity standardizes the presence/absence of taxa across all samples and addresses bias by measuring the frequency or occurrence rather than abundance. (Marston 2014). For example, if maize (Zea mays) is present in two of ten samples, then its ubiquity value is 0.20 or 20 percent. The formula is expressed as $U = x/t$ where U is ubiquity, x is the number of contexts a particular taxon is present, and t is the total number of contexts.

Ratios

Ratios are one of two relative measures that will be used in this thesis. In general, ratios represent a simple statistic that standardizes plant macroremain data by relating it to a constant variable (Miller 1988; Pearsall 1988; Scary 1986). Ratios provide more information than abundance and ubiquity. Two types of ratios in plant macroremain analysis include dependent and independent ratios (Marston 2014; Miller 1988; Pearsall 2016; VanDerwarker 2003). In dependent ratios, the numerator is a subset of the denominator (Miller 1988). In independent ratios, the numerator and denominator are mutually exclusive to one another (Miller 1988). It is important to note that ratios lack significance unless used through comparison with other ratios. Additionally, they do not provide information on the caloric contributions of foodstuffs.

For this thesis, both dependent and independent ratios will be used. This includes density, plant food, and kernel: cupule. The density ratio (d) standardizes plant data by dividing the count or weight of plant material with the total soil volume for each sample or context (Marston 2014; Miller 1988). Density considers plant remains relative to other activities represented in a feature or context. This ratio measures the abundance of plant taxa with the assumption that larger volumes of soil yield more plant remains. Differences in sample contexts regarding deposition and site activities structure the relationship between soil volume and abundance of plant macoremains (Scarry 1986; VanDerwarker 2003).

The plant food ratio assesses the importance of a specific plant taxon or category relative to other plants in the same sample or context (Scarry 1986; VanDerwarker 2003). The plant food ratio standardizes by plant food weight, considering the contribution of a specific plant taxon regarding plant-related activities. This ratio is useful for intrasite analysis as it is sensitive to spatial and temporal differences across a site. The denominator of the plant food ratio is the sum of weights for all plant food specimens from all samples. The numerator is the count of the specific plant taxon, or category of plant taxa, of interest. The ratio is expressed as $q = a/f$ where q is the plant food ratio, a is abundance count (c) or weight (w) of a particular taxon in a given context, and f is the total plant food weight from all contexts (Scarry 1986; VanDerwarker 2003)

The kernel to cupule ratio (e) provides information on the intensity of maize processing and consumption. Maize processing can be seen archaeologically through shelling. During the process of turning maize into flour, the kernels are removed from the cob, leaving the cob and cupules as byproducts (VanDerwarker 2003). Kernels represent the part of maize meant for consumption and cupules represent the discard byproducts during processing. Lower ratio of kernel counts to cupule counts indicate elevated levels of maize processing. (Scarry and Steponaitis 1997; VanDerwarker 2003).

Diversity

Diversity is the second relative measure of quantitative analysis that will be used in this thesis. Diversity indices describe the species diversity and abundance of each throughout a plant assemblage (Pearsall 2016; Popper 1988). This is useful for assessing diet breadth. Two diversity indices were utilized for this thesis: the Shannon-Weaver index and Simpson's index. The Shannon-Weaver index is a diversity index that calculates biodiversity of assemblages and is used in both floral and faunal analyses (Popper 1988). A high diversity score results when many species are even distributed. Low diversity results when the number of species is low, or when one species dominates most of the assemblage (Pearsall 2016). The following formula uses natural logarithms to calculate the Shannon-Weaver index:

$$H = \mathrm{Sum}(Nj/N) \ln (Nj/N)$$

where N = total number of seeds/fragments in the phase
Nj = total number of specimens of taxon j in the phase
(cited in Popper 1988:67).

This thesis uses the Shannon-Weaver richness, diversity, and evenness (or equitability). Richness is the number of species/taxa within a population. Evenness or equitability is the homogeneity of a species. Although part of this thesis explores intersite diversity between Robinson Reserve and Washington Irving, it is important to acknowledge that measures of diversity can be affected by differential preservation (Pearsall 2016). The Shannon-Weaver index does not account for differential preservation or sample size bias. Additionally, due to the combination of richness and evenness, assemblages may appear to be more alike than they are. The Simpson's index was also used as it is more accurate with low-density taxa (Marston 2014).

$$D=\Sigma n_i(n_i-1)N(N-1)$$

where D= Simpson's Index, n_i is the number of a given taxon, and N is the total number of all taxa (Lyman 2008). It ranges from 0 to 1 – where 1 indicates no diversity and 0 represents infinite diversity (Marston 2014). By taking the inverse of D, it is possible to determine the evenness of the assemblage as well. As the inverse decreases, "the more an assemblage is dominated by a single taxon" (Lyman 2008:197). Since D ranges between 0 and 1, the lowest possible value of 1/D is 1 (samples with a single taxon).

Sample Selection

The Robinson Reserve site was divided into northern and southern sections to aid in assessing site variation in site function (Figure 3.1). For this thesis, the north section will also be called the mortuary section. The mortuary section includes mound contexts and is assumed to be mortuary focused (Figure 3.2). The southern section will be called the habitation section. The habitation section includes habitation related contexts (Figure 3.3). A comparison of northern and southern contexts will help to identify if/how plant use during mortuary-related activities differ from daily plant use at the site. In total, twenty-five samples were chosen for analysis (Table 3.1).

A total of fifteen features were analyzed, including samples from two burial pits. In the North section, all ten contexts were analyzed due to their relation or inclusion in burial contexts. From the south section, fifteen contexts were analyzed. Samples chosen for this thesis do not represent the total number of flotation samples taken at the time of excavation. Because the south section contained many features, samples were only chosen if they had available flotation data. Feature fill was preferred over feature trench fill. Additionally, samples from lower strata or zones were preferred. Feature type (post mold, midden, pit) and spatial location within both sections was also taken into consideration (Table 3.1). A few contexts were riffle-sorted as they were not feasible to analyze. The percentage of each context sorted is noted in Table 3.1. This is also accounted for in Liters analyzed (Appendix C).

Table 3.1. Robinson Reserve Flotation Sample Selection

Section	Lot Number	Liters	% Sorted	Unit	Feature	Level	Zone	Comments
North	M1.1	22	100%	M1		8,9		Mound TU 1
North	M1.3	9	100%	M1		6		Mound TU 1
North	M1.4	10	100%	M1		7		Mound TU 1
North	M2.1	13	100%	M2		6	F	Mound TU 2
North	M2.2	26	100%	M2	Burial 1		C	Mound TU 2, (B1)
North	M2.3	12	100%	M2		7	No Ext	Mound TU 2, North Extension
North	M2.4	26	100%	M2	Burial 1	8	Ext	Mound TU 2, (B1), Extension
North	M2.5	52	100%	M2	Burial 1			Mound TU 2, (B1)
North	M2.6	9	100%	M2	Burial 2	9		Mound TU 2, (B2)
North	M2.7	29	100%	M2	37			Mound TU 2
South	F2.10	32	100%		2		B	
South	F4.1	32	50%		4		2	
South	F5.19	92.4	100%		5		3	
South	F5.20	87.25	50%		5	Basin	4	
South	F8.1	77	100%		8	Basin	A	
South	F12.1	7	100%		12	Basin	B-D	
South	F13.1	22	100%		13	Basin	A	
South	F23.3	6	100%		23	Basin	A	
South	F23.4	12	100%		23	Basin	B	
South	F32.5	18	100%		32	2	A	
South	F50.1	2	100%		50	2		
South	F50.2	28.67	33.33%		50	Basin		
South	F52.4	68	100%		52	Basin		
South	F53.3	18	100%		53	Basin	8	
South	F55.8	14.5	100%		55	9		

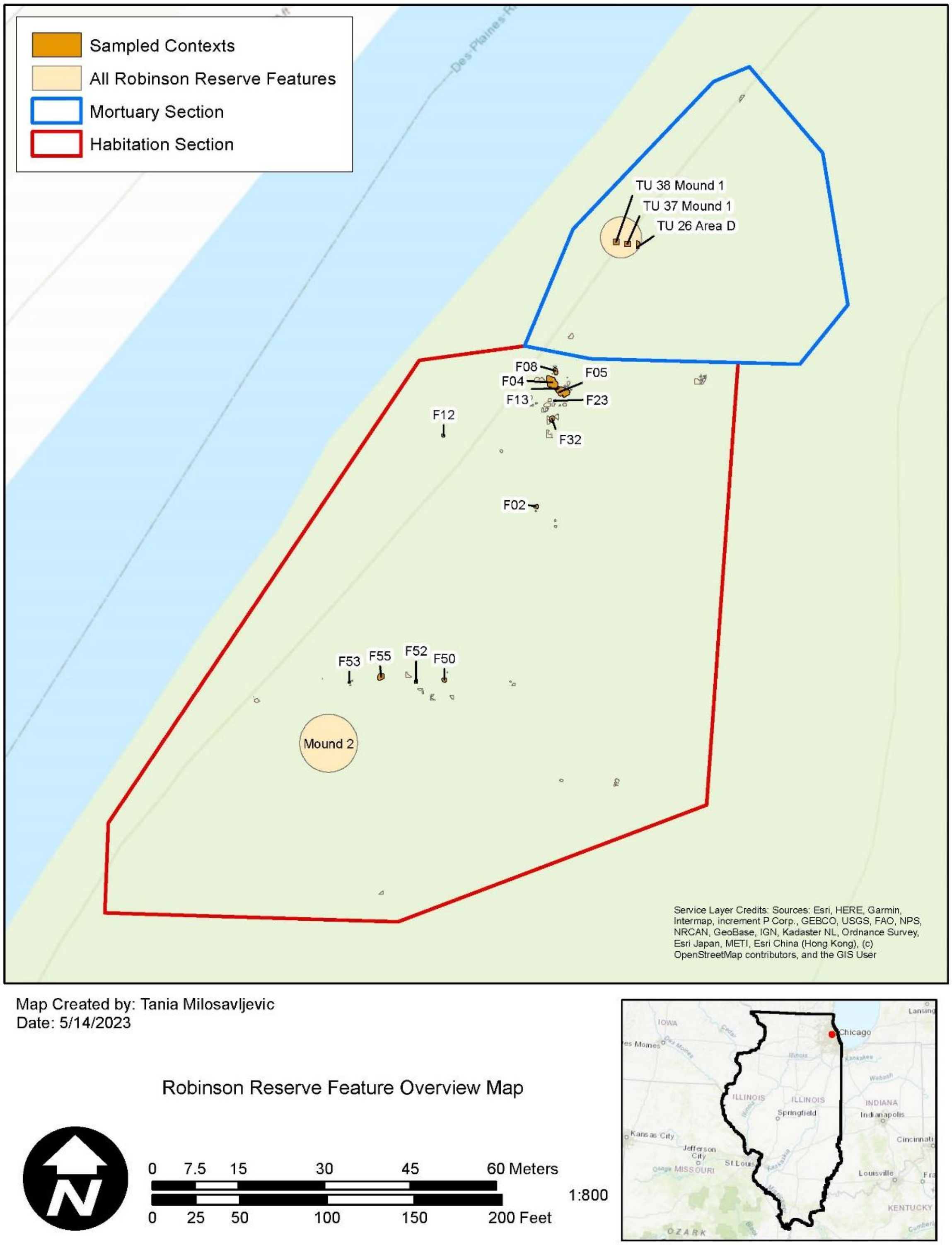

Figure 3.1. Overview of Robinson Reserve Sections and Features

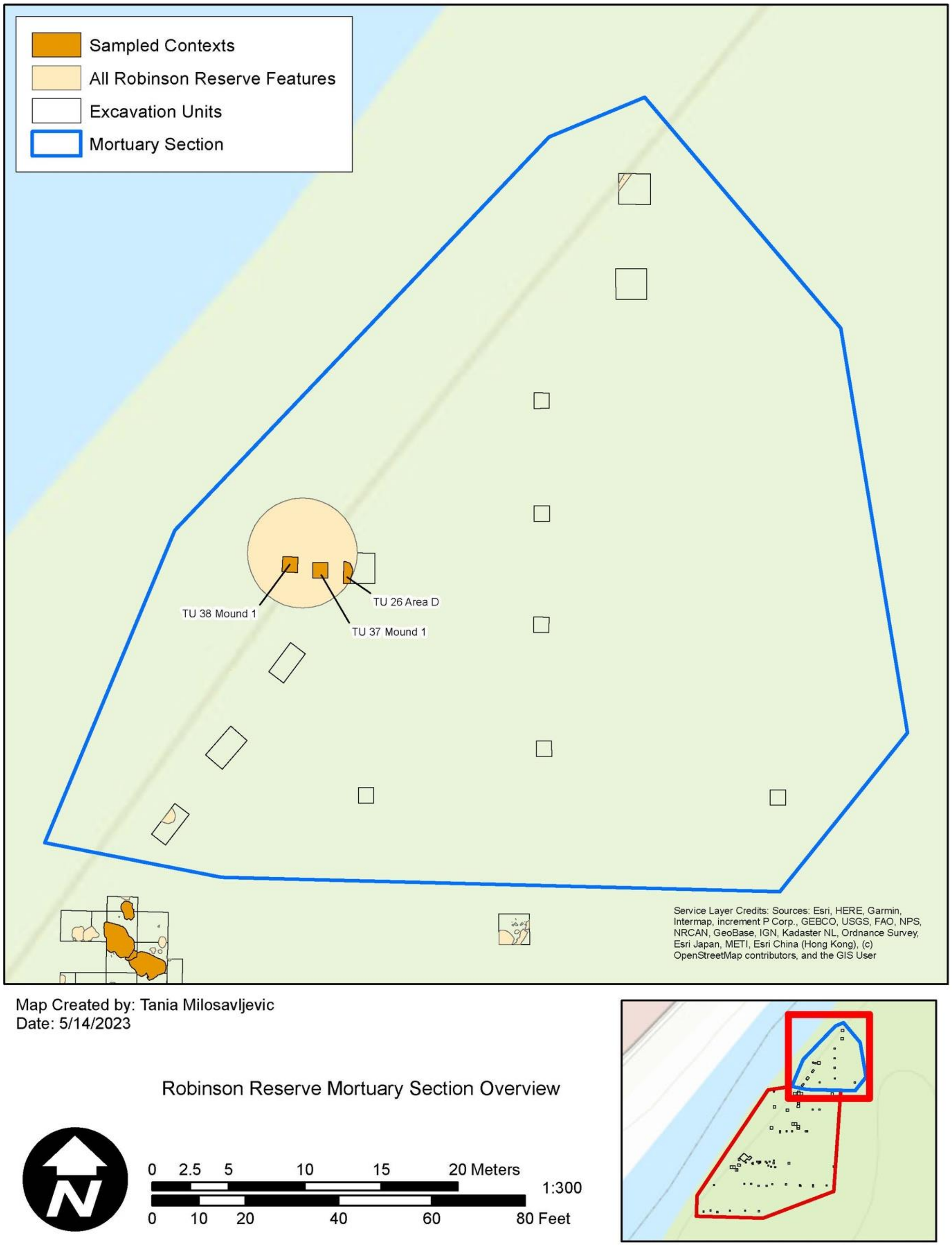

Figure 3.2. Mortuary Section of Robinson Reserve

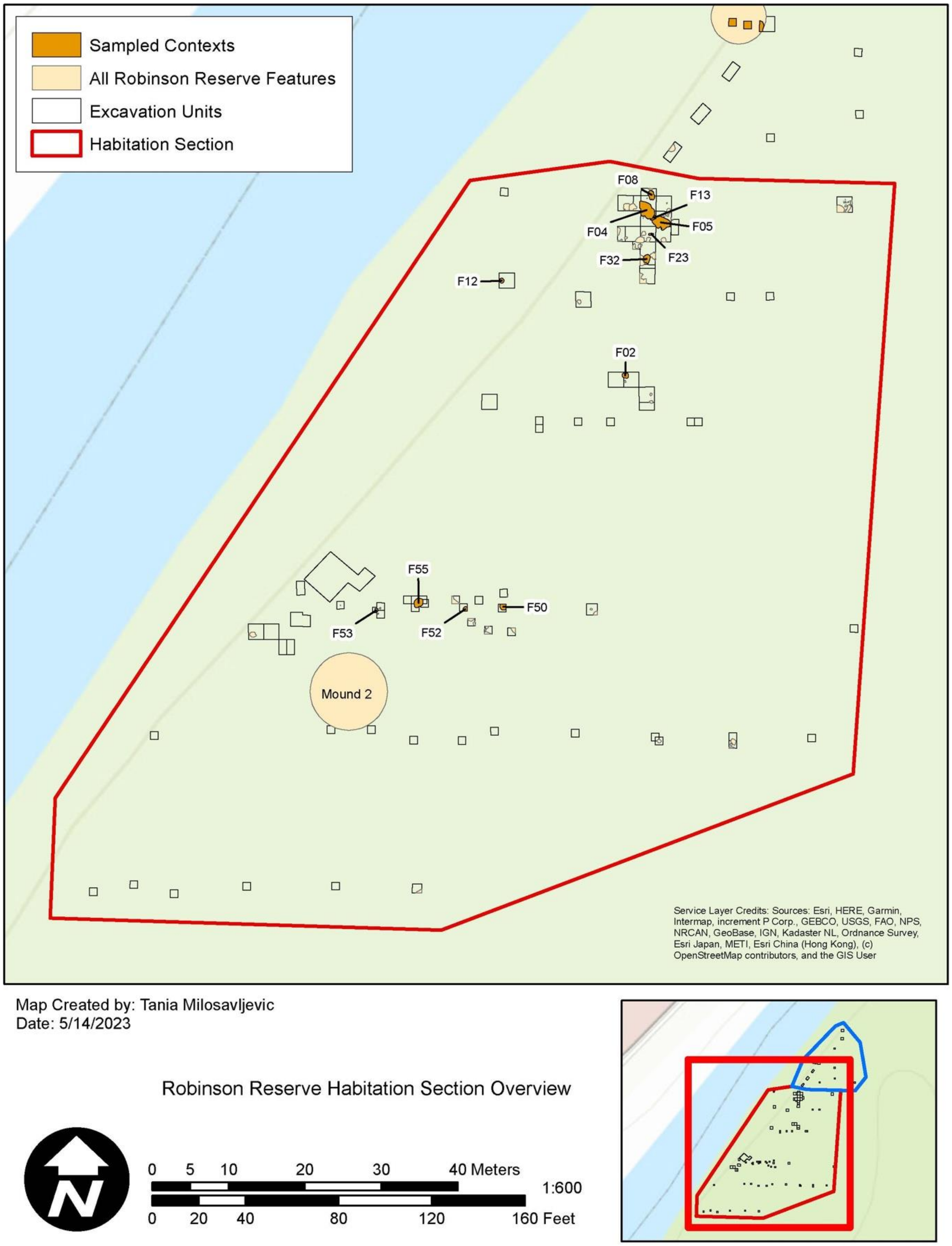

Figure 3.3. Habitation Section of Robinson Reserve

Research Expectations

As discussed in the first chapter, if behavior displays adaptive design, then we should be able to generate expectations about what that looks like in the archaeological record. Applications of HBE provide significant insights in the field of archaeology. It can be used to address major research questions such as subsistence, lifeways, social organization, and their respective impacts on the archaeological record (Bird and O'Connell 2006). Similarly, the integration of HBE in paleoethnobotany has contributed to many advances in longstanding research themes such as "hunting and gathering, transitions to agriculture, agricultural risk management, and settlement location" (Marston et al. 2014:8).

In past research, the theoretical core of HBE models were often founded in microeconomic principles such as optimization, efficiency maximization, and risk minimization (Bird and O'Connell 2006; Smith and Winterhalder 1992; Winterhalder and Goland 1997). These principles provide functional frameworks for hypotheses which concentrate on fitness implications of behavior. Typically, functional explanations identify potential courses of action, asses fitness-related trade-offs, and overall hypothesize on which behavioral pattern is most likely to be adopted under the various stipulated constraints and for what reasons (Bird and O'Connell 2006:145).

Caveats of HBE

Although the employment of HBE models is useful as a foundation for various hypotheses, some archaeologists approach it with skepticism. Some believe HBE models force interpretations to reflect economic rationale. In scholarly debate, HBE is often equated to genetic determinism, dehumanization, and an overall denial of agency (Gremillion 2014:341).

While functional and adaptive explanations are useful in understanding patterns in human prehistory, they should not be conflated with any specific model (Marston et al. 2014: 341). According to Bird and O' Connell, "BE models are not designed to specify a mode of inheritance; instead, they are tools that help formulate testable hypotheses about the potential fitness-related tradeoffs individuals may face in particular socio-ecological contexts" (2006:144).

This thesis uses a human behavioral ecology theoretical perspective to hypothesize on the variation of floral assemblages within a mortuary site, and between a mortuary site and a village site. If site types reflect site function, theoretically this can be seen through the assemblage. What we see in an assemblage is the result of competing adaptive mechanisms within a cultural system (Jeske 1987). Through functional explanations, we can hypothesize which behavioral patterns are the most likely outcome.

A set of theoretical expectations were developed based on previous analyses of Langford patterns and site function (Jeske 1987; McTavish 2019; Styles and Purdue 1991). The theoretical expectations will be used for intrasite and intersite analysis. Robinson Reserve is a mortuary site with mound and habitation components. For this thesis, the north portion of Robinson Reserve will be compared to the mound expectations in Table 3.2. To better understand the extent of occupation at Robinson Reserve, the south section will be compared to the mortuary camp and habitation expectations. Washington Irving's botanical assemblage will be compared to the habitation expectations.

Table 3.2. Site-Type Expectations (Styles and Purdue 1991)

Site Type	**Density (Food)**	**Diversity**	**Unusual/Non-local species**
Mortuary (mound)	Low	Variable	High
Mortuary Camp	Intermediate?	Low	Intermediate?
Habitation/Village	High	High	Low

Mortuary (mound)

Activities at mortuary sites revolve around mound building, burial/internment, ancestor veneration, and feeding those performing the mortuary activities (McTavish 2019; Styles and Purdue 1991). Mound assemblages are specifically associated with burial/internment and ancestor veneration. We should expect burials to consist of burial furnishings, items of personal adornment, and other material grave goods. Food offerings could be present; however, food density should be lower than what we see at mortuary camps and habitations. Cultural aspects of identity likely outweigh economic efficiency. Like other grave goods, floral and faunal assemblages can convey insight on social identity and prestige (Styles and Purdue 1991). Because of this, diversity of plant taxa could be variable. Along the same vein, mound assemblages will likely have a higher amount of “exotic” or nonlocal species.

Mortuary Camp

Due to short-term habitation, there would be little food procurement, processing and storing at camps (Styles and Purdue 1991). To save time and energy, food likely would have been transported from other nearby sites. Mortuary rituals might include ancestor veneration and feasting. Subsistence choices can be a mixture of energy efficiency and cultural tradition. We should expect intermediate food density. This would also be reflected by low diversity of taxa in the botanical assemblage. Although Robinson Reserve has mortuary components, not all activities performed at the site are mortuary. For example, there would be activities related to the maintenance of the participants engaged in this work (Styles and Purdue 1991). Because of the duality of Robinson Reserve, we should expect an intermediate number of unusual/nonlocal species.

Habitation/Village

Langford village sites are generally long-term continuous occupations. Long-term occupations for longer periods of time likely see a wider array of activities. We should expect village sites to have higher densities of food refuse and higher diversity. Although it is difficult to categorize all village sites, there are likely fewer ceremonial activities. Activities regarding home maintenance, food procurement, processing, and storage would be the most common. With this in mind, we should expect a low number of unusual and non-local plant species.

CHAPTER 4: RESULTS AND ANALYSIS

In this chapter I discuss the results of the plant macroremain analysis from Robinson Reserve. The first part of this chapter provides an overview of the macrobotanical assemblage. These results address the first research question: What is the nature of the floral assemblage at Robinson Reserve? The second part of this chapter provides an intrasite analysis, comparing plant remains recovered between the northern and southern sections of the site. The use of intrasite comparison addresses the second research question: Does the floral assemblage at Robinson Reserve provide insight on spatial patterning indicative of site function?

Results of Robinson Reserve Paleoethnobotanical Analysis

A total of 25 flotation samples were chosen for analysis. These flotation samples come from 25 contexts across both site sections, totaling about 725 L (Table 4.1). A total of 23,321 fragments of charred plant macro remains, weighing a total of 283.63 g were recovered from the chosen samples (Table 4.2). The charred plant material includes wood and bark charcoal, plant remains (nuts, seeds, maize, squash rind), and other charred materials (fungus, resin, rhizome, stem, and unidentifiable material) (Table 4.3). The Robinson Reserve plant macro remain assemblage has at least 29 plant taxa. This includes nuts, maize, squash rind, cultigens, fruit seeds, and other wild seeds (cultigens/grains, fruit, and other) (Table 4.4).

Table 4.1. Summary Data for the Flotation Samples by Site Section

Site Section	# of Samples	# of Contexts	Total Liters (Analyzed)
North (Mound)	10	10	208
South (Habitation)	15	15	516.82
Total	**25**	**25**	**724.82**

Table 4.2. Summary of the Plant Macroremain Data

Description	Count	Weight(g)
Wood and Bark Charcoal	19,498	263.96
Plant Remains (Non-Wood)	2,824	13.94
Other	999	5.74
Grand Total	**23,321**	**283.63**

Table 4.3. Other Plant Macroremain Data

Description	Count	Weight (g)
Fungus	536	3.01
cf. Resin	4	0.039
Rhizome	11	0.092
Stem	53	0.542
Unidentifiable	395	2.057
Subtotal	**999**	**5.74**

Table 4.4. Common and Taxonomic Names of Plants Identified in the Robinson Reserve Plant Macroremain Assemblage

Taxa	Common Name
Nuts	
Carya sp.	Hickory
Corylus sp.	Hazelnut
Juglandaceae	Walnut Family
Quercus sp.	Acorn
Grains, Greens & Oil Seeds	
Amaranthus sp.	Pigweed, Waterhemp
Chenopodium sp.	Chenopod
Hordeum pusillum	Little Barley
Iva sp.	Sumpweed
Polygonum sp.	Knotweed
Fruit Seeds	
Crataegus sp.	Hawthorn
Myrica sp.	Bayberry
Rosaceae	Rose (family)
Rubus sp.	Blackberry/Raspberry
Vitaceae	Grape (family)
Vaccinium sp.	Blueberry
Other Seeds	
Asteraceae	Composite (family)
Brassicaceae	Mustard (family)
Fabaceae	Bean (family)
Galium sp.	Bedstraw
Poaceae	Grass (family)
Portulaca sp.	Purslane
Scirpus sp.	Bulrush
Urticaceae	Nettle (family)
Squash/Cucurbit	
Curcurbita sp.	Squash Rind
Maize	
Zea mays	Maize

Note: List of plant taxa includes both food and non-food plants. It is indeterminate whether the cultigen and grain seeds are domesticated or wild.

Wood and Bark Charcoal

Wood and Bark charcoal are charcoal are the most abundant and ubiquitous categories site-wide (Table 4.5). Wood and bark charcoal were found in all sample contexts across the site. Charcoal had an overall density of 269ct./10L (Table 4.5). A five percent sample (n=723) of the wood charcoal was selected for further analysis. Of the 723 analyzed fragments, 70.68 percent (n=511) were not identifiable to family and 22.13 percent (n=160) were identified as ring porous (UID RP).

A total of three families of wood were identified at the site: *Fagaceae, Oleaceae*, and *Ulmaceae*. Of the three families, four genera were identified including two from *Fagaceae* (*Fagus* or beech, and *Quercus* or oak/acorn), one from Oleaceae (*Fraxinus* or ash), and one from *Ulmaceae* (*Ulmus* or elm). Of the four identified genera of wood species, elm was the most abundant (n=135), found in 40% of contexts with the highest density of 1.86ct./10L (Table 4.5). Oak was the second most abundant genera, found in 28% of contexts, with a density of 0.66ct./10L (Table 4.5). This is followed by beech (n=28) which had a lower ubiquity of 12% and lower density of 0.39ct./10L (Table 4.5). Ash had the lowest abundance (n=1) with 4% ubiquity and density of 0.01ct/10L (Table 4.5).

Table 4.5. Wood and Bark Charcoal Data

Description	**Total**			**Density (d)**		**Percentages**	
Wood Charcoal	**Count**	**Weight (g)**	**Ubiquity**	**Density (d) Count**	**Density (d) Weight**	**% Count ****	**% Weight****
cf. Beech (*Fagus* sp.)	28	1.00	0.12	0.39	0.01	0.14 (3.87)	0.34 (3.00)
cf. Ash (*Fraxinus* sp.)	1	0.07	0.04	0.01	<0.01	<0.01 (0.14)	0.03 (0.21)
Oak (*Quercus* sp.)	48	3.83	0.28	0.66	0.05	0.25 (6.64)	1.45 (11.5)
cf. Elm (*Ulmus* sp.)	135	15.49	0.4	1.86	0.21	0.69 (18.67)	5.89 (46.5)
UID DP	29	1.08	0.28	0.40	0.01	0.15 (4.01)	0.41 (3.24)
UID RP	160	5.24	0.64	2.21	0.07	0.82 (22.13)	1.99 (15.73)
UID Conifer	7	0.27	0.12	0.10	<0.01	0.04 (0.99)	0.1 (0.81)
UID	315	6.34	0.88	4.35	0.09	1.62 (43.57)	2.4 (19.03)
Bark Charcoal*	5396	99.39	0.72	74.45	1.37	27.67	37.65
Wood Charcoal*	13,379	131.25	0.76	184.58	1.81	68.62	49.72
Subtotal	**19498**	**263.96**	**0.92**	**269.01**	**3.64**	**100**	**100**

Note: UID= Unidentified; RP= Ring Porous; DP= Diffuse Porous

Percentages include bark charcoal

*Wood and bark charcoal not chosen for analysis

** % of Taxa w/ wood and bark charcoal not analyzed (% of Taxa w/o wood and bark charcoal not analyzed (Ct=723, Wt.=33.31g))

Nutshell

Of the non-wood plant categories, nuts are the most abundant (n=732) and with a site-wide ubiquity of 80% (Table 4.6). Nutshell also has a moderately high density (10.0ct./10L) compared to the other plant types (Table 4.6). Three families of nutshell were identified including the walnut family (Juglandaceae), beech family (Fagaceae), and birch family (Betulaceae) (Table 4.7).

Table 4.6. Site-Wide Abundance, Ubiquity (*U*), and Density (*d*) by Plant Taxa

Plant Taxa	Total		Ubiquity (*U*)		Density (*d*)	
	Count	Weight	# of contexts	*U*	(*d*) (count/10L)	(*d*) (g/10L)
Wood and Bark Charcoal	19498	263.96	25	1.00	269.00	3.64
Nut	732	10.57	20	0.80	10.10	0.15
Seed	1483	--	25	1.00	20.46	--
Cucurbit	5	0.02	2	0.08	0.07	<0.01
Maize	604	3.35	20	0.80	8.33	0.05

Table 4.7. Nutshell at Robinson Reserve

Nut Taxa	Total		Density		Ubiquity	Percentage (count)
	Count	Weight	(count/10L)	(g/10L)		
Hickory (*Carya* sp.)	297	5.75	4.10	0.08	0.56	40.57
Hazelnut (*Corylus* sp.)	37	0.55	0.51	0.01	0.40	5.04
Walnut family (Juglandaceae)	20	1.60	0.28	0.02	0.20	2.73
Acorn (*Quercus* sp.)	212	1.14	2.92	0.02	0.40	28.96
Unidentified Nutshell	166	1.52	2.29	0.02	0.60	22.68
Total	**732**	**10.57**	**10.10**	**0.15**	**0.80**	**100**

Three genera of nutshell were identified including hickory (*Carya* sp.), oak/acorn (*Quercus* sp.) and hazelnut (*Corylus* sp.) (Table 4.7). Hazelnut (*Corylus* sp.) is likely *Corylus americana* per Egan (1985). Unidentifiable nutmeat/nutshell fragments are also present in the assemblage (*U*=60%) (Table 4.7). Of the nut taxa, hickory was the most abundant (n=297) found in 56% of contexts, with the highest of densities (4.1ct/10L), accounting for about 41% of the nut assemblage (Table 4.7). Acorn was the second most abundant nut taxa (n=212) found in 40% of contexts with the second highest density (2.92ct./10L), accounting for about 29% of the nut assemblage. Acorn is followed by hazelnut (n=37) found in 40% of contexts with a lower density (0.51ct./10L) with a relative frequency of about 5%. Some nutshell was only identifiable to the walnut family (Juglandaceae). This taxon was the least abundant (n=20), found in 20% of contexts, with the lowest density (0.28ct./10L). Both Juglandaceae and hazelnut make up 5% of the nutshell assemblage. It is possible that the identified acorn (Quercus sp.) in the Robinson Reserve nut assemblage is *Corylus sp*. or pecan (*Carya illinoiensis*).

Maize (Zea mays)

Maize (*Zea mays*) is one of two plant foods that compose the domesticate category of non-wood pant foods (Table 4.6). Maize has a high site-wide ubiquity (*U*=80%), with an overall density of 8.33ct./10L (Table 4.8). Maize is high in abundance (n=604), and is separated into kernel, cupule, glume, cupule/glume, and unidentifiable fragments (Table 4.8). Kernel fragments were among the most abundant (n=189), with the highest ubiquity (*U*=72%), and the second highest density (2.61ct./10L). Comparatively, maize cupules had a higher abundance (n=223), found in 56% of contexts, with the highest density (3.08ct./10L). However, maize kernels and cupules have the same density by weight (0.02g/10L) (Table 4.8). Maize glumes had the lowest abundance (n=18), ubiquity (*U*=28%), and density (0.25ct./10L). This is to be expected as maize glumes are the least likely to preserve due to their fragility. Maize fragments were also split categorized into cupule/glume fragments, which had a moderate abundance, lower ubiquity (*U*=36%), density, and frequency (Table 4.8). Charred fragments that were likely maize yet unidentifiable were categorized under cf. Maize UNID. Due to the fragmentary nature of most of the assemblage, it is unsurprising that this category had a higher abundance, lower ubiquity, and higher density. Kernel: Cupule ratios were calculated for the entire site (Table 4.9). Overall, the ratio (e=0.61) along with absolute counts of kernels and cupule (Table 4.9) indicates a higher level of maize consumption to maize processing.

Table 4.8. Maize (*Zea mays*) at Robinson Reserve

Description	Total		Density		Ubiquity	Percentage (count)
	Ct.	Wt.	(count/10L)	(g/10L)		
Maize (*Zea mays*) kernel	189	1.41	2.61	0.02	0.72	31.29
Maize (*Zea mays*) cupule	223	1.26	3.08	0.02	0.56	36.92
Maize (*Zea mays*) glume	18	0.05	0.25	<0.01	0.28	2.98
Maize (*Zea mays*) cupule/glume	71	0.35	0.98	<0.01	0.36	11.75
cf. Maize (Zea mays) Unidentifiable	103	0.29	1.42	<0.01	0.52	17.05
Total	**604**	**3.35**	**8.33**	**0.05**	**0.80**	**100**

Table 4.9. Robinson Reserve Kernel to Cupule Ratio

Description	**Total**		**Percent**		**Kernel: cupule ratio (e)**
	Count	Weight (g)	Count	Weight(g)	
Cob/Cupule	312	1.65	62.28	53.92	
Kernel	189	1.41	37.72	46.08	
Total	**501**	**3.06**	**100**	**100**	0.61

*Maize totals do not include unidentified cf. *Zea mays* (n=103). Glume, Cupule/glume included in Cob/Cupule counts.

Squash (Cucurbita sp.*)*

Squash rind (*Cucurbita* sp.) fragments are the second plant food within the domesticate category. Squash rind fragments had a very low abundance (n=5), found in 8% of contexts site-wide, with a low density (<0.01ct./10L) (Table 4.10).

Table 4.10. Summary of Squash/Cucurbit *(Cucurbita sp.)* Data

Description	Count	Weight(g)	Ubiquity	Density (d) Count	Density (d) Weight
Squash (*Cucurbita sp*.) rind	5	0.02	0.08	0.07	<0.01

Cultigen and Grain Seeds

Cultigen and grain seeds include starchy and oily seeds: pigweed *(Amaranthus* sp.), goosefoot or chenopod *(Chenopodium* sp.), little barley (*Hordeum pusillum* sp.), sumpweed (*Iva* sp.), and knotweed (*Polygonum* sp.). Overall, cultigen seeds had a high abundance (n=514), showing up in 56% of contexts site-wide. Cultigen seeds account for about 35% of the total seed assemblage at Robinson Reserve (Table 4.11). Knotweed *(Polygonum* sp.) had the highest abundance by count (n=414), showing up in 68% of contexts, with the highest seed density (5.7ct./10L), accounting for 27% of the total seed assemblage. A photo of this taxon can be found in Appendix E. Goosefoot (*Chenopodium* sp.) (n=49), and little barley (cf. *Hordeum pusillum*) (n=40) both show up in 24% of contexts site-wide (Table 4.11). Goosefoot has a slightly higher density than little barley, however each taxon account for roughly 3% of the assemblage. Amaranth (n=10) and sumpweed (n=1) had the lowest abundance of all cultigen seeds, both showing up in 4% of site-wide contexts.

Table 4.11. Cultigen and Grain Seeds from Robinson Reserve

Description	Total (count)	Density (count/10L)	Ubiquity	Percentage (count)
Amaranthus sp. (Amaranth)	10	0.1	0.04	0.7
Chenopodium sp. (Goosefoot)	49	0.7	0.24	3.3
cf. *Hordeum pusillum* (Little Barley)	40	0.6	0.24	2.7
cf. *Iva sp.* (Sumpweed)	1	<0.01	0.04	0.1
Polygonum sp. (Knotweed)	414	5.7	0.68	27.9
Totals	**514**	**7.1**	**0.72**	**34.7%**

Fruit Seeds

The second group of seeds present in the seed assemblage at Robinson reserve includes fruit seeds. There are a total of six species identified: hawthorn (*Crataegus* sp.), bayberry (cf. *Myrica* sp.), rose family (Rosaceae), blackberry/strawberry (*Rubus* sp.), grape family (Vitaceae), and blueberry (*Vaccinium* sp.) (Table 4.12). Overall fruit seeds had a lower abundance (n=107), showing up in 56% of contexts site-wide, with a lower density (1.48ct./10L), accounting for 7% of the seed assemblage (Table 4.12). Blueberry seeds had the highest abundance by count (n=51), showing up in 48% of contexts site-wide, with the highest density (0.7ct./10L) out of all fruit seed taxa. Bayberry seed/nutlet fragments had the second highest abundance (n=28), with a lower ubiquity (*U*=20%), and higher density (0.39ct./10L). It is important to note seed/nutlet fragments were included in bayberry counts, and likely skews the data when looking solely at absolute counts. Blackberry/raspberry (*Rubus* sp.) seeds have a total of 18 seeds, showing up in 32% of contexts, with a lower density (0.25ct/10L). Hawthorn (*Crataegus* sp.) seed fragments ranked fourth in abundance (n=7), were present in 12% of contexts, with a low density (0.1ct/10L). Rose family (Rosaceae) and grape family (Vitaceae) had the lowest abundance and densities of all fruit seeds (Table 4.12). Both seed families show up in 4% of site contexts (Table 4.12).

Table 4.12. Fruit Seeds from Robinson Reserve

Description	Total (count)	Density (count/10L)	Ubiquity	Percentage (count)
Crataegus sp. (Hawthorn)	7	0.1	0.12	0.5
Myrica sp. (Bayberry)	28	0.39	0.2	1.9
Rosaceae (Rose family)	2	0.03	0.04	0.1
Rubus sp. (Blackberry/Raspberry)	18	0.25	0.32	1.2
Vaccinium sp. (Blueberry)	51	0.7	0.48	3.4
Vitaceae (Grape family)	1	0.01	0.04	0.1
Totals	**107**	**1.48**	**0.56**	**7.2%**

Other Seeds

Seeds that did not fit into cultigen, grain, or fruit categories were placed into "other". Overall, seeds in this category account for over half of the seed assemblage at Robinson Reserve, with the highest abundance (n=862) including all unidentified seed fragments (Table 4.13). Seeds in this category show up in the most contexts (*U*=96%) and the highest density (12ct./10L). This third seed category had a total of eight species: composite family (Asteraceae), mustard family (Brassicaceae), bean family (Fabaceae), bedstraw (*Galium* sp.), grass family (Poaceae), purslane (*Portulaca* sp.), bullrush (*Scirpus* sp.), and nettle family (cf. Urticaceae) (Table 4.13). Seeds that could not be identified were placed under unidentified. Seeds belonging to the grass family (Poaceae) had the highest abundance (n=467), ubiquity (*U*=72%), and density (6.4ct./10L). Composite family (Asteraceae) seeds or asters ranked second in abundance (n=64), with a much lower ubiquity (*U*=24%) and density (0.9ct./10L). Photos of the Asteraceae and Poaceae (cf. *Hordeum* sp.) taxa can be found in Appendix E. Bullrush (*Scirpus* sp.) ranked third in abundance (n=34), with moderate ubiquity (*U*=36%), and low density (0.5ct./10L). Bedstraw (*Galium* sp.) ranked fourth in abundance (n=7), found in 20% of contexts, with low density as well (Table 4.13). Seeds with the lowest abundance include purslane (*Portulaca* sp.), bean family (Fabaceae), nettle family (cf. Urticaceae), and mustard family (Brassicaceae). Low abundance indicates these taxa likely were seed rain or brought in accidentally.

Table 4.13 Other Seeds from Robinson Reserve

Description	Total (count)	Density (count/10L)	Ubiquity	Percentage (count)
Asteraceae (Composite family)	64	0.9	0.24	4.3
Brassicaceae (Mustard family)	1	0.01	0.04	0.1
Fabaceae (Bean/Legume family)	2	0.03	0.08	0.1
Galium sp. (Bedstraw)	7	0.1	0.02	0.5
Poaceae (Grass family)	467	6.4	0.72	31.5
Portulaca sp. (Purslane)	3	0.04	0.04	0.2
Scirpus sp. (Bullrush)	34	0.5	0.36	2.3
cf. Urticaceae (Nettle family)	2	0.03	0.04	0.1
Unidentified	282	3.9	0.8	19
Totals	**862**	**11.9**	**0.96**	**58%**

Robinson Reserve Summary

Robinson Reserve and Langford Subsistence

Robinson Reserve's macrobotanical assemblage both aligns and varies compared to previously observed patterns of Langford subsistence. In general, subsistence patterns at Langford sites exhibit a mixed subsistence economy of hunting and gathering wild plant foods, with a stable supplement of maize agriculture. Wild plant foods consist mainly of nutshell, with very little starchy grains or EAC crops (Egan 1985; Emerson et al. 2005; Jeske 2000; Jeske and Hart 1988). Floral data generally show a lack of EAC crops in Langford subsistence (Egan 1985; Egan-Bruhy 2014; Emerson et al. 2005: 86; Jeske 2000, 2002). For example, at LaSalle County Farm,"cultigens such as maygrass, little barley, chenopod, or iva are absent from the assemblage…" (Jeske 2002:114). There are a few (n<10) seeds of wild goosefoot (*Chenopodium* sp.), knotweed (*Polygonum* sp.) and little barley (*Hordeum pusillum*) at Langford sites such as

Washington Irving, Reeves, and Keeshin Farms while other starchy cultigens such as maygrass are absent (Emerson et al 2005:86).

A previous floral analysis from Robinson Reserve reported 258 wild chenopodium seeds in addition to polygonum (Redmer 1989). Cultigen and grain seeds accounted for 35% of the seed assemblage in the current analysis, mainly due to the high abundance of knotweed (*Polygonum* sp.) followed by much lower amounts of goosefoot (*Chenopodium* sp.), little barley (cf. *Hordeum pusillum*), and sumpweed (*Iva* sp.). It is indeterminate whether these taxa are domesticated or wild.

Like other Langford sites, wild plant foods such as nutshell are present in abundance. Hickory (*Carya* sp.) was the most abundant and ubiquitous, followed by a moderate amount of acorn (*Quercus* sp.) and hazelnut (*Corylus* sp.). Although black walnut (*Juglans nigra*) and pecan (*Carya illinoinensis*) were not identified, they are likely present in the nut assemblage. Similar to previous Langford subsistence traits, maize at Robinson Reserve is ubiquitous (U=80%), however found in relatively low densities. Squash is also present, however there are very minimal (n=5) fragments. This is likely due to poor preservation, thus its economic importance at the site is ambiguous.

Other wild plant taxa are present at Robinson Reserve. The "other" seed category accounted for about 40% of the seed assemblage. Seeds from the grass family (Poaceae) were the most abundant in this category, similar in abundance with knotweed. Although most of the grass seeds were poorly preserved, some of them were identified as little barley (cf. *Hordeum pusillum*). An unidentified genus of aster seeds within the composite family (Asteraceae) are also present in the "other" seeds category.

Fruit seeds only accounted for about 7% of the seed assemblage, with generally low abundance, ubiquity, and density. Of the fruit seeds, blueberry (*Vaccinium* sp.) was the most abundant, followed by mulberry (cf. *Myrica* sp.), blackberry/raspberry (*Rubus* sp.), hawthorn (*Crataegus* sp.), rose family (Rosaceae*)*, and grape family (Vitaceae).

Intrasite Analysis

To identify and describe differences between mortuary and non-mortuary contexts at Robinson Reserve, a variety of measures such as ubiquity, density, plant food ratio, kernel: cupule ratios, diversity indices, and statistical data will be used. A description of the results will be broken down by major plant categories such as wood, nuts, maize, cucurbit, and seeds.

Wood and Bark Charcoal

Site-wide wood and bark charcoal were ubiquitous and were the most abundant plant macroremain in the assemblage. However, there were spatial differences in charcoal density; the southern section had a substantially higher density (311.48ct./10L) than the northern section (163.46ct./10L) (Table 4.14). Translating this to site function and contexts, charcoal density in the habitation area was higher than the northern mound/mortuary context.

Nutshell

Nutshell ubiquity is moderately high to very high for both sections (Table 4.14). The north section had a lower ubiquity of 70%, whereas the south was higher with 93% ubiquity (Table 4.14). Nutshell density between both sections is essentially the same with 10.34ct./10L in the north and 10ct./10L in the south. Density by weight is also similar, however slightly higher in the south (0.17g/10L). Conversely, plant food ratios indicate nutshell had a higher significance in the north (q=71.43) versus the south (q=47.30) (Table 4.15). Although values differ between the site sections, Mann Whitney U results for nuts indicate the distribution of nutshell densities between the north and south sections are not statistically distinct (U=36 p=0.86).

Table 4.14. Ubiquity and Density of Plant Taxa by Section of Site

Section (Total Liters)	Plant Taxa	Ubiquity	Density	
			(count/10L)	(g/10L)
North (208 L)				
	Wood and Bark Charcoal	1.00	163.46	1.59
	Nutshell	0.7	10.34	0.09
	Seed	1.00	6.44	--
	Cucurbit	0.00	0.00	0.00
	Maize	0.6	11.88	0.06
South (516.82 L)				
	Wood and Bark Charcoal	1.00	311.48	4.47
	Nutshell	0.93	10.00	0.17
	Seed	1.00	26.10	--
	Cucurbit	0.13	0.10	<0.01
	Maize	0.93	6.91	0.04

Table 4.15. Plant Food (*q*) Ratios by Section of Site

Description	North	South
Nut	71.43	47.30
Maize	82.06	32.66
Cucurbit	0.00	0.46
Cultigen and Grain Seeds	10.96	44.01
Fruit Seeds	8.97	7.32
Other Seeds	24.58	72.10

North total plant weight (g): 3.01 g
South total plant weight (g): 10.93 g

Maize (Zea mays)

Maize has a higher ubiquity in the south section (*U*=93%) versus the north (*U*=60%) (Table 4.14). Maize has a substantially higher density in the north (11.88ct./10L) compared to the south (6.91ct./10L), however, densities are roughly the same by weight (0.06g/10L versus 0.04g/10L). Interestingly, plant food ratios indicate maize is much more significant in the north (*q*=82.06) versus the south (*q*=32.66) (Table 4.15). Mann Whitney U results indicate the distribution of maize densities between the north and south sections are not statistically significant or distinct from one another (U=16 p=0.09). The lack of significance likely has to do with the small sample size. Although the north and south sections are not statistically different, data trends suggest higher ubiquity and density in the south section.

These data provide insight on the presence and intensity of maize throughout and within the site, however they do not address site activities. The kernel:cupule ratio is a measure of the degree of maize consumption versus processing (Scarry and Steponaitis 1997; VanDerwarker 2003). Kernel:cupule ratios were calculated for both site sections (Table 4.16). The south section had a much higher ratio (e=1.20) than the north (e=0.23), which suggests high levels of maize processing in the north section of the site. Conversely, the higher kernel:cupule ratio in the south indicates higher maize consumption compared to the north.

Table 4.16. Maize (Zea mays) Kernels and Cupules

Section	Maize Kernels	Maize Cob/Cupules	Kernel:Cupule Ratio (e)
North	31	137	0.23
South	172	143	1.20

Squash (Cucurbita sp.)

Squash had low ubiquity and density between the two site sections (Table 4.14). Squash rind was absent in the north section entirely, whereas it had low ubiquity (*U*=13%) and density

(0.10ct./10L) in the south. Although plant food ratios could not be calculated in the north section, the south section had a very low ratio (*q*=0.46) compared to the other plant types (Table 4.15). Recognizing the poor preservation of squash rind, the ratio indicates that squash is not very significant at the site.

Seeds

Overall, seeds have 100% ubiquity in both north and south sections (Table 4.14). The south section has a higher density (26.10ct./10L) compared to the north (6.44ct./10L). Plant food ratios were calculated for each section and show the relative importance of specific seed types relative to one another (Table 4.15). In the north section, plant food ratios indicate the "other seeds" category was the most significant (*q*=24.58) compared to cultigen and grain seeds (*q*=10.96) and fruit seeds (*q*=8.97) (Table 4.15). It is important to note unidentified/unidentifiable seeds conflate the importance of the "other" seed category. In the south section, plant food ratios indicate the "other seeds" category is also the most significant (*q*=72.10) compared to cultigen and grain seeds (*q*=44.01) and fruit seeds (*q*=7.32).

Comparing both sections, cultigen and grain seeds were much more significant in the south than the north (Table 4.15). Fruit seeds have roughly the same significance compared to other categories within each section even though the north has a slightly higher ratio (*q*=8.97) than the south (*q*=7.32). The other seed category is substantially more significant in the south than the north (Table 4.15).

Diversity

The Shannon-Weaver index for richness (N of taxa), diversity (H'), and equitability (V) were calculated for both site sections, and Robinson Reserve as a whole (Table 4.17). Richness was the same between both site sections (S=19). In terms of evenness or equitability, the south section had a higher distribution of taxa (V’=0.69) than the north (V’=0.57) (Table 4.17). The diversity index indicates the south section had a higher diversity.

The Simpson’s diversity index was also utilized for the intrasite portion of this thesis. Tables 4.18 compares the Shannon-Weaver and Simpson’s diversity indices. The Simpson’s index data align with Shannon-Weaver data. The south section has higher diversity (0.83) than the north section (0.70). We expect more diversity with higher number of plant macroremains (N). Sample size bias impacts the diversity results.

Table 4.17. Shannon-Weaver Diversity Indices by Site Section

	Description	North	South	Site Totals
Nuts	*Carya* sp.	6	291	**297**
	Corylus sp.	19	18	**37**
	Juglandaceae	4	16	**20**
	Quercus sp.	152	60	**212**
Seeds	*Amaranthus* sp.	10	0	**10**
	Chenopodium sp.	10	39	**49**
	Hordeum sp.	0	40	**40**
	Sumpweed sp.	1	0	**1**
	Polygonum sp.	12	402	**414**
	Crataegus sp.	4	3	**7**
	Myrica sp.	0	28	**28**
	Rosaceae	0	2	**2**
	Rubus sp.	4	14	**18**
	Vitaceaea	1	0	**1**
	Vaccinium sp.	18	33	**51**
	Asteraceae	0	64	**64**
	Brassicaceae	0	1	**1**
	Fabaceae	2	0	**2**
	Galium sp.	2	5	**7**
	Poaceae	14	453	**467**
	Portulaca sp.	3	0	**3**
	Scirpus sp.	20	14	**34**
	Urticaceae	2	0	**2**
Maize	All maize	247	357	**604**
Squash	*Cucurbita* sp.	0	5	**5**
	Total (N)	**531**	**1845**	**2376**
	S (Richness: N of taxa)	**19**	**19**	**25**
	H'(diversity index)	**1.68**	**2.03**	**2.14**
	V'(equitability)	**0.57**	**0.69**	**0.66**

Note: Calculations do not include unidentified or unidentifiable specimens

Table 4.18 Intrasite Comparison of Diversity Indices at Robinson Reserve

Section	Total (N)	Shannon-Weaver			Simpson's
		S	H'	V'	(1-D)
North	531	19	1.68	0.57	0.70
South	1845	19	2.03	0.69	0.83

Question 1: What is the nature of the floral assemblage at Robinson Reserve?

The occupants of Robinson Reserve were maize agriculturalists who supplemented their diet with wild plant foods. Wild plant foods include nuts such as hickory (*Carya* sp.), acorn (*Quercus* sp.), hazelnut (*Corylus* sp.), and some walnut family (Juglandaceae). Other wild plant foods foraged include berries, mainly blackberry/raspberry (*Rubus* sp.) and blueberry (*Vaccinium* sp.). Very little squash (*Cucurbita* sp.) is present at Robinson Reserve. The heavy presence of EAC plants at the site sets it apart from other Langford tradition sites. Other notable seed taxa at the site include composite family (Asteraceae) and bulrush (*Scirpus* sp.) seeds.

Question 2) Does the floral assemblage at Robinson Reserve provide insight on spatial patterning indicative of site function?

The north and south sections of Robinson Reserve show patterns that both align and vary with the HBE expectations laid out in chapter three. It is important to compare the intrasite results with the theoretical expectations to better understand site function.

Expectation 1: The mortuary/(mound) component should have a lower density of food plant taxa compared to the habitation/village component.

The Mann Whitney U results indicate the density distributions of maize, nuts, and EAC plants between the north and south sections are not statistically different from one another, however; there are differences in other plant macroremain densities which might indicate differences in site function. Although wood is not a food taxon, differences in wood density could indicate different activities. Because habitation contexts are generally long-term occupations, we should see a larger array of activities, thus higher fuel use. This would mean a higher density of wood charcoal and plant food taxa. Additionally, fuel use in mortuary contexts is likely centered around ritual burning. Unless there are multiple episodes of burning, it would make sense that habitation contexts use more fuel. Robinson Reserve intrasite data show the south section has a higher ubiquity and density of wood (Table 4.14).

Looking at plant food taxa, nut density is essentially the same between the north and south sections (Table 4.14). Plant food ratios indicate nutshell was more significant in the north (Table 4.15). The high presence of nutshell in the north could be attributed to food offerings in mortuary/mound contexts, however these data do not align with the theoretical expectations.

Maize is not statistically different between the north and south sections; however, data trends suggest higher ubiquity and density in the south section. This is likely due to sample bias. Plant food ratios in the north indicate maize is more significant compared to other plant taxa (Table 4.15). Looking at mortuary/ mound site expectations, activities revolve around burial/internment and ancestor veneration. The abundant use of maize in the north section is possibly related to ceremonial contexts. Maize has a lower ubiquity in the north (*U*=60%) than the south (*U*=93%). Food offerings would likely be concentrated in single carbonization contexts; thus, a lower ubiquity supports the expectations. Additionally, if maize is used daily and for longer periods of time, we should expect a higher ubiquity in the south. The kernel:cupule ratios indicate more maize consumption in the south than the north. We should expect there to be maintenance of the participants engaged in mortuary ritual at the site. The higher amount of consumption in the south section could be evidence of feasting. In summary, there are theoretical explanations that support the heavy presence of maize in both mortuary and habitation contexts. Any differences between the north and south sections are not enough to be statistically significant.

Although not all the seeds at Robinson Reserve are food taxa, the intrasite analysis shows evidence of differences between the two site sections. Seeds have a substantially higher density in the south than the north (Table 4.14). Part of this could be due to sample bias. Plant food ratios broke down the seeds by category. Cultigen and grain seeds are much more significant in the south (Table 4.15). Fruit seeds are slightly more significant in the north. The "other" seeds are more significant in the south. Looking at each section individually, the other seeds category is the most significant in the north. Although unidentified seeds likely conflate the significance, the seed assemblage in the north section consists mostly of Poaceae (n=14) and *Scirpus* sp. (n=20). In the south, the "other" seeds category comprises the unidentified genus of aster (Asteraceae) and Poaceae seeds. Aster taxa are only present in the south section.

We should expect plant food taxa to have a higher density in habitation contexts. Interestingly, bulrush (*Scirpus* sp.) is only present in the north section. The Menomini used bulrush (*Scirpus* sp.) for mat material (Smith 1923). According to Smith (1923), rushes would have been gathered, cleansed, bleached, dried, then sorted for weaving. Bulrush (*Scirpus* sp.) could have been used for a burial furnishing. Its presence only in the north is an interesting pattern indicative of mortuary function. Similarly, the unidentified genus of aster seeds is only present in the south section. Ethnographically, aster seeds were used for food (oily seeds such as *Helianthus annus, Helianthus tuberosus*) (Densmore 1974). Some aster seeds were used medicinally or in making dyes (Smith 1923). Although its presence cannot be easily interpreted, this is another example of the patterning of plant macoremains throughout the site.

Expectation 2: The habitation/village component should have a higher diversity.

According to Shannon-Weaver Diversity index data, the south section plant macroremain assemblage has higher diversity and equitability and the same richness (S=19) (Table 4.17) compared to the north. The Simpson's index also indicates the south section is more diverse (Table 4.18). These results support the expectations between mortuary and habitation contexts.

Due to the continuous and long-term nature of habitation sites, we should expect a wider array of activities revolving around the maintenance of daily life. Most energy is spent on keeping up with chores. The constant bustling of day-to-day creates more evidence of carbonization events and subsequent chances of more seed taxa becoming carbonized. Higher diversity in the south section supports the habitation expectations.

A mortuary/mound context could also have high diversity, but this is more likely due to ceremonial activities around burial/internment and ancestor veneration. This could include furnishings, adornment, food offerings, or other material grave goods that convey social identity and prestige. With a multitude of ways to conduct ceremonies, habitation sites are still more likely to have a larger number of carbonization events for a longer period.

Expectation 3: The mortuary/(mound) component should have a higher amount of unusual/non-local species.

Due to the cultural nature of mortuary contexts, we should expect less consideration of economic or energetic efficiency. Like diversity in mortuary contexts, grave goods and food offerings convey cultural meaning. Because the north section is primarily from mortuary or mound contexts, we should expect a higher amount of exotic or nonlocal species. Interestingly, the Mann Whitney U results for nuts, maize, and EAC seed taxa indicate the north and south are not statistically significant from one another in terms of density distributions.

With the statistical data in mind, there are still a few patterns indicative of site function between the north and south sections. First, it is interesting that Bulrush (*Scirpus* sp.) is only present in the north section. Second, maize is plentiful at Robinson Reserve, however plant food ratios indicate it is the most significant plant taxa in the north section. Its importance in the north section indicates it is likely related to cultural or ceremonial ritual around burial/internment. The third pattern indicative of site function is the presence of EAC seed taxa throughout the site. EAC seed taxa are also known as the cultigen and grain seed category (*Amaranthus* sp., *Chenopodium* sp., cf. *Hordeum* sp., cf. *Iva* sp., and *Polygonum* sp.). EAC seed taxa are present in both sections, however they are much more abundant in the south. Additionally, plant food ratios indicate these seeds are far more significant in the south (q=44.01) versus the north (q=10.96). These data do not align with the mortuary expectations.

The presence of EAC plant taxa at Langford site is extremely unusual. Previous Langford subsistence analyses support this (Egan 1985; Egan-Bruhy 2014; Emerson et al. 2005: 86; Jeske 2000, 2002). The high abundance of EAC plant taxa is likely indicative of feasting or a form of ancestor veneration. The presence of EAC plant taxa at Robinson Reserve will be explored in the next chapter through a comparison with the Washington Irving site.

CHAPTER 5: AN INTERSITE COMPARISON OF ROBINSON RESERVE AND WASHINGTON IRVING

This chapter provides an intersite comparison of plant macroremain assemblages between Robinson Reserve and Washington Irving. First, this chapter provides a brief overview of the plant macroremain assemblage from Washington Irving based on previously published research (Egan 1985; Jeske 2000). Second, this chapter compares the plant assemblages of Robinson Reserve and Washington Irving. These results address the third research question: How does the floral assemblage at Robinson Reserve compare to the floral assemblage of Washington Irving? Diversity indices for Robinson Reserve and Washington Irving are also discussed later in the chapter. Finally, a summary of the work in this thesis will address the last research question: Do the floral assemblages at Robinson Reserve and Washington Irving follow the perceived expectations of Langford mortuary and village site function?

A Summary of the Washington Irving Floral Assemblage

The Washington Irving botanical assemblage includes wood charcoal, nutshell, tropical cultigens, and terrestrial and aquatic seed genera (Egan 1985). There are a total of 29 taxa at Washington Irving, including tree species (Table 5.1). There are a variety of tree genera present in the wood charcoal assemblage. Trees from the white oak group are most represented. The nut assemblage is mostly composed of hickory (*Carya* sp.), hazelnut (*Corylus* sp.), and acorn (*Quercus* sp.). Similar to other nearby Langford sites, maize is ubiquitous yet in low densities (Egan 1985, 1988; Emerson 1999; Jeske 1989, 2000, 2003). Squash is also present in small amounts. The carbonized seed assemblage is small, but species present were collected from a variety of habitats. Eastern Agricultural Complex seeds are present but their low abundance, ubiquity, and density suggests that they were not economically important. Interestingly, an unidentified genus of composite family (Asteraceae) seeds dominates the assemblage

Table 5.1. Common and Taxonomic Names of Plants Identified in the Washington Irving Plant Macroremain Assemblage

Taxa	**Common Name**
Nuts	
Carya sp.	Hickory
Carya illinoensis	Pecan
Corylus americana	Hazelnut
Juglandaceae	Walnut (family)
Juglans nigra	Black Walnut
Quercus sp.	Acorn
Cultigen and Grain Seeds	
Amaranthus sp.	Amaranth
Chenopodium sp.	Goosefoot
Hordeum pusillum	Little Barley
Iva annua	Sumpweed
Fruit Seeds	
Crataegus sp.	Hawthorn
Rubus sp.	Blackberry/Raspberry
Vaccinium sp.	Blueberry
Vitis sp.	Grape
Other Seeds	
Ambrosia sp.	Ragweed
Asteraceae	Composite (family)
Desmodium sp.	Tick-trefoil
Fabaceae	Bean/Legume (family)
Galium sp.	Bedstraw
Nelumbo lutea	American Lotus
Poaceae	Grass (family)
Scirpus sp.	Bullrush
Squash/Cucurbit	
Cucurbita sp.	Squash Rind
Maize	
Zea mays	Maize

An Intersite Comparison of Robinson Reserve and Washington Irving

Question 3) How does the floral assemblage at Robinson Reserve compare to the floral assemblage of Washington Irving?

Wood Charcoal

Wood charcoal is the most common plant remain type recovered at both Robinson Reserve and Washington Irving. In comparison to plant food categories, wood dominates the plant macroremain assemblage (Table 5.2). Although wood is the most common plant category for both sites, absolute counts from Washington Irving surpass counts at Robinson Reserve. Table 5.3 compares wood assemblages between Robinson Reserve and Washington Irving. At Robinson Reserve, elm (*Ulmus* sp.) (18.67%) was the most identified wood genera, followed by oak (*Quercus* sp.) (6.64%), beech (*Fagus* sp.) (3.87%), and one fragment of ash (*Fraxinus* sp.) (0.14%) (Table 5.2). Wood and bark charcoal not analyzed are not included in Table 5.3 (see Table 4.5). In comparison, Washington Irving had a higher number of identified wood genera, the majority belonging to the white oak group (*Quercus* sp.) (85.3%), followed by small quantities of hickory (*Carya* sp.) (7.1%), Red oak (*Quercus* sp.) (1.3%), ash (*Fraxinus* sp.) (0.8%), maple (*Acer* sp.)(0.2%), pine (*Pinus* sp.) (0.2%), mulberry (*Morus rubra*) (0.2%), and walnut (*Juglans* sp.)(0.2%) (Egan 1985; Jeske 2000) (Table 5.3).

Table 5.2. A Comparison of Robinson Reserve and Washington Irving by Plant Category

	Robinson Reserve				**Washington Irving**			
Description	**Total (count)**	***U***	***d***	**%**	**Total (count)**	***U***	***d***	**%**
Wood	19498	100%	269	87.35	26650	88%	80.24	93.38
Nut	732	84%	10.10	3.28	1016	52%	3.06	3.56
Maize	604	80%	8.33	2.71	676	48%	2.04	2.37
Cucurbit	5	8%	0.07	0.02	33	18%	0.10	0.12
Seeds	1483	100%	20.5	6.64	164	48%	0.49	0.57

Note: Densities are count/10L

Table 5.3. A Comparison of Robinson Reserve and Washington Irving Wood Identifications

	Robinson Reserve				**Washington Irving**			
Wood Identifications	**Total (count)**	***U***	***d***	**%**	**Total (count)**	***U***	***d***	**%**
Acer sp. (maple)	--	--	--	--	4	6%	0.01	0.48
Carya sp. (hickory)	--	--	--	--	43	42%	0.12	5.2
Fagus sp. (beech)	28	12%	0.39	3.87	--	--	--	--
Fraxinus sp. (ash)	--	--	--	--	7	9%	0.01	0.85
cf. *Fraxinus* sp. (ash)	1	4%	0.01	0.14	--	--	--	--
Juglans sp. (walnut)	--	--	--	--	1	3%	<0.01	0.12
Morus rubra (mulberry)	--	--	--	--	1	3%	<0.01	0.12
Pinus sp. (pine)	--	--	--	--	1	3%	<0.01	0.12
Platanus sp. (sycamore)	--	--	--	--	2	3%	0.01	0.24
Quercus sp. (white oak gp.)	--	--	--	--	631	85%	1.90	76.3
Quercus sp. (red oak gp.)	--	--	--	--	16	21%	0.05	1.93
Quercus sp. (oak)	48	28%	0.66	6.64	10	3%	0.03	1.21
Ulmus sp. (elm)	135	40%	1.86	18.67	--	--	--	--
UID RP	160	64%	2.21	22.13	67	67%	0.23	8.1
UID DP	29	28%	0.40	4.01	13	18%	0.03	1.57
UID Conifer	7	12%	0.10	0.99	--	--	--	--
Unidentified	315	88%	4.35	43.57	31	39%	0.10	3.75
Total	**723**	**100%**	**9.97***	**100**	**827**	**100%**	**2.49***	**100**

Note: UID= Unidentified; RP= Ring Porous; DP= Diffuse Porous
Washington Irving wood data from Jeske 2000:283
*****Densities are count/10L, only includes identified wood charcoal

Nutshell

Nut assemblages between Robinson Reserve and Washington Irving were compared using a Mann Whitney U test. Results indicate the distribution of nutshell densities between both sites are not statistically different from one another (U=109 p=0.23).

Statistical evidence indicates the nut assemblages are the same, however abundance, ubiquity, density, and percentage data provide further comparison. Looking at percentages from Table 5.2, nutshell is the second most frequently identified food plant taxa at Robinson Reserve. In contrast, nutshell has the highest relative frequency at Washington Irving. Nutshell ubiquity is higher at Robinson Reserve (*U*=84%) in comparison to 52% at Washington Irving (Table 5.2). Nutshell densities are higher at Robinson Reserve (10.10ct./10L) than Washington Irving (3.06ct/10L) (Table 5.2).

Table 5.4 breaks nutshell at both sites down to genus. At Robinson Reserve, hickory (*Carya* sp.) is the most abundant followed by acorn (*Quercus* sp.) and hazelnut (*Corylus* sp.). This takes into consideration density, ubiquity, and relative frequency (Table 5.4). At Washington Reserve, hickory (*Carya* sp.) is also the most abundant, followed by walnut/hickory family (Juglandaceae), hazelnut (*Corylus* sp.), and acorn (*Quercus* sp.). Hazelnut (*Corylu*s sp. or *Corylus americana*) and walnut/hickory family (*Juglandaceae*) are far more abundant at Washington Irving. Additionally, pecan (*Carya illinoensis*) and black walnut (*Juglans nigra*) were identified in small amounts at Washington Irving. These species are likely present at Robinson Reserve, however poor preservation called for identifications to genera.

The lack of statistical significance between both nutshell assemblages likely has to do with sample size bias. Data trend towards higher ubiquity and density at Robinson Reserve, however these differences are not big enough statistically.

Table 5.4. Comparison of Robinson Reserve and Washington Irving Nut Assemblages

Nut Taxa	Robinson Reserve				Washington Irving			
	Total (count)	***U***	***d***	**%**	**Total (count)**	***U***	***d***	**%**
Carya spp. (hickory)	297	56%	4.10	40.57	397	42%	1.20	39.07
Carya illinoensis (pecan)	--	--	--	--	15	9%	0.05	1.48
Corylus americana (hazelnut)	37	40%	0.51	5.04	132	15%	0.40	12.99
Juglans nigra (black walnut)	--	--	--	--	7	15%	0.02	0.69
Juglandaceae (walnut/hickory family)	20	20%	0.28	2.73	342	30%	1.03	33.66
Quercus sp. (acorn)	212	40%	2.92	28.96	123	15%	0.37	12.11
Unidentified	166	60%	2.29	22.68	--	--	--	--
Total	**732**	**84%**	**10.10**	**100**	**1016**	**52%**	**3.06**	**100**

Note: Densities are count/10L

Maize (Zea mays)

According to Mann Whitney U results for maize, the null hypothesis (H_0: Mortuary_RR-dist.=Village_XIRV-dist.) is not supported. The tests indicate the distributions of maize densities at both sites are statistically distinct from one another (U=60 p=.007).

Statistics indicate maize assemblages at both sites are notably different from one another, however, it is important to delve into the nuances. Table 5.2 indicates maize has about the same relative frequency at both sites and in comparison, to the other plant categories. Maize has a higher ubiquity (*U*=80%) at Robinson Reserve compared to Washington Irving (*U*=48%). Maize also has a higher density at Robinson reserve (8.33ct./10L) than Washington Irving (2.04ct./10L) (Table 5.2).

Table 5.5 provides a comparison of kernel to cupule ratios between Robinson Reserve and Washington Irving. Robinson Reserve has a higher kernel to cupule ratio (e=0.61) than Washington Irving (e=0.41) (Table 5.5). Individually, both sites show higher levels of maize processing than consumption. The higher ratio at Robinson Reserve indicates there is more maize consumption at Robinson Reserve than Washington Irving. A chi-square test of independence using kernel and cupule counts showed the kernel to cupule ratios are different between the sites (X2=9.53, df=1, p=.002).

Table 5.5. A Comparison of Kernel to Cupule Ratios at Robinson Reserve and Washington Irving

Site	Maize Kernels	Maize Cob/Cupules	Kernel: Cupule Ratio (e)
Robinson Reserve	189	312	0.61
Washington Irving	187	456	0.41

Squash (Cucurbita sp.)

Squash rind fragments are present in both plant macro remains assemblages. Cucurbit has low ubiquity and density at both sites (Table 5.2). Cucurbit has a higher relative frequency at Washington Irving (0.12%) than Robinson Reserve (0.02%) (Table 5.2). Although squash has a low presence at both sites, it is more abundant at Washington Irving (n=33) than Robinson Reserve (n=5). Part of this could be due to preservation bias. Density is slightly higher at Washington Irving (0.10) than Robinson Reserve (0.07) (Table 5.2). A statistical analysis could not be conducted due to the small sample size. Additionally, poor preservation makes it difficult to hypothesize how important squash was at both sites.

Seeds

The seed assemblages at Robinson Reserve and Washington Irving vary based on abundance, ubiquity, density, and relative frequency. Table 5.2 shows seeds are far more abundant at Robinson Reserve than at Washington Irving. Seeds make up about 7% of the plant macroremain assemblage at Robinson Reserve, whereas at Washington Irving they make up almost 1% of the total assemblage. Part of this is likely due to sample and preservation biases.

For example, seed abundance at Robinson Reserve may be conflated due to including fragments in absolute counts. Differences in flotation techniques between both sites contribute to sample biases. Additionally, a number of features at Washington Irving were shallow and subject to erosion. The following sections break seeds down into categories.

Cultigen and Grain Seeds

Overall, starchy seeds are far more abundant at Robinson Reserve than at Washington Irving (Table 5.6). They also have a much higher ubiquity and density. Cultigen and grain seeds make up about 35% of the seed assemblage at Robinson Reserve versus 6% at Washington Irving. Notably, EAC seeds are virtually absent at Washington Irving, while Robinson Reserve has a much higher density of EAC taxa than expected from Langford sites. The unusually high presence of knotweed (*Polygonum* sp.) at Robinson Reserve likely skews these numbers, although Redmer (1989) also identified a large number of chenopods at Robinson Reserve. Interestingly, knotweed (*Polygonum* sp.) is not present at Washington Irving. A Mann Whitney U test indicates that the distributions of EAC seed taxa densities between Robinson Reserve and Washington Irving are statistically different (U=1.5 p=0.002).

Table 5.6 An Intersite Comparison of Cultigen and Grain Seeds

Cultigen and Grain Seeds	Robinson Reserve				Washington Irving			
	Total (count)	***U***	***d***	**%**	**Total (count)**	***U***	***d***	**%**
Amaranthus sp. (Amaranth)	10	4%	0.1	0.7	1	3%	<0.1	0.6
Chenopodium sp. (Goosefoot)	49	24%	0.7	3.3	5	9%	<0.1	3.1
Hordeum pusillum (Little Barley)	--	--	--	--	1	3%	<0.1	0.6
cf. *Hordeum pusillum* (Little Barley)	40	24%	0.6	2.7	--	--	--	--
Iva annua (Sumpweed)	--	--	--	--	2	3%	<0.1	1.2
cf. *Iva sp.* (Sumpweed)	1	4%	<0.1	0.1	--	--	--	--
Polygonum sp. (Knotweed)	414	68%	5.7	27.9	--	--	--	--
Totals	**514**	**72%**	**7.1**	**34.7**	**9**	**15%**	**<0.1**	**5.5**

Fruit Seeds

Fruit seeds have a higher abundance, ubiquity, and density at Robinson Reserve than Washington Irving. Table 5.7 indicates fruit seeds at Robinson Reserve have a much higher ubiquity (*U*=50%) compared to 9% at Washington Irving. The relative frequency of fruit seeds is about the same at both sites. Hawthorn (*Crataegus* sp.), blackberry/raspberry (*Rubus* sp.), blueberry (*Vaccinium* sp.), and grape (*Vitis* sp./*Vitaceae*) are present at both Robinson Reserve and Washington Irving. Conversely, bayberry (*Myrica* sp.) nutlet/seed fragments are present at Robinson Reserve. Blueberry (*Vaccinium* sp.) seeds are more commonly identified at Robinson Reserve than Washington Irving. Looking back at the catchment analyses in chapter two, the differences in fruit seeds could indicate microenvironmental differences between wooded east bank of Des Plaines and more savanna-like conditions at Washington Irving.

Table 5.7. An Intersite Comparison of Fruit Seeds

	Robinson Reserve				**Washington Irving**			
Fruit Seeds	**Total (count)**	***U***	***d***	**%**	**Total (count)**	***U***	***d***	**%**
Crataegus sp. (Hawthorn)	7	12%	0.1	0.5	2	3%	<0.1	1.2
Myrica sp. (Bayberry)	28	20%	0.39	1.9	--	--	--	--
Rosaceae (Rose family)	2	4%	0.03	0.1	--	--	--	--
Rubus sp. (Blackberry/Raspberry)	18	32%	0.25	1.2	2	3%	<0.1	1.2
Vaccinium sp. (Blueberry)	51	48%	0.7	3.4	2	3%	<0.1	1.2
Vitis sp. (Grape)	--	--	--	--	3	6%	<0.1	1.8
Vitaceae (Grape family)	1	4%	0.01	0.1	--	--	--	--
Totals	**107**	**56%**	**1.48**	**7.2**	**9**	**9%**	**<0.1**	**5.5**

Other Seeds

Like the previous two categories, other seeds have a higher abundance at Robinson Reserve. Table 5.8 indicates other seeds have a moderate ubiquity at Washington Irving (*U*=48%) and twice that at Robinson Reserve (*U*=96%). Interestingly, aster/composite family (*Asteraceae*) seeds have the same abundance at both sites. There are a couple of outlying differences between the two sites. First, grass (*Poaceae*) seeds have an unusually high abundance, ubiquity, and density at Robinson Reserve (Table 5.8). Second, there is a moderate amount of American lotus (*Nelumbo lutea*) at Washington Irving. This taxon was not identified at Robinson Reserve. There are multiple reasons why this taxon is absent at Robinson Reserve. Sample bias, preservation bias, and possibly identification error could contribute to this. Differences of the environments between both sites likely plays a larger role. The occupants of Washington Irving utilized the nearby marshes, whereas the occupants of Robinson Reserve had the main river channel.

Table 5.8. An Intersite Comparison of Other Seeds

	Robinson Reserve				**Washington Irving**			
Other Seeds	**Total (count)**	***U***	***d***	**%**	**Total (count)**	***U***	***d***	**%**
Ambrosia sp. (Ragweed)	--	--	--	--	1	3%	<0.1	0.6
Asteraceae (Composite family)	64	24%	0.9	4.3	64	18%	0.2	39.0
Brassicaceae (Mustard family)	1	4%	0.01	0.1	--	--	--	--
Desmodium sp. (Tick-trefoil)	--	--	--	--	2	3%	<0.1	1.2
Fabaceae (Bean/Legume family)	2	8%	0.03	0.1	1	3%	<0.1	0.6
Galium sp. (Bedstraw)	7	2%	0.1	0.5	3	9%	<0.1	1.8
Nelumbo lutea (American Lotus)	--	--	--	--	56	18%	0.2	34.2
Poaceae (Grass family)	467	72%	6.4	31.5	3	6%	<0.1	1.8
Portulaca sp. (Purslane)	3	4%	0.04	0.2	--	--	--	--
Scirpus sp. (Bullrush)	34	36%	0.5	2.3	1	3%	<0.1	0.6
cf. *Urticaceae* (Nettle family)	2	4%	0.03	0.1	--	--	--	--
Unidentified	282	80%	3.9	19	15	27%	0.1	--
Totals	**862**	**96%**	**11.9**	**58%**	**146**	**48%**	**0.5**	**79.9**

Diversity

Diversity indices were calculated for both Robinson Reserve and Washington Irving (Table 5.9). Robinson Reserve has slightly higher richness (R= 25), than Washington Irving (R=24). In terms of equitability or evenness, the Shannon-Weaver index shows a higher value for Robinson Reserve (V’=0.66) than Washington Irving (0.58). The overall Shannon-Weaver diversity index for Robinson Reserve (H’=2.14) is higher than that of Washington Irving

(H’=1.83). Simpson’s Diversity Index was also calculated as it is less sensitive to species richness. Simpson’s calculations also show a higher diversity index for Robinson Reserve (0.84) than Washington Irving (0.79) (Table 5.9). We should expect a mortuary site to have lower diversity than a habitation site. This is clearly not the case. Based on the diversity indices, Robinson Reserve’s plant assemblage is more representative of a habitation site than Washington Irving is.

Table 5.9. Intersite Comparison of Diversity Indices

			Shannon-Weaver		**Simpson's**
Site	**Total (N)**	**S**	**H'**	**V'**	**(1-D)**
Robinson Reserve	2376	25	2.14	0.66	0.84
Washington Irving	1874	24	1.83	0.58	0.79

Intersite Summary

Question 4) Do the floral assemblages at Robinson Reserve and Washington Irving follow the perceived expectations of Langford mortuary and village site function?

Expectation 1: The mortuary site should have a lower density of food plant taxa compared to the habitation site.

There are multiple patterns in the intersite data that do not align with the theoretical expectations between a mortuary and habitation site. For example, wood has a much higher density at Robinson Reserve (269ct./10L) than Washington Irving (80ct./10L) (Table 5.2). We should expect habitation sites to have a higher amount of fuel use, especially if they are occupied year-round. At the same time, mortuary sites could have large amounts of fuel use related to feasting and other forms of ceremonial burning.

Statistically, the nutshell assemblages between Robinson Reserve and Washington Irving are not different from one another. Second, there is more maize at Robinson Reserve. Although maize is ubiquitous at both sites, it has a much higher density at Robinson Reserve. The chi-square test indicates a higher level of consumption at Robinson Reserve than Washington Irving.

The Mann Whitney U results also support these data. These data are interesting, as we would not expect a mortuary site or mortuary camp to have higher densities than a village site. Third, seeds have a higher density at Robinson Reserve.

There are also a few interesting patterns that could be indicative of adaptive strategies related to site function. For example, hickory (*Carya* sp.) is present in the nutshell assemblage at Robinson Reserve, but it was not Identified in the wood samples. Conversely, hickory (Carya sp.) is present in both the nut and wood assemblage at Washington Irving (Table 5.3, Table 5.4). Theoretically, we should expect the occupants of a habitation site to utilize nearby wood for fuel. This could be indicative of year-round residence. Perhaps the occupants of Robinson Reserve only foraged hickory (*Carya* sp.) nutshell. This pattern also appears with *Juglans* sp./Juglandaceae nutshell.

Expectation 2: The habitation site should have higher diversity.

Robinson Reserve has higher diversity than Washington Irving. According to the Shannon-Weaver index, Robinson Reserve has higher richness, evenness, and overall diversity (Table 5.9). The Simpson's index provides further evidence that Robinson Reserve has higher diversity than Washington Irving. These results do not align with the theoretical expectations.

Expectation 3: The mortuary site should have a higher amount of unusual/non-local species.

The high abundance and density of EAC plant taxa at Robinson Reserve aligns with theoretical expectations of a mortuary site. Technically EAC seed taxa are present at Washington Irving, however Egan (1985) concluded low quantities of the taxa indicate they did not contribute to subsistence. Knotweed (*Polygonum* sp.) seeds are not present at all within Washington Irving. The Mann Whitney U test results for EAC taxa density distributions between both sites indicate that they are statistically different from one another.

We should expect less consideration of energetic or economic efficiency in mortuary sites. Grave goods and food offerings can convey meaning. The presence of EAC taxa Robinson Reserve is unique in Langford contexts. These plant taxa likely have a cultural connection to ancestor veneration. Further implications of patterns in the plant macroremain assemblages between Robinson Reserve and Washington Irving will be discussed in the next chapter.

CHAPTER 6: DISCUSSION AND CONCLUSION

The goal of this thesis is to examine the ways in which archaeological plant macroremain assemblages are reflected in determining site function. To achieve this goal, flotation samples from the 1986-1988 Robinson Reserve field schools were analyzed. These data was compared to existing floral data from the Washington Irving site. Four research questions were laid out. **1)** What is the nature of the floral assemblage at Robinson Reserve? **2)** Does the floral assemblage at Robinson Reserve provide insight on spatial patterning indicative of site function? **3)** How does the floral assemblage at Robinson Reserve compare to the floral assemblage of Washington Irving? **4)** Do the floral assemblages at Robinson Reserve and Washington Irving follow the perceived expectations of Langford mortuary and village site function? These questions will be answered in the following discussion.

Subsistence

The occupants of Robinson Reserve were maize agriculturalists who supplemented their diets with wild foods such as nuts and berries, foraged from nearby upland microenvironments. The presence and density of maize supports its widespread use in Upper Mississippian foodways. Squash (*Cucurbita* sp.) is also present, however poor preservation makes it difficult to extrapolate its importance at Robinson Reserve. Squash grows in wooded areas with moist soil along water sources. Robinson Reserve had both environments readily available.

Wild foods such as nuts and berries were also foraged at Robinson Reserve. The nearby wooded environments of Robinson Reserve would have made foraging an energy efficient activity. Nutshell such as hickory (*Carya* sp.), acorn (*Quercus* sp.), hazelnut (*Corylus* sp.), and walnut family (Juglandaceae) typically occurs in groves and are found in oak openings or savannas, hardwood forests, and upland slopes (Asch and Asch 1985; Asch 1994; Densmore

1979; Scarry 2003; Talalay et al. 1984). Wild fruits such as hawthorn (*Crataegus sp*.), bayberry (*cf. Myrica sp*.), rose family (*Rosaceae*), bramble or blackberry/raspberry (*Rubus sp*.), grape family (*Vitaceae*), and blueberry (*Vaccinium sp.*) can also be found in the same habitats.

Site Function

It is important to look at previous analyses of site data when considering site function. According to Lurie (1992:94), there are multiple lines of evidence that indicate Robinson Reserve could be a combination of a village site and a multi-seasonal camp. A wide array of activities such as hunting and fishing, maize agriculture, tool manufacture, and human burial likely spans multiple seasons. Fowler previously described the site as "two mounds and one village" (Fowler 1949). McTavish (2019) concluded Robinson Reserve is a mortuary encampment based on the narrow range of fauna exploited (2019:198).

Based on paleoethnobotanical data from this thesis, it can be concluded that Robinson Reserve is both a mortuary and village site. Results from the intrasite analysis support diverse plant taxa representative of mortuary and village site use patterns maintained by Lurie (1992). Statistically, the density distributions of maize, nut, and EAC crops between the north and south sections of Robinson Reserve are not different from one another. However, there are nuances in site density that support the HBE theoretical expectations.

Wood has a much higher density at Robinson Reserve than Washington Irving. We should expect habitation sites to have a higher amount of fuel use, especially if they are occupied year-round. The seed assemblage in the north section consists mostly of grass family (Poaceae) and bulrush (*Scirpus* sp.) seeds. Grass seeds are poorly preserved at Robinson Reserve, but this taxon could have been used to line pits with burial offerings. The presence of bulrush (*Scirpus* sp.) only in the north section is notable. This taxon could have been used as mat material for burial furnishings (Smith 1923). An unidentifiable genus of aster seeds is only present in the south section. There are multiple uses for aster such as food, medicine, and dyes (Densmore 1974; Smith 1923). Future identification to a species level would provide insight on its use at Robinson Reserve.

The intersite comparison indicates both Robinson Reserve and Washington Irving are village sites. According to the intersite HBE theoretical expectations, the Robinson Reserve botanical signature is more of a habitation site than Washington Irving. Evidence of this can be seen through higher densities and diversity at Robinson Reserve.

Mortuary Tradition

Robinson Reserve is also a mortuary site. There is an unusually high amount of EAC plant taxa at Robinson Reserve unlike Washington Irving. At Robinson Reserve, EAC taxa make up the cultigen and grain category, accounting for 35% of the seed assemblage. This comprises five species including amaranth (*Amaranthus* sp.), goosefoot (*Chenopodium* sp.), sumpweed (*Iva annua*), little barley (cf. *Hordeum pusillum*), and knotweed (*Polygonum* sp.). All these taxa are native cultigens domesticated in Eastern North America and compose a suite of plants important to subsistence before the height of maize agriculture. These taxa are also known as the EAC (Eastern Agricultural Complex). Although EAC taxa are present, knotweed (*Polygonum* sp.) has an unusually high abundance and density at Robinson Reserve. Knotweed is known as an economically important precontact indigenous crop. Erect Knotweed (*Polygonum erectum*) is an annual herbaceous species that was cultivated as early as 1500 BC (Mueller 2018). This edible plant species is abundant and ubiquitous in archaeological contexts dating from Middle Woodland through Mississippian periods, c. 250 BC-1400AD (Mueller 2018). EAC crops are not present in previous botanical analyses of Langford sites (Egan 1985; Egan-Bruhy 2014; Jeske 1990a, 2000, 2002; Walz 1998).

Intersite data shows further evidence that EAC crops are indicative of mortuary tradition at Robinson Reserve. The Mann Whitney U test results for EAC taxa between both sites indicate that they are statistically different from one another. This also aligns with theoretical expectations of a mortuary site. We should expect less consideration of energetic or economic efficiency in mortuary sites. Grave goods and food offerings can convey meaning. The presence of EAC taxa is unique in Langford contexts, and especially at a mortuary site such as Robinson Reserve. These plant taxa could have a cultural connection to ancestor veneration.

Robinson Reserve Seasonality

Plant macroremain evidence indicates Robinson Reserve was occupied throughout the summer to late fall. Evidence of summer and fall habitation can be seen with the presence of squash (*Cucurbita* sp.), EAC crops, and other seed genera. The fruit of squash ripens from May to September (Scary 2003). EAC crops, particularly knotweed (*Polygonum* sp.) would ripen from late summer to fall. These native cultigens could be harvested during the summer to replenish diminishing spring grain stocks. Little Barley (*Hordeum* sp.) could have been harvested during the early summer season when other plants were scarce (Asch and Asch 1985). Even if that is unlikely to be the case, *Hordeum* sp. could be harvested later in the year like other EAC crops. Grass seeds (Poaceae) are difficult to determine seasonality, however this analysis identified some as little barley (*Hordeum* sp.).

Fruit seeds were available for collection during the summer growing season. Blackberry/raspberry (*Rubus* sp.) or bramble is available from mid to late summer. Grape (*Vitis* sp.) is available from late summer into the fall. Blueberry (*Vaccinium* sp.) is available during the late summer. Other plant taxa such as maize and nuts provide evidence of fall habitation at Robinson Reserve. Maize would have been harvested during the fall. Nuts would also ripen by fall (Scarry 2003).

Although Robinson Reserve is a habitation site, it is not necessarily occupied year-round. Aside from some deep pit features, there is no evidence of sod houses that suggest year-round or cold weather use like at Washington Irving. Additionally, we should expect the occupants of a habitation site to utilize nearby wood for fuel. At Robinson Reserve, hickory (*Carya* sp.) is present in the nut assemblage but not in the wood. Conversely, both nutshell and wood species are present at Washington Irving. To determine if Robinson Reserve was occupied year-round, more samples need to be analyzed.

Washington Irving Seasonality

Multiple lines of evidence indicate Washington Irving is a year-round occupation. Evidence of spring to late fall habitation is present in the plant macroremain data at Washington Irving. According to Jeske (1990) the presence of American lotus (*Nelumbo lutea*) could indicate spring habitation at the site. American lotus would have been available during most of the year. American lotus flowers peak from June to September, and its seed pods are harvested in the late fall after the leaves die (Orozco-Obando et al. 2012). American lotus could be dried and stored for winter use too. Ethnohistoric accounts mention they could be dug from under the ice (Smith 1923). Evidence of summer habitation is also present in the seed assemblage. Woody taxa such as hawthorn (*Crataegus* sp.), rose family (Rosaceae), bramble or blackberry/raspberry (*Rubus* sp.), grape family (Vitaceae), and blueberry (*Vaccinium* sp.) were available in the late summer and fall. Fruit seeds also would have been available during the summer growing season (Egan 1985; Smith 1923). The reliance on maize and nuts at Washington Irving further indicates a fall occupation of the site. This data, in addition to sod houses for cold weather use indicate Washington Irving was occupied year-round.

Conclusions

The research conducted for this thesis provided interesting insight into site function. Overall, the occupants of Robinson Reserve were maize agriculturalists who supplemented their diets with wild foods. Aside from the presence of EAC taxa and the heavy consumption of maize, the floral assemblages between Robinson Reserve and Washington Irving are essentially the same. The presence of EAC taxa at Robinson Reserve likely has a cultural connection around mortuary ritual.

Robinson Reserve is a multi-seasonal mortuary and village site. This aligns with previous interpretations of Fowler (1949) and Lurie (1992). Interestingly, the Robinson Reserve floral assemblage has a more pronounced village signature than Washington Irving. Although HBE provides a good way to understand the causal relationships between site function and plant macroremain assemblages, human nature is varied and complex. The Styles and Purdue (1991) theoretical expectations do not necessarily reflect this. The whole of human nature cannot be defined by the boundaries of site function. Sometimes humans act upon individual and collective agency. This is not necessarily connected to efficiency in resource management. The variation in plant macroremain data between Robinson Reserve and Washington Irving provides an example of Langford site variation.

Limitations and Future Research

It is important to reiterate the limitations of this research. Robinson Reserve's plant macroremain data comes from a legacy collection. There is quite a berth in time from when flotation samples were processed until this analysis was conducted. Differences in methods and processing techniques create sample biases that affect the comparability of assemblages. Flotation samples were processed differently, which greatly impacts what we see in the plant macroremain assemblage. Second, Robinson Reserve's sample size is much smaller than

Washington Irving's. Fifteen features were analyzed at Robinson Reserve compared to the thirty-three at Washington Irving. More data is needed.

The work conducted in this thesis has generated further research goals. For example, there is a substantial amount of knotweed (*Polygonum* sp.) that should be identifiable to a species level. Additionally, these seeds have intact achenes, thus making it possible to measure them to see if they are domesticated. If there were domesticated cultigens at Robinson Reserve, this would generate more questions on the role of EAC taxa in Langford tradition sites. Expanded ethnographic research would provide further insight on whether there is a link between EAC taxa and mortuary ritual.

Overall, this research provides an interesting comparison of Langford tradition site function, and it can be used in a larger-scale investigation of Upper Mississippian foodways.

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APPENDIX A: UWM ARCHAEOLOGICAL RESEARCH LABORATORY PLANT MACOROREMAINS ANALYSIS PROTOCOLS

PLANT MACROREMAIN ANALYSIS

FEBRUARY 2021

PREPARING SAMPLES FOR SPECIALTY ANALYSIS

1. Prior to starting the analysis of the plant macroremains, flotation samples should be inventoried and entered into the inventory in the MS Access database set up for the project.

2. Plant macroremain analysis should include materials from all recovery contexts, inclusive of flotation, waterscreen, dry-screen, hand picked, etc.

3. Processed flotation samples are prepared for analysis. Generate list of the lot number containing plant macroremains. Samples are then physically prepped for analysis.

4. The list is placed in a binder for the plant macroremain analysis. The binder stays in the SEED LAB.

5. The binder should also contain a tracking analysis that is filled out daily.

6. Some assemblages are "pre-sorted" see PREPARING SAMPLES FOR SPECIALTIY ANALYSIS

ANALYSIS & IDENTIFICATION

General Comments

1. Keep work space clean - clean up prior to and after handling samples
2. Plant macroremains are delicate and easily fractured which leads to difficulties with identification (or precludes it). Handle materials with extreme care.
3. Use white paper and lunch trays to enhance visibility, facilitate cleanliness, and to help avoid cross sample contamination
4. Clean out materials stuck in screens before moving to a new sample (use a wire brush).
5. Use acid-free paper tags in the jars & bags. Be sure that tags are visible and labeled correctly. Pay particular attention when labeling material to avoid later complications.
6. Light fraction and heavy fractions are analyzed and recorded separately using one paper form per lot number.
7. The analysis is typically restricted to carbonized plant material.

Lot Number
STATE SITE NUMBER

Feature/Unit Number
Depth
Additional Provenience

Sample Type
Flot Fraction

Plant Material Category
Plant Material Detail

Figure 1. Sample label for jars and bags.

Analysis of Heavy Fraction

Typically samples are passed through a 2.0 mm geological screen and a 1.5 mm screen, with materials in the ≥2.0 mm and ≥1.5 mm split analyzed. The <2.0 mm split is only scanned for seeds. However, if a sample is particularly dense with larger materials, a 4.0 mm screen is also used in order to more easily sort the plant macroremains from the non-plant artifact assemblage.

1. Pass the heavy fraction through a 2.0 mm geological screen and >1.5 mm screen with bottom tray, separating into a ≥2.0 mm, ≥1.5 mm and a <2.0 mm group.

2. Place the <1.5 mm split in a glass bottle with the appropriate labels and set aside for now.

<u>For the ≥2.0 mm sample and ≥1.5 mm sample:</u>

3. Clean the sample. Remove large roots checking them for specks of charcoal that may have stuck to them. Gently brush off any specks into the screen. Place the root on a white piece of paper to see whether any other specks are present. Gently break up clumps of small root hairs/charcaol specks.

4. Using the microscope or magnifying glass, sort into categories. Typically these are WOOD, NUTSHELL, CORN (Kernels and/or cupules), SEEDS, SQUASH RIND, OTHER. Each category is placed into a paper boat and (if needed) with a temporary label.

5. IDENTIFY the remains, WOOD is last.

6. For each CATEGORY & TYPE, record count and weight on the analysis form. Each CATEGORY/ TYPE is placed in a labelled gelatin capsule (as needed) and/or labeled foil bag. The gelatin capsule/ foil bag is then placed in a clear plastic bag with a paper label.

<u>For the <1.5 mm sample</u>

7. Determine if a subsample is needed. If needed, following the process for sub-sampling.

8. Sprinkle a small amount of the <1.5 mm sample on a lined box to view under a 10x microscope. Push/pull everything over a line, one or a few at a time, until everything is viewed OR spread a thin layer on a box lid then move the box lid back and forth under the microscope until the entire box lid is scanned.

9. Using a tweezers, pick up any seeds and place onto a paper boat. WOOD, NUT, SQUASH are noted as present but are not picked. MODERN SEEDS are noted as present but not picked.

10. Common culprits for seed look alikes - FUNGUS or As - do not pick these from the sample but you can note the items are present on the form.

11. When finished scanning, write SCANNED DATE INITIALS on the paper tag in the jar.

12. Identify the seeds, count and weight. The seeds go into a gelatin capsule and then in labelled plastic bag.

Analysis of Light Fraction

Typically samples are passed through a 2.0 mm geological screen and a 1.5 mm screen, with materials in the ≥2.0 mm and ≥1.5 mm split analyzed. The <2.0 mm split is only scanned for seeds. However, if a sample is particularly dense with larger materials, a 4.0 mm screen is also used in order to more easily sort the plant macroremains from the non-plant artifact assemblage.

1. Pass the heavy fraction through a 2.0 mm geological screen and >1.5 mm screen with bottom tray, separating into a ≥2.0 mm, ≥1.5 mm and a <2.0 mm group.

2. Place the <1.5 mm split in a glass bottle with the appropriate labels and set aside for now.

For the ≥2.0 mm sample and ≥1.5 mm sample:

3. Clean the sample. Remove large roots checking them for specks of charcoal that may have stuck to them. Gently brush off any specks into the screen. Place the root on a white piece of paper to see whether any other specks are present. Gently break up clumps of small root hairs/charcaol specks.

4. Using the microscope or magnifying glass, sort into categories. Typically these are WOOD, NUTSHELL, CORN (Kernels and/or cupules), SEEDS, SQUASH RIND, OTHER. Each category is placed into a paper boat and (if needed) with a temporary label.

5. IDENTIFY the remains, WOOD is last.

6. For each CATEGORY & TYPE, record count and weight on the analysis form. Each CATEGORY/TYPE is placed in a labelled gelatin capsule (as needed) and/or labeled foil bag. The gelatin capsule/foil bag is then placed in a clear plastic bag with a paper label.

For the <1.5 mm sample

7. Determine if a subsample is needed. If needed, following the process for sub-sampling.

8. Sprinkle a small amount of the <1.5 mm sample on a lined box to view under a 10x microscope. Push/pull everything over a line, one or a few at a time, until everything is viewed OR spread a thin layer on a box lid then move the box lid back and forth under the microscope until the entire box lid is scanned.

9. Using a tweezers, pick up any seeds and place onto a paper boat. WOOD, NUT, SQUASH are noted as present but are not picked. MODERN SEEDS are noted as present but not picked.

10. Common culprits for seed look alikes - FUNGUS or As - do not pick these from the sample but you can note the items are present on the form.

11. When finished scanning, write SCANNED DATE INITIALS on the paper tag in the jar.

12. Identify the seeds, count and weight. The seeds go into a gelatin capsule and then in labelled plastic bag.

Sampling the <1.5 mm split

1. For large samples, a sub sample of the flotation heavy and/or light fraction can be used.
2. Use the riffle sorter to separate the sample. Select the sample for analysis - placed in a clean glass jar with a label. Label should include ANALYZED SUBSAMPLE.
3. The <1.5 mm split that will not be analyzed is placed in a clean glass jar with a label. Label should include NOT ANALYZED.
4. Indicate on the analysis form the procedure for sub-sampling, if applied to the LT and/or HY, and the subsample size.

APPENDIX B: ROBINSON RESERVE RAW FLORAL DATA

Lot Number	Context Type	Artifact No	Material Detail	Family	Genus	Species	Carbonization	cf?	Count	Weight (g)	INV	Initials	Comments
F02.10	Feature	1	Seed	Poaceae	Hordeum		carbonized	FALSE	2	0.002	6/14/2022	TLM	
F02.10	Feature	2	Seed		Polygonum		carbonized	TRUE	1	0.000	6/14/2022	TLM	<0.001g
F02.10	Feature	3	Seed	Unidentified			carbonized	FALSE	4	0.002	6/14/2022	TLM	
F02.10	Feature	4	Kernel		Zea	mays	carbonized	FALSE	19	0.255	6/14/2022	TLM	
F02.10	Feature	5	Cupule		Zea	mays	carbonized	FALSE	8	0.054	6/14/2022	TLM	
F02.10	Feature	6	Glume		Zea	mays	carbonized	FALSE	1	0.004	6/14/2022	TLM	
F02.10	Feature	7	Cupule/Glume		Zea	mays	carbonized	FALSE	2	0.011	6/14/2022	TLM	
F02.10	Feature	8	Rhizome				partially carbonized	FALSE	1	0.004	6/14/2022	TLM	
F02.10	Feature	9	Fungus				carbonized	FALSE	2	0.011	6/14/2022	TLM	
F02.10	Feature	10	Wood Charcoal				partially carbonized	FALSE	9	0.105	6/14/2022	TLM	
F02.10	Feature	11	Wood Charcoal				carbonized	FALSE	229	1.482	6/14/2022	TLM	Counts updated to include wood ID 11/27/22
F02.10	Feature	12	Bark				partially carbonized	FALSE	2	0.125	6/14/2022	TLM	
F02.10	Feature	13	Bark				carbonized	FALSE	139	1.683	6/14/2022	TLM	
F02.10	Feature	14	Nutshell		Carya		carbonized	FALSE	27	0.611	6/14/2022	TLM	
F02.10	Feature	15	Nutshell		Carya		partially carbonized	FALSE	8	0.103	6/14/2022	TLM	
F02.10	Feature	16	Nutshell		Corylus		partially carbonized	TRUE	1	0.007	6/14/2022	TLM	
F02.10	Feature	17	Nutshell	Unidentified			carbonized	FALSE	7	0.067	6/14/2022	TLM	nutmeat?
F02.10	Feature	18	Nutshell	Unidentified			partially carbonized	FALSE	3	0.018	6/14/2022	TLM	nutmeat?
F02.10	Feature	19	Nutshell	Unidentified			carbonized	FALSE	3	0.014	6/14/2022	TLM	
F02.10	Feature	20	Unidentified		Zea	mays	carbonized	TRUE	4	0.014	6/14/2022	TLM	

F02.10	Feature	21	Unidentified				carbonized	FALSE	21	0.168	6/14/2022	TLM	
F04.1	Feature	1	Seed	Asteraceae			carbonized	TRUE	1	0.000	6/15/2022	TLM	<0.001g
F04.1	Feature	2	Seed		Morus		carbonized	TRUE	4	0.014	6/15/2022	TLM	
F04.1	Feature	3	Seed		Polygonum		carbonized	FALSE	1	0.000	6/15/2022	TLM	<0.001g
F04.1	Feature	4	Seed	Poaceae			carbonized	FALSE	22	0.021	6/15/2022	TLM	
F04.1	Feature	5	Seed		Vaccinium		carbonized	FALSE	5	0.001	6/15/2022	TLM	
F04.1	Feature	6	Seed		Rubus		partially carbonized	FALSE	3	0.004	6/15/2022	TLM	
F04.1	Feature	7	Seed	Unidentified			carbonized	FALSE	25	0.032	6/15/2022	TLM	fragments and and UNID seed to ID?
F04.1	Feature	8	Kernel		Zea	mays	carbonized	FALSE	3	0.027	6/15/2022	TLM	
F04.1	Feature	9	Unidentified		Zea	mays	carbonized	TRUE	1	0.001	6/15/2022	TLM	
F04.1	Feature	10	Rhizome				carbonized	FALSE	1	0.006	6/15/2022	TLM	
F04.1	Feature	11	Stem				partially carbonized	FALSE	6	0.064	6/15/2022	TLM	
F04.1	Feature	12	Stem				carbonized	FALSE	7	0.080	6/15/2022	TLM	
F04.1	Feature	13	Fungus				carbonized	FALSE	30	0.111	6/15/2022	TLM	
F04.1	Feature	14	Nutshell		Corylus		carbonized	FALSE	3	0.019	6/15/2022	TLM	
F04.1	Feature	15	Nutshell		Corylus		partially carbonized	FALSE	2	0.021	6/15/2022	TLM	
F04.1	Feature	16	Nutshell		Carya		carbonized	FALSE	2	0.050	6/15/2022	TLM	
F04.1	Feature	17	Nutshell		Quercus		carbonized	TRUE	3	0.006	6/15/2022	TLM	
F04.1	Feature	18	Nutshell	Unidentified			carbonized	FALSE	2	0.012	6/15/2022	TLM	
F04.1	Feature	19	Wood Charcoal				partially carbonized	FALSE	115	2.215	6/15/2022	TLM	
F04.1	Feature	20	Wood Charcoal				carbonized	FALSE	1028	14.192	6/15/2022	TLM	Ct and Wt estimated, counts updated to include wood ID 11/27/2022

F04.1	Feature	21	Bark				partially carbonized	FALSE	171	6.263	6/15/2022	TLM	
F04.1	Feature	22	Bark				carbonized	FALSE	697	12.469	6/15/2022	TLM	Ct and Wt estimated
F04.1	Feature	23	Unidentified				partially carbonized	FALSE	8	0.034	6/15/2022	TLM	
F04.1	Feature	24	Unidentified				carbonized	FALSE	34	0.181	6/15/2022	TLM	
F05.19	Feature	1	Seed		Chenopodium		carbonized	FALSE	1	0.000	6/15/2022	TLM	<0.001g, sprouted?
F05.19	Feature	2	Seed	Asteraceae			carbonized	FALSE	22	0.008	6/15/2022	TLM	
F05.19	Feature	3	Seed	Poaceae			carbonized	FALSE	16	0.013	6/15/2022	TLM	
F05.19	Feature	4	Seed		Polygonum		carbonized	FALSE	32	0.013	6/15/2022	TLM	
F05.19	Feature	5	Seed		Rubus		carbonized	FALSE	2	0.002	6/15/2022	TLM	
F05.19	Feature	6	Seed		Scirpus		carbonized	FALSE	2	0.002	6/15/2022	TLM	
F05.19	Feature	7	Seed		Vaccinium		carbonized	FALSE	1	0.000	6/15/2022	TLM	<0.001g
F05.19	Feature	8	Seed	Unidentified			carbonized	FALSE	40	0.026	6/15/2022	TLM	includes fragments
F05.19	Feature	9	Kernel		Zea	mays	carbonized	FALSE	6	0.031	6/15/2022	TLM	
F05.19	Feature	10	Cupule		Zea	mays	carbonized	FALSE	7	0.056	6/15/2022	TLM	
F05.19	Feature	11	Unidentified		Zea	mays	carbonized	TRUE	2	0.005	6/15/2022	TLM	
F05.19	Feature	12	Fungus				carbonized	FALSE	28	0.171	6/15/2022	TLM	
F05.19	Feature	13	Fungus				partially carbonized	FALSE	73	0.529	6/15/2022	TLM	
F05.19	Feature	14	Stem				carbonized	FALSE	3	0.047	6/15/2022	TLM	
F05.19	Feature	15	Unidentified				carbonized	FALSE	18	0.111	6/15/2022	TLM	
F05.19	Feature	16	Nutshell		Carya		carbonized	FALSE	29	0.900	6/15/2022	TLM	
F05.19	Feature	17	Nutshell		Carya		partially carbonized	FALSE	1	0.034	6/15/2022	TLM	
F05.19	Feature	18	Nutshell		Junglans		carbonized	FALSE	8	0.361	6/15/2022	TLM	
F05.19	Feature	19	Nutshell		Junglans		partially carbonized	FALSE	3	0.091	6/15/2022	TLM	
F05.19	Feature	20	Nutshell	Unidentified			carbonized	FALSE	4	0.024	6/15/2022	TLM	nutmeat? Cotyledon
F05.19	Feature	21	Nutshell	Unidentified			partially carbonized	FALSE	8	0.063	6/15/2022	TLM	nutmeat? Cotyledon

F05.19	Feature	22	Nutshell	Unidentified			carbonized	FALSE	6	0.041	6/15/2022	TLM	
F05.19	Feature	23	Wood Charcoal				carbonized	FALSE	340	2.459	6/15/2022	TLM	Counts updated to include wood ID 11/27/22
F05.19	Feature	24	Wood Charcoal				partially carbonized	FALSE	6	0.031	6/15/2022	TLM	
F05.19	Feature	25	Bark				carbonized	FALSE	246	4.141	6/15/2022	TLM	
F05.19	Feature	26	Bark				partially carbonized	FALSE	1	0.007	6/15/2022	TLM	
F05.19	Feature	27	Seed	Poaceae	Hordeum		carbonized	TRUE	4	0.004	11/27/2022	TLM	
F05.20	Feature	1	Seed	Asteraceae			carbonized	FALSE	15	0.008	6/15/2022	TLM	
F05.20	Feature	2	Seed		Vaccinium		carbonized	FALSE	4	0.000	6/15/2022	TLM	<0.001g
F05.20	Feature	3	Seed		Scirpus		carbonized	FALSE	9	0.006	6/15/2022	TLM	
F05.20	Feature	4	Seed		Polygonum		carbonized	FALSE	17	0.008	6/15/2022	TLM	
F05.20	Feature	5	Seed	Poaceae			carbonized	FALSE	38	0.043	6/15/2022	TLM	
F05.20	Feature	6	Seed	Poaceae			carbonized	TRUE	47	0.036	6/15/2022	TLM	fragments included in counts and weights
F05.20	Feature	7	Seed	Unidentified			carbonized	FALSE	35	0.021	6/15/2022	TLM	
F05.20	Feature	8	Kernel		Zea	mays	carbonized	FALSE	8	0.062	6/15/2022	TLM	
F05.20	Feature	9	Cupule		Zea	mays	carbonized	FALSE	7	0.029	6/15/2022	TLM	
F05.20	Feature	10	Glume		Zea	mays	carbonized	FALSE	3	0.008	6/15/2022	TLM	
F05.20	Feature	11	Fungus				partially carbonized	FALSE	40	0.551	6/15/2022	TLM	
F05.20	Feature	12	Stem				carbonized	FALSE	11	0.099	6/15/2022	TLM	
F05.20	Feature	13	Nutshell		Corylus		carbonized	FALSE	1	0.018	6/15/2022	TLM	
F05.20	Feature	14	Nutshell		Junglans	nigra	partially carbonized	FALSE	2	0.052	6/15/2022	TLM	combined in Juglandaceae
F05.20	Feature	15	Nutshell		Junglans	nigra	carbonized	FALSE	1	0.031	6/15/2022	TLM	combined in Juglandaceae
F05.20	Feature	16	Nutshell		Carya		partially carbonized	FALSE	2	0.062	6/15/2022	TLM	
F05.20	Feature	17	Nutshell		Carya		carbonized	FALSE	1	0.018	6/15/2022	TLM	

F05.20	Feature	18	Wood Charcoal				carbonized	FALSE	538	4.573	6/15/2022	TLM	Counts updated to include wood ID 11/27/22
F05.20	Feature	19	Bark				carbonized	FALSE	515	6.650	6/15/2022	TLM	
F05.20	Feature	20	Nutshell	Unidentified			carbonized	FALSE	3	0.006	6/15/2022	TLM	
F05.20	Feature	21	Unidentified				carbonized	FALSE	20	0.075	6/15/2022	TLM	
F05.20	Feature	22	Seed	Poaceae	Hordeum		carbonized	TRUE	5	0.005	11/27/2022	TLM	
F08.1	Feature	1	Seed	Asteraceae			carbonized	FALSE	2	0.001	6/15/2022	TLM	
F08.1	Feature	2	Seed		Morus		partially carbonized	TRUE	1	0.000	6/15/2022	TLM	<0.001g
F08.1	Feature	3	Seed		Vaccinium		carbonized	FALSE	8	0.002	6/15/2022	TLM	
F08.1	Feature	4	Seed		Polygonum		carbonized	FALSE	3	0.002	6/15/2022	TLM	
F08.1	Feature	5	Seed		Galium		carbonized	FALSE	3	0.013	6/15/2022	TLM	
F08.1	Feature	6	Kernel		Zea	mays	carbonized	FALSE	10	0.043	6/15/2022	TLM	
F08.1	Feature	7	Kernel		Zea	mays	partially carbonized	FALSE	1	0.002	6/15/2022	TLM	
F08.1	Feature	8	Cupule		Zea	mays	carbonized	FALSE	10	0.069	6/15/2022	TLM	
F08.1	Feature	9	Cupule		Zea	mays	partially carbonized	FALSE	1	0.002	6/15/2022	TLM	
F08.1	Feature	10	Glume		Zea	mays	carbonized	FALSE	2	0.004	6/15/2022	TLM	
F08.1	Feature	11	Rind		Cucurbita		carbonized	FALSE	3	0.008	6/15/2022	TLM	
F08.1	Feature	12	Fungus				partially carbonized	FALSE	30	0.088	6/15/2022	TLM	
F08.1	Feature	13	Fungus				carbonized	FALSE	10	0.026	6/15/2022	TLM	
F08.1	Feature	14	Unidentified		Zea	mays	carbonized	TRUE	5	0.021	6/15/2022	TLM	
F08.1	Feature	15	Unidentified				carbonized	FALSE	9	0.053	6/15/2022	TLM	
F08.1	Feature	16	Nutshell		Carya		carbonized	FALSE	3	0.098	6/15/2022	TLM	
F08.1	Feature	17	Nutshell		Carya		partially carbonized	FALSE	6	0.167	6/15/2022	TLM	
F08.1	Feature	18	Nutshell		Corylus		carbonized	FALSE	3	0.016	6/15/2022	TLM	
F08.1	Feature	19	Nutshell		Corylus		partially carbonized	FALSE	7	0.111	6/15/2022	TLM	
F08.1	Feature	20	Nutshell		Junglans	nigra	carbonized	TRUE	1	0.037	6/15/2022	TLM	combined in Juglandaceae

F08.1	Feature	21	Nutshell	Unidentified			carbonized	FALSE	4	0.033	6/15/2022	TLM	
F08.1	Feature	22	Nutshell	Unidentified			partially carbonized	FALSE	5	0.087	6/15/2022	TLM	
F08.1	Feature	23	Wood Charcoal				partially carbonized	FALSE	21	0.211	6/15/2022	TLM	
F08.1	Feature	24	Wood Charcoal				carbonized	FALSE	533	5.009	6/15/2022	TLM	Counts updated to include wood ID 11/27/22
F08.1	Feature	25	Bark				carbonized	FALSE	1	0.010	6/15/2022	TLM	
F08.1	Feature	26	Bark				partially carbonized	FALSE	267	3.842	6/15/2022	TLM	
F08.1	Feature	27	Stem				carbonized	FALSE	9	0.072	6/15/2022	TLM	
F08.1	Feature	28	Seed		Rubus		partially carbonized	FALSE	2	0.001	6/15/2022	TLM	
F08.1	Feature	29	Seed	Poaceae			carbonized	FALSE	26	0.015	6/15/2022	TLM	fragments included in counts and weights
F08.1	Feature	31	Seed	Brassicaceae			carbonized	TRUE	1	0.000	6/15/2022	TLM	<0.001g
F08.1	Feature	32	Seed	Unidentifed			carbonized	FALSE	8	0.014	6/15/2022	TLM	
F08.1	Feature	33	Seed	Unidentifed			carbonized	FALSE	24	0.014	6/15/2022	TLM	fragments
F08.1	Feature	30	Seed	Poaceae	Hordeum		carbonized	TRUE	3	0.003	11/27/2022	TLM	
F12.1	Feature	1	Seed	Asteraceae			carbonized	FALSE	8	0.003	6/15/2022	TLM	
F12.1	Feature	2	Seed	Poaceae			carbonized	FALSE	6	0.006	6/15/2022	TLM	
F12.1	Feature	3	Seed		Vaccinium		carbonized	FALSE	3	0.000	6/15/2022	TLM	<0.001g
F12.1	Feature	4	Unidentified				carbonized	FALSE	4	0.003	6/15/2022	TLM	
F12.1	Feature	5	Kernel		Zea	mays	partially carbonized	TRUE	1	0.005	6/15/2022	TLM	
F12.1	Feature	6	Fungus				partially carbonized	FALSE	10	0.057	6/15/2022	TLM	
F12.1	Feature	7	Fungus				carbonized	FALSE	1	0.007	6/15/2022	TLM	
F12.1	Feature	8	Nutshell	Unidentified			carbonized	FALSE	1	0.011	6/15/2022	TLM	
F12.1	Feature	9	Wood Charcoal				carbonized	FALSE	17	0.062	6/15/2022	TLM	Sample Ct: 20, Wt: 0.061g
F12.1	Feature	10	Bark				carbonized	FALSE	10	0.056	6/15/2022	TLM	
F12.1	Feature	11	Bark				partially carbonized	FALSE	1	0.010	6/15/2022	TLM	

F13.1	Feature	1	Seed	Asteraceae			carbonized	FALSE	16	0.006	6/15/2022	TLM	
F13.1	Feature	2	Seed		Morus		carbonized	TRUE	19	0.054	6/15/2022	TLM	CF.
F13.1	Feature	3	Seed		Polygonum		carbonized	FALSE	2	0.001	6/15/2022	TLM	
F13.1	Feature	4	Seed	Poaceae			carbonized	TRUE	4	0.003	6/15/2022	TLM	
F13.1	Feature	5	Seed		Rubus		carbonized	FALSE	3	0.002	6/15/2022	TLM	
F13.1	Feature	6	Kernel		Zea	mays	carbonized	FALSE	1	0.005	6/15/2022	TLM	
F13.1	Feature	7	Cupule		Zea	mays	carbonized	FALSE	1	0.007	6/15/2022	TLM	
F13.1	Feature	8	Unidentified		Zea	mays	carbonized	TRUE	2	0.009	6/15/2022	TLM	
F13.1	Feature	9	Unidentified				carbonized	FALSE	4	0.014	6/15/2022	TLM	
F13.1	Feature	10	Stem				carbonized	FALSE	7	0.094	6/15/2022	TLM	
F13.1	Feature	11	Nutshell		Carya		carbonized	FALSE	3	0.032	6/15/2022	TLM	
F13.1	Feature	12	Nutshell		Carya		partially carbonized	FALSE	1	0.005	6/15/2022	TLM	
F13.1	Feature	13	Nutshell		Junglans		carbonized	TRUE	1	0.020	6/15/2022	TLM	
F13.1	Feature	14	Nutshell	Unidentified			carbonized	FALSE	3	0.036	6/15/2022	TLM	
F13.1	Feature	15	Wood Charcoal				carbonized	FALSE	464	3.583	6/15/2022	TLM	Counts updated to include wood ID 11/27/22
F13.1	Feature	16	Bark				carbonized	FALSE	226	3.084	6/15/2022	TLM	
F13.1	Feature	17	Bark				partially carbonized	FALSE	21	0.713	6/15/2022	TLM	
F13.1	Feature	18	Fungus				partially carbonized	FALSE	132	0.717	6/15/2022	TLM	
F13.1	Feature	19	Seed		Scirpus		carbonized	FALSE	2	0.002	6/15/2022	TLM	
F13.1	Feature	20	Seed		Vaccinium		carbonized	FALSE	4	0.000	6/15/2022	TLM	<0.001g
F13.1	Feature	21	Seed		Chenopodium		carbonized	FALSE	1	0.000	6/15/2022	TLM	sprouted?, <0.001g
F13.1	Feature	22	Seed		Crataegus		carbonized	TRUE	1	0.011	6/15/2022	TLM	
F13.1	Feature	23	Seed	Unidentified			carbonized	FALSE	30	0.021	6/15/2022	TLM	fragments included in counts and weights

F23.3	Feature	1	Seed		Polygonum		carbonized	FALSE	1	0.000	6/15/2022	TLM	<0.001g
F23.3	Feature	2	Seed		Vaccinium		carbonized	FALSE	1	0.000	6/15/2022	TLM	<0.001g
F23.3	Feature	3	Seed	Unidentified			carbonized	FALSE	1	0.002	6/15/2022	TLM	fragment
F23.3	Feature	4	Kernel		Zea	mays	carbonized	FALSE	2	0.031	6/15/2022	TLM	
F23.3	Feature	5	Unidentified				carbonized	FALSE	13	0.045	6/15/2022	TLM	
F23.3	Feature	6	Nutshell		Carya		carbonized	FALSE	19	0.714	6/15/2022	TLM	
F23.3	Feature	7	Nutshell		Carya		partially carbonized	FALSE	4	0.104	6/15/2022	TLM	
F23.3	Feature	8	Nutshell	Unidentified			carbonized	FALSE	1	0.020	6/15/2022	TLM	
F23.3	Feature	9	Wood Charcoal				carbonized	FALSE	45	0.362	6/15/2022	TLM	Sample Ct: 44, Wt: 0.366g
F23.3	Feature	10	Bark				partially carbonized	FALSE	4	0.118	6/15/2022	TLM	
F23.3	Feature	11	Bark				carbonized	FALSE	16	0.150	6/15/2022	TLM	
F23.4	Feature	1	Seed	Poaceae			carbonized	FALSE	1	0.001	6/15/2022	TLM	
F23.4	Feature	2	Seed	Unidentified			carbonized	FALSE	1	0.003	6/15/2022	TLM	fragment
F23.4	Feature	3	Kernel		Zea	mays	carbonized	FALSE	11	0.126	6/15/2022	TLM	
F23.4	Feature	4	Cupule		Zea	mays	carbonized	FALSE	3	0.030	6/15/2022	TLM	
F23.4	Feature	5	Unidentified		Zea	mays	carbonized	TRUE	1	0.009	6/15/2022	TLM	
F23.4	Feature	6	Unidentified				carbonized	FALSE	19	0.149	6/15/2022	TLM	
F23.4	Feature	7	Nutshell		Carya		carbonized	FALSE	37	0.438	6/15/2022	TLM	
F23.4	Feature	8	Nutshell		Carya		partially carbonized	FALSE	14	0.322	6/15/2022	TLM	
F23.4	Feature	9	Nutshell	Unidentified			carbonized	FALSE	3	0.070	6/15/2022	TLM	
F23.4	Feature	10	Wood Charcoal				carbonized	FALSE	90	0.908	6/15/2022	TLM	Sample Ct: 92, Wt: 0.91g
F23.4	Feature	11	Bark				partially carbonized	FALSE	32	0.315	6/15/2022	TLM	
F23.4	Feature	12	Bark				carbonized	FALSE	41	0.537	6/15/2022	TLM	

F32.5	Feature	1	Seed		Polygonum		carbonized	FALSE	5	0.002	6/15/2022	TLM	
F32.5	Feature	2	Seed	Poaceae			carbonized	FALSE	11	0.005	6/15/2022	TLM	fragments
F32.5	Feature	3	Seed	Poaceae			partially carbonized	FALSE	2	0.001	6/15/2022	TLM	
F32.5	Feature	4	Seed	Unidentified			carbonized	FALSE	13	0.007	6/15/2022	TLM	
F32.5	Feature	5	Seed		Chenopodium		carbonized	FALSE	1	0.000	6/15/2022	TLM	<0.001g
F32.5	Feature	6	Kernel		Zea	mays	carbonized	FALSE	2	0.012	6/15/2022	TLM	
F32.5	Feature	7	Cupule		Zea	mays	carbonized	FALSE	10	0.062	6/15/2022	TLM	
F32.5	Feature	8	Rhizome				carbonized	FALSE	2	0.009	6/15/2022	TLM	stem/rhizome
F32.5	Feature	9	Rhizome				partially carbonized	FALSE	4	0.053	6/15/2022	TLM	stem/rhizome
F32.5	Feature	10	Fungus				partially carbonized	FALSE	2	0.002	6/15/2022	TLM	
F32.5	Feature	11	Unidentified				carbonized	FALSE	21	0.097	6/15/2022	TLM	
F32.5	Feature	12	Nutshell		Carya		carbonized	FALSE	1	0.002	6/15/2022	TLM	
F32.5	Feature	13	Nutshell		Carya		partially carbonized	FALSE	2	0.060	6/15/2022	TLM	
F32.5	Feature	14	Nutshell		Quercus		carbonized	FALSE	1	0.003	6/15/2022	TLM	
F32.5	Feature	15	Wood Charcoal				carbonized	FALSE	205	1.401	6/15/2022	TLM	Counts updated to include wood ID 11/27/22
F32.5	Feature	16	Bark				carbonized	FALSE	74	0.896	6/15/2022	TLM	
F32.5	Feature	17	Unidentified				carbonized	FALSE	1	0.012	6/15/2022	TLM	cf resin?
F50.1	Feature	1	Seed	Poaceae			carbonized	TRUE	4	0.001	6/15/2022	TLM	
F50.1	Feature	2	Seed		Polygonum		carbonized	FALSE	11	0.003	6/15/2022	TLM	
F50.1	Feature	3	Cupule		Zea	mays	carbonized	FALSE	4	0.016	6/15/2022	TLM	
F50.1	Feature	4	Unidentified				carbonized	FALSE	3	0.010	6/15/2022	TLM	
F50.1	Feature	5	Nutshell		Quercus		carbonized	TRUE	1	0.002	6/15/2022	TLM	
F50.1	Feature	6	Wood Charcoal				carbonized	FALSE	110	0.918	6/15/2022	TLM	Counts updated to include wood ID 11/27/22
F50.1	Feature	7	Bark				carbonized	FALSE	38	0.444	6/15/2022	TLM	
F50.2	Feature	1	Seed	Poaceae	Hordeum		carbonized	TRUE	22	0.023	11/27/2022	TLM	
F50.2	Feature	2	Seed	Poaceae			carbonized	TRUE	54	0.035	11/27/2022	TLM	
F50.2	Feature	3	Seed		Polygonum		carbonized	FALSE	323	0.134	11/27/2022	TLM	
F50.2	Feature	4	Seed		Chenopodium		carbonized	FALSE	33	0.014	11/27/2022	TLM	
F50.2	Feature	5	Seed		Galium		carbonized	FALSE	1	0.004	11/27/2022	TLM	
F50.2	Feature	6	Seed		Vaccinium		carbonized	FALSE	7	0.000	11/27/2022	TLM	<0.001g
F50.2	Feature	7	Seed		Rubus		carbonized	FALSE	1	0.000	11/27/2022	TLM	<0.001g

F50.2	Feature	8	Seed		Scirpus		carbonized	FALSE	1	0.000	11/27/2022	TLM	<0.001g
F50.2	Feature	9	Seed	Unidentified			carbonized	FALSE	63	0.025	11/27/2022	TLM	
F50.2	Feature	10	Rind		Cucurbita		carbonized	FALSE	2	0.014	11/27/2022	TLM	
F50.2	Feature	11	Unidentified				carbonized	FALSE	32	0.183	11/27/2022	TLM	
F50.2	Feature	12	Seed		Rubus		partially carbonized	FALSE	1	0.000	11/27/2022	TLM	<0.001g
F50.2	Feature	13	Nutshell		Carya		carbonized	FALSE	95	1.257	11/27/2022	TLM	
F50.2	Feature	14	Nutshell		Quercus		carbonized	TRUE	35	0.205	11/27/2022	TLM	
F50.2	Feature	15	Seed		Crataegus		carbonized	FALSE	2	0.068	11/27/2022	TLM	
F50.2	Feature	16	Seed		Morus		carbonized	FALSE	1	0.010	11/27/2022	TLM	
F50.2	Feature	17	Kernel		Zea	mays	carbonized	FALSE	11	0.087	11/27/2022	TLM	
F50.2	Feature	18	Cupule		Zea	mays	carbonized	FALSE	9	0.061	11/27/2022	TLM	
F50.2	Feature	19	Glume		Zea	mays	carbonized	FALSE	3	0.012	11/27/2022	TLM	
F50.2	Feature	20	Cupule/Glume		Zea	mays	carbonized	FALSE	4	0.031	11/27/2022	TLM	
F50.2	Feature	21	Unidentified		Zea	mays	carbonized	TRUE	3	0.011	11/27/2022	TLM	
F50.2	Feature	22	Wood Charcoal				carbonized	FALSE	1274	19.264	11/27/2022	TLM	counts estimated, Counts updated to include wood ID 11/27/22
F50.2	Feature	23	Bark				carbonized	FALSE	408	6.621	11/27/2022	TLM	counts estimated
F50.2	Feature	24	Resin				carbonized	FALSE	1	0.035	11/27/2022	TLM	
F50.2	Feature	25	Rhizome				carbonized	FALSE	3	0.020	11/27/2022	TLM	
F50.2	Feature	26	Fungus				carbonized	FALSE	40	0.225	11/27/2022	TLM	
F52.4	Feature	1	Seed	Poaceae			carbonized	FALSE	12	0.010	6/21/2022	TLM	
F52.4	Feature	2	Seed	Poaceae			partially carbonized	FALSE	4	0.005	6/21/2022	TLM	
F52.4	Feature	3	Seed		Polygonum		carbonized	FALSE	4	0.002	6/21/2022	TLM	
F52.4	Feature	4	Seed	Unidentified			carbonized	FALSE	7	0.024	6/21/2022	TLM	
F52.4	Feature	5	Seed	Rosaceae			carbonized	FALSE	2	0.038	6/21/2022	TLM	
F52.4	Feature	6	Seed		Morus		carbonized	TRUE	3	0.014	6/21/2022	TLM	
F52.4	Feature	7	Seed		Galium		carbonized	FALSE	1	0.004	6/21/2022	TLM	
F52.4	Feature	8	Kernel		Zea	mays	carbonized	FALSE	35	0.280	6/21/2022	TLM	
F52.4	Feature	9	Kernel		Zea	mays	partially carbonized	FALSE	5	0.036	6/21/2022	TLM	
F52.4	Feature	10	Cupule		Zea	mays	carbonized	FALSE	37	0.169	6/21/2022	TLM	
F52.4	Feature	11	Cupule		Zea	mays	partially carbonized	FALSE	25	0.121	6/21/2022	TLM	
F52.4	Feature	12	Cupule/Glume		Zea	mays	carbonized	FALSE	5	0.027	6/21/2022	TLM	

F52.4	Feature	13	Glume		Zea	mays	carbonized	FALSE	3	0.007	6/21/2022	TLM	
F52.4	Feature	14	Unidentified		Zea	mays	carbonized	TRUE	7	0.025	6/21/2022	TLM	
F52.4	Feature	15	Fungus				carbonized	FALSE	39	0.164	6/21/2022	TLM	
F52.4	Feature	16	Unidentified				carbonized	FALSE	48	0.254	6/21/2022	TLM	
F52.4	Feature	17	Unidentified				partially carbonized	FALSE	64	0.296	6/21/2022	TLM	
F52.4	Feature	18	Nutshell		Carya		carbonized	FALSE	19	0.322	6/21/2022	TLM	
F52.4	Feature	19	Nutshell		Carya		partially carbonized	FALSE	14	0.248	6/21/2022	TLM	
F52.4	Feature	20	Nutshell		Quercus		carbonized	FALSE	17	0.074	6/21/2022	TLM	
F52.4	Feature	21	Nutshell		Quercus		partially carbonized	FALSE	3	0.022	6/21/2022	TLM	
F52.4	Feature	22	Nutshell	Unidentified			carbonized	FALSE	59	0.434	6/21/2022	TLM	
F52.4	Feature	23	Nutshell	Unidentified			partially carbonized	FALSE	20	0.207	6/21/2022	TLM	
F52.4	Feature	24	Wood Charcoal				partially carbonized	FALSE	80	0.714	6/21/2022	TLM	
F52.4	Feature	25	Wood Charcoal				carbonized	FALSE	3630	32.733	6/21/2022	TLM	Counts updated to include wood ID 11/27/22
F52.4	Feature	26	Bark				partially carbonized	FALSE	29	0.268	6/21/2022	TLM	
F52.4	Feature	27	Bark				carbonized	FALSE	486	9.262	6/21/2022	TLM	
F52.4	Feature	28	Unidentified				carbonized	FALSE	1	0.007	6/21/2022	TLM	cf resin?
F52.4	Feature	29	Stem				carbonized	FALSE	3	0.040	6/21/2022	TLM	
F52.4	Feature	30	Seed	Poaceae	Hordeum		carbonized	TRUE	4	0.005	11/27/2022	TLM	
F53.3	Feature	1	Seed		Polygonum		carbonized	FALSE	1	0.000	6/21/2022	TLM	<0.001g
F53.3	Feature	2	Bark				carbonized	FALSE	1525	24.729	6/21/2022	TLM	
F53.3	Feature	3	Bark				partially carbonized	FALSE	226	6.938	6/21/2022	TLM	
F55.8	Feature	1	Seed		Chenopodium		carbonized	FALSE	3	0.000	6/22/2022	TLM	<0.001g
F55.8	Feature	2	Seed		Rubus		partially carbonized	FALSE	1	0.000	6/22/2022	TLM	<0.001g
F55.8	Feature	3	Seed		Rubus		carbonized	FALSE	1	0.000	6/22/2022	TLM	<0.001g
F55.8	Feature	4	Seed	Poaceae			partially carbonized	FALSE	206	0.152	6/22/2022	TLM	

F55.8	Feature	5	Seed		Polygonum		carbonized	FALSE	1	0.000	6/22/2022	TLM	<0.001g
F55.8	Feature	6	Kernel		Zea	mays	carbonized	FALSE	31	0.133	6/22/2022	TLM	
F55.8	Feature	7	Kernel		Zea	mays	partially carbonized	FALSE	12	0.048	6/22/2022	TLM	
F55.8	Feature	8	Cupule		Zea	mays	carbonized	FALSE	11	0.061	6/22/2022	TLM	
F55.8	Feature	9	Cupule		Zea	mays	partially carbonized	FALSE	12	0.043	6/22/2022	TLM	
F55.8	Feature	10	Glume		Zea	mays	partially carbonized	FALSE	1	0.003	6/22/2022	TLM	
F55.8	Feature	11	Cupule/Glume		Zea	mays	partially carbonized	FALSE	1	0.004	6/22/2022	TLM	
F55.8	Feature	12	Unidentified		Zea	mays	carbonized	TRUE	2	0.007	6/22/2022	TLM	
F55.8	Feature	13	Unidentified		Zea	mays	partially carbonized	TRUE	2	0.005	6/22/2022	TLM	
F55.8	Feature	14	Nutshell		Carya		carbonized	FALSE	3	0.040	6/22/2022	TLM	
F55.8	Feature	15	Nutshell		Corylus		partially carbonized	TRUE	1	0.002	6/22/2022	TLM	
F55.8	Feature	16	Wood Charcoal				carbonized	FALSE	1595	15.323	6/22/2022	TLM	counts estimated, Counts updated to include wood ID 11/27/22
F55.8	Feature	17	Wood Charcoal				partially carbonized	FALSE	48	0.383	6/22/2022	TLM	
F55.8	Feature	18	Bark				carbonized	FALSE	353	8.703	6/22/2022	TLM	counts estimated
F55.8	Feature	19	Bark				partially carbonized	FALSE	38	0.261	6/22/2022	TLM	
F55.8	Feature	20	Fungus				partially carbonized	FALSE	2	0.005	6/22/2022	TLM	
F55.8	Feature	21	Unidentified				carbonized	FALSE	11	0.046	6/22/2022	TLM	
F55.8	Feature	22	Stem				carbonized	FALSE	2	0.007	6/22/2022	TLM	
F55.8	Feature	23	Stem				partially carbonized	FALSE	1	0.007	6/22/2022	TLM	

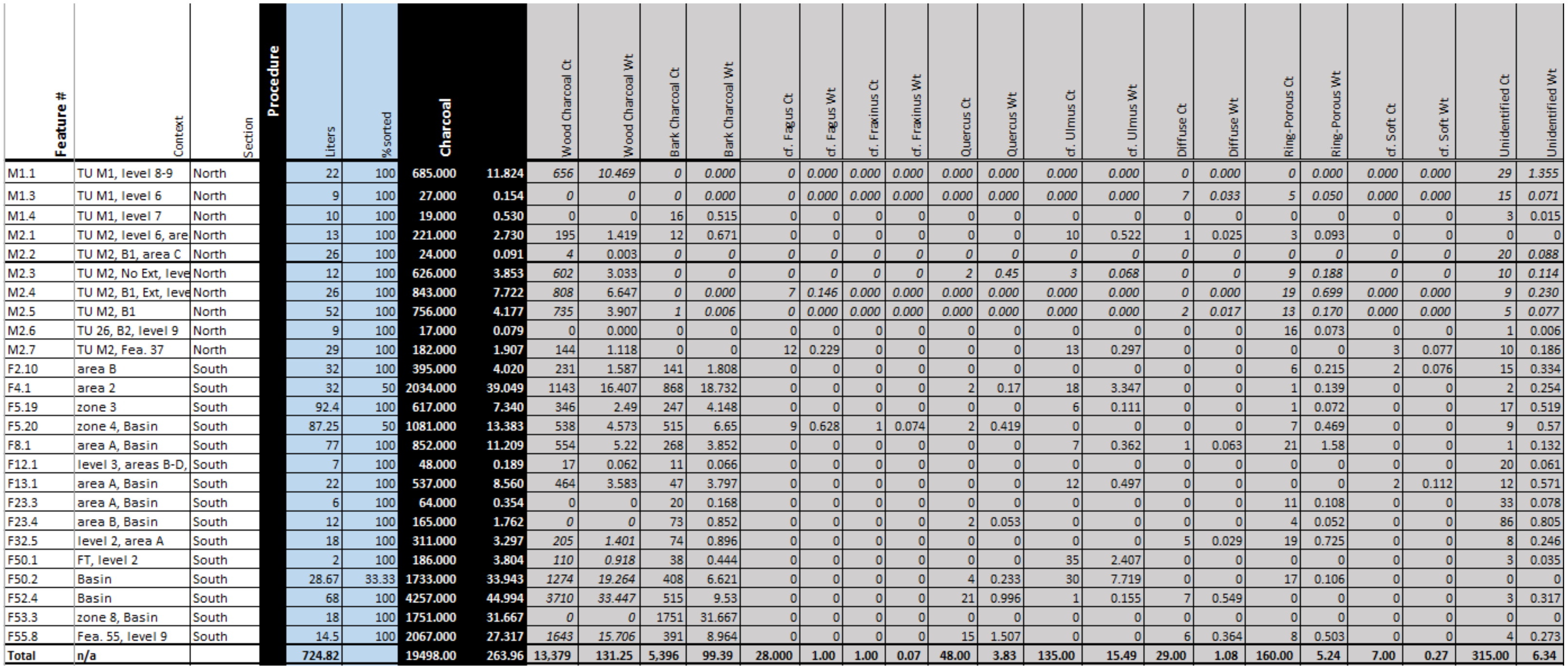
M1.1	Mortuary	1	Seed	Unidentified			carbonized	FALSE	1	0.000	6/8/2022	TLM	<0.001
M1.1	Mortuary	2	Seed	Urticaceae			carbonized	TRUE	2	0.003	6/8/2022	TLM	
M1.1	Mortuary	3	Fungus				carbonized	FALSE	12	0.066	6/8/2022	TLM	
M1.1	Mortuary	4	Wood Charcoal				carbonized	FALSE	656	10.469	6/8/2022	TLM	Counts updated to include wood ID 11/27/22
M1.1	Mortuary	5	Unidentified				carbonized	FALSE	1	0.021	6/8/2022	TLM	cf Resin
M1.3	Mortuary	1	Seed	Unidentified			carbonized	FALSE	2	0.000	6/8/2022	TLM	Fragments, <0.001g
M1.3	Mortuary	2	Seed	Poaceae			carbonized	FALSE	1	0.000	6/8/2022	TLM	<0.001g
M1.3	Mortuary	3	Nutshell		Corylus		carbonized	FALSE	1	0.033	6/8/2022	TLM	
M1.3	Mortuary	4	Wood Charcoal				carbonized	FALSE	20	0.153	6/8/2022	TLM	Sample Ct: 27, Wt: 0.154g
M1.4	Mortuary	1	Seed	Unidentified			carbonized	FALSE	1	0.000	6/8/2022	TLM	<0.001g
M1.4	Mortuary	2	Unidentified				carbonized	FALSE	1	0.000	6/8/2022	TLM	<0.001g
M1.4	Mortuary	3	Wood Charcoal				carbonized	FALSE	19	0.507	6/8/2022	TLM	Sample Ct: 19, Wt: 0.53g
M2.1	Mortuary	1	Seed	Unidentified			carbonized	FALSE	5	0.003	6/8/2022	TLM	Fragments
M2.1	Mortuary	2	Seed	Poaceae			carbonized	TRUE	2	0.002	6/8/2022	TLM	
M2.1	Mortuary	3	Seed		Iva		carbonized	TRUE	1	0.000	6/8/2022	TLM	<0.001g, axillaris?
M2.1	Mortuary	4	Seed		Scirpus		carbonized	FALSE	2	0.000	6/8/2022	TLM	<0.001g
M2.1	Mortuary	5	Kernel		Zea	mays	carbonized	FALSE	8	0.062	6/8/2022	TLM	
M2.1	Mortuary	6	Cupule		Zea	mays	carbonized	FALSE	12	0.073	6/8/2022	TLM	
M2.1	Mortuary	7	Glume		Zea	mays	carbonized	FALSE	5	0.011	6/8/2022	TLM	
M2.1	Mortuary	8	Cupule/Glume		Zea	mays	carbonized	FALSE	1	0.014	6/8/2022	TLM	
M2.1	Mortuary	9	Fungus				partially carbonized	FALSE	7	0.022	6/8/2022	TLM	
M2.1	Mortuary	10	Nutshell		Quercus		carbonized	FALSE	17	0.063	6/8/2022	TLM	
M2.1	Mortuary	11	Nutshell		Corylus		carbonized	FALSE	7	0.164	6/8/2022	TLM	
M2.1	Mortuary	12	Nutshell	Unidentified			carbonized	FALSE	2	0.038	6/8/2022	TLM	cf nutmeat?
M2.1	Mortuary	13	Nutshell	Unidentified			partially carbonized	FALSE	2	0.030	6/8/2022	TLM	cf nutmeat?
M2.1	Mortuary	14	Stem				carbonized	FALSE	1	0.009	6/8/2022	TLM	
M2.1	Mortuary	15	Wood Charcoal				carbonized	FALSE	195	1.419	6/8/2022	TLM	Counts updated to include wood ID 11/27/22

M2.1	Mortuary	16	Unidentified				carbonized	FALSE	8	0.033	6/8/2022	TLM	
M2.2	Mortuary	1	Seed	Unidentified			partially carbonized	FALSE	1	0.000	6/8/2022	TLM	<0.001g
M2.2	Mortuary	2	Nutshell		Quercus		carbonized	FALSE	1	0.002	6/8/2022	TLM	
M2.2	Mortuary	3	Wood Charcoal				carbonized	FALSE	4	0.003	6/8/2022	TLM	Counts updated to include wood ID 11/27/22
M2.2	Mortuary	4	Fungus				carbonized	FALSE	1	0.001	6/8/2022	TLM	
M2.3	Mortuary	1	Seed		Galium		carbonized	FALSE	1	0.005	6/8/2022	TLM	
M2.3	Mortuary	2	Seed	Vitaceae			partially carbonized	FALSE	1	0.006	6/8/2022	TLM	
M2.3	Mortuary	3	Kernel		Zea	mays	carbonized	FALSE	3	0.014	6/8/2022	TLM	
M2.3	Mortuary	4	Cupule		Zea	mays	carbonized	FALSE	19	0.104	6/8/2022	TLM	
M2.3	Mortuary	5	Cupule/Glume		Zea	mays	carbonized	FALSE	1	0.004	6/8/2022	TLM	
M2.3	Mortuary	6	Fungus				carbonized	FALSE	39	0.158	6/8/2022	TLM	
M2.3	Mortuary	7	Unidentified				carbonized	FALSE	3	0.017	6/8/2022	TLM	
M2.3	Mortuary	8	Nutshell		Carya		carbonized	FALSE	3	0.025	6/8/2022	TLM	
M2.3	Mortuary	9	Nutshell		Junglans		carbonized	TRUE	4	0.112	6/8/2022	TLM	
M2.3	Mortuary	10	Nutshell		Quercus		carbonized	FALSE	50	0.314	6/8/2022	TLM	
M2.3	Mortuary	11	Nutshell	Unidentified			carbonized	FALSE	11	0.065	6/8/2022	TLM	
M2.3	Mortuary	12	Nutshell	Unidentified			carbonized	FALSE	2	0.015	6/8/2022	TLM	nutmeat?
M2.3	Mortuary	13	Wood Charcoal				carbonized	FALSE	602	3.033	6/8/2022	TLM	Counts updated to include wood ID 11/27/22
M2.3	Mortuary	14	Stem				carbonized	FALSE	3	0.023	6/8/2022	TLM	
M2.3	Mortuary	15	Seed	Fabaceae			carbonized	FALSE	1	0.003	6/8/2022	TLM	
M2.3	Mortuary	16	Seed		Scirpus		carbonized	FALSE	4	0.002	6/8/2022	TLM	
M2.3	Mortuary	17	Seed		Scirpus		partially carbonized	FALSE	1	0.003	6/8/2022	TLM	
M2.3	Mortuary	18	Seed		Polygonum		carbonized	FALSE	1	0.000	6/8/2022	TLM	cf erectum, <0.001g
M2.3	Mortuary	19	Seed		Vaccinium		carbonized	TRUE	1	0.000	6/8/2022	TLM	<0.001g
M2.3	Mortuary	20	Seed	Unidentified			carbonized	FALSE	4	0.002	6/8/2022	TLM	
M2.4	Mortuary	1	Kernel		Zea	mays	carbonized	FALSE	10	0.091	6/14/2022	TLM	
M2.4	Mortuary	2	Cupule		Zea	mays	carbonized	FALSE	47	0.298	6/14/2022	TLM	
M2.4	Mortuary	3	Unidentified		Zea	mays	carbonized	TRUE	11	0.059	6/14/2022	TLM	
M2.4	Mortuary	4	Unidentified				carbonized	FALSE	21	0.106	6/14/2022	TLM	
M2.4	Mortuary	5	Nutshell		Quercus		carbonized	FALSE	53	0.309	6/14/2022	TLM	
M2.4	Mortuary	6	Nutshell		Corylus		carbonized	TRUE	8	0.129	6/14/2022	TLM	
M2.4	Mortuary	7	Nutshell		Carya		carbonized	TRUE	3	0.136	6/14/2022	TLM	
M2.4	Mortuary	8	Nutshell	Unidentified			carbonized	FALSE	13	0.197	6/14/2022	TLM	
M2.4	Mortuary	9	Wood Charcoal				carbonized	FALSE	808	6.647	6/14/2022	TLM	Counts updated to include wood ID 11/27/22
M2.4	Mortuary	10	Unidentified				carbonized	FALSE	2	0.020	6/14/2022	TLM	cf resin

M2.4	Mortuary	11	Fungus				carbonized	FALSE	10	0.029	6/14/2022	TLM	
M2.4	Mortuary	12	Seed		Polygonum		carbonized	FALSE	1	0.000	6/14/2022	TLM	<0.001g
M2.4	Mortuary	13	Seed	Poaceae			carbonized	TRUE	1	0.000	6/14/2022	TLM	<0.001g
M2.4	Mortuary	14	Seed		Galium		carbonized	FALSE	1	0.002	6/14/2022	TLM	
M2.4	Mortuary	15	Seed		Scirpus		carbonized	FALSE	2	0.000	6/14/2022	TLM	<0.001g
M2.4	Mortuary	16	Seed	Unidentified			carbonized	FALSE	1	0.000	6/14/2022	TLM	<0.001g
M2.4	Mortuary	17	Seed		Chenopodium		partially carbonized	FALSE	10	0.008	6/14/2022	TLM	carbonization indeterminate
M2.4	Mortuary	18	Seed		Amaranthus		partially carbonized	FALSE	10	0.003	6/14/2022	TLM	carbonization indeterminate, mostly fragments
M2.4	Mortuary	19	Seed	Fabaceae			carbonized	FALSE	1	0.003	6/14/2022	TLM	
M2.4	Mortuary	20	Unidentified				carbonized	FALSE	3	0.004	6/14/2022	TLM	
M2.5	Mortuary	1	Seed		Crataegus		carbonized	TRUE	4	0.009	6/14/2022	TLM	includes fragments
M2.5	Mortuary	2	Seed	Poaceae			carbonized	FALSE	7	0.006	6/14/2022	TLM	
M2.5	Mortuary	3	Seed		Polygonum		carbonized	FALSE	5	0.003	6/14/2022	TLM	
M2.5	Mortuary	4	Seed		Rubus		carbonized	FALSE	2	0.000	6/14/2022	TLM	<0.001g
M2.5	Mortuary	5	Seed		Scirpus		carbonized	FALSE	9	0.004	6/14/2022	TLM	
M2.5	Mortuary	6	Seed	Unidentified			carbonized	FALSE	12	0.018	6/14/2022	TLM	Unid seeds and fragments
M2.5	Mortuary	7	Cupule/Glume		Zea	mays	carbonized	FALSE	36	0.200	6/14/2022	TLM	
M2.5	Mortuary	8	Kernel		Zea	mays	carbonized	FALSE	8	0.041	6/14/2022	TLM	
M2.5	Mortuary	9	Unidentified		Zea	mays	carbonized	FALSE	13	0.051	6/14/2022	TLM	
M2.5	Mortuary	10	Nutshell		Corylus		carbonized	TRUE	1	0.003	6/14/2022	TLM	
M2.5	Mortuary	11	Nutshell		Quercus		carbonized	FALSE	25	0.099	6/14/2022	TLM	
M2.5	Mortuary	12	Nutshell	Unidentified			carbonized	FALSE	3	0.024	6/14/2022	TLM	nutmeat?
M2.5	Mortuary	13	Unidentified				carbonized	FALSE	15	0.052	6/14/2022	TLM	
M2.5	Mortuary	14	Fungus				carbonized	FALSE	19	0.009	6/14/2022	TLM	
M2.5	Mortuary	15	Wood Charcoal				carbonized	FALSE	735	3.907	6/14/2022	TLM	Counts updated to include wood ID 11/27/22
M2.5	Mortuary	16	Seed		Vaccinium		carbonized	FALSE	10	0.000	6/14/2022	TLM	<0.001g

M2.6	Mortuary	1	Seed	Poaceae			carbonized	FALSE	2	0.002	6/14/2022	TLM	
M2.6	Mortuary	2	Seed		Polygonum		carbonized	FALSE	5	0.004	6/14/2022	TLM	
M2.6	Mortuary	3	Seed		Scirpus		carbonized	FALSE	2	0.001	6/14/2022	TLM	
M2.6	Mortuary	4	Seed		Vaccinium		carbonized	FALSE	1	0.000	6/14/2022	TLM	<0.001g
M2.6	Mortuary	5	Cupule/Glume		Zea	mays	carbonized	FALSE	15	0.026	6/14/2022	TLM	
M2.6	Mortuary	6	Unidentified		Zea	mays	carbonized	TRUE	47	0.031	6/14/2022	TLM	
M2.6	Mortuary	7	Unidentified				carbonized	FALSE	1	0.004	6/14/2022	TLM	
M2.6	Mortuary	8	Wood Charcoal				carbonized	FALSE	17	0.078	6/14/2022	TLM	Sample Ct: 17, Wt: 0.079g
M2.7	Mortuary	1	Seed	Poaceae			carbonized	FALSE	1	0.001	6/14/2022	TLM	cf. digitaria?
M2.7	Mortuary	2	Seed		Vaccinium		carbonized	FALSE	6	0.001	6/14/2022	TLM	
M2.7	Mortuary	3	Seed		Portulaca		carbonized	FALSE	3	0.000	6/14/2022	TLM	<0.001g
M2.7	Mortuary	4	Seed		Rubus		carbonized	FALSE	2	0.000	6/14/2022	TLM	<0.001g
M2.7	Mortuary	5	Seed	Unidentified			carbonized	FALSE	4	0.000	6/14/2022	TLM	<0.001g, fragments
M2.7	Mortuary	6	Cupule/Glume		Zea	mays	carbonized	FALSE	6	0.031	6/14/2022	TLM	
M2.7	Mortuary	7	Kernel		Zea	mays	carbonized	FALSE	2	0.018	6/14/2022	TLM	
M2.7	Mortuary	8	Unidentified		Zea	mays	carbonized	TRUE	3	0.041	6/14/2022	TLM	
M2.7	Mortuary	9	Nutshell		Corylus		carbonized	TRUE	2	0.028	6/14/2022	TLM	
M2.7	Mortuary	10	Nutshell		Quercus		carbonized	FALSE	6	0.043	6/14/2022	TLM	
M2.7	Mortuary	11	Nutshell	Unidentified			carbonized	FALSE	1	0.008	6/14/2022	TLM	
M2.7	Mortuary	12	Fungus				carbonized	TRUE	9	0.061	6/14/2022	TLM	
M2.7	Mortuary	13	Unidentified				carbonized	FALSE	13	0.101	6/14/2022	TLM	
M2.7	Mortuary	14	Wood Charcoal				carbonized	FALSE	144	1.118	6/14/2022	TLM	

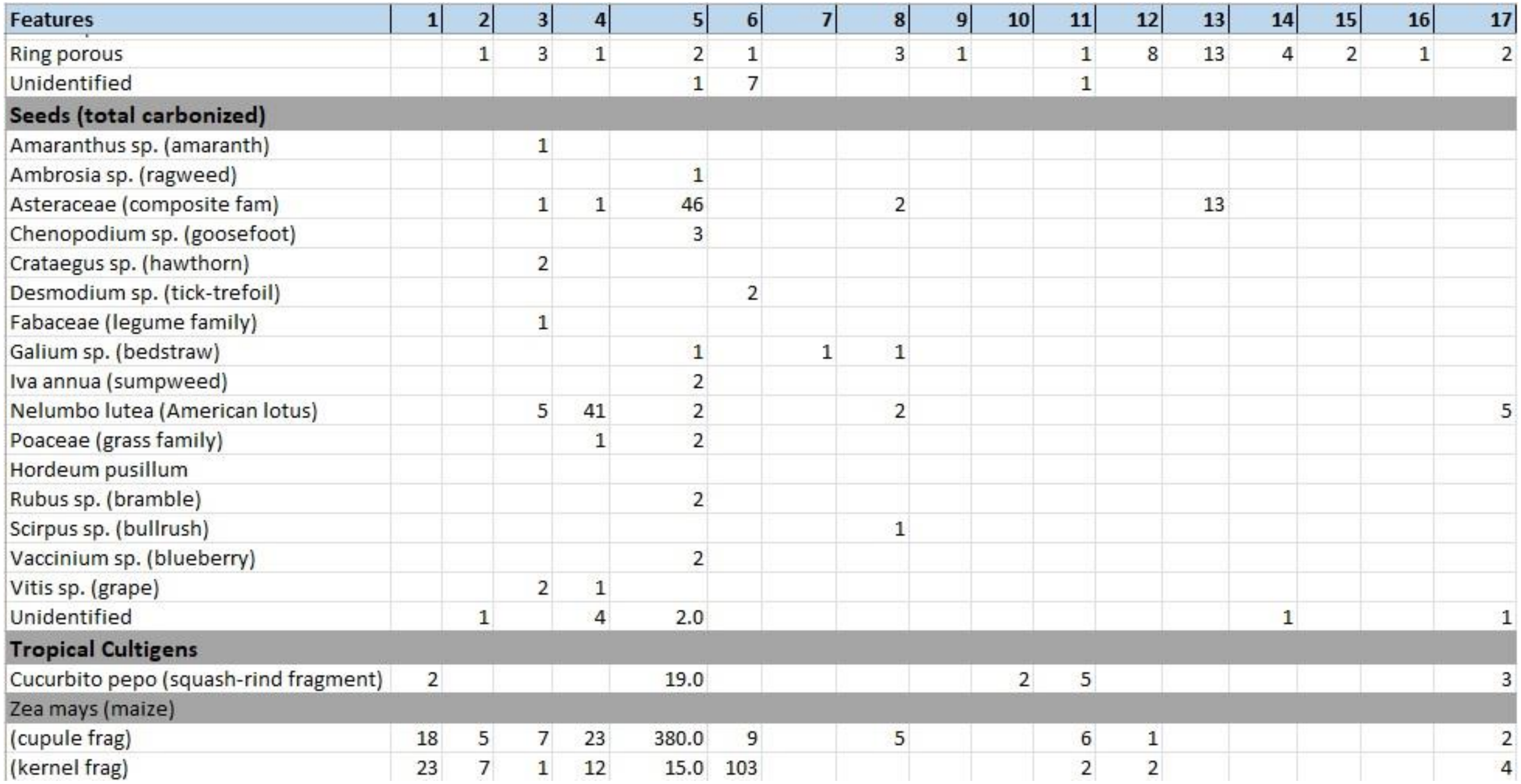
APPENDIX C: ROBINSON RESERVE WOOD CHARCOAL DATA



Feature #	Context	Section	Procedure		Charcoal		Wood Charcoal Ct	Wood Charcoal Wt	Bark Charcoal Ct	Bark Charcoal Wt	cf. Fagus Ct	cf. Fagus Wt	cf. Fraxinus Ct	cf. Fraxinus Wt	Quercus Ct	Quercus Wt	cf. Ulmus Ct	cf. Ulmus Wt	Diffuse Ct	Diffuse Wt	Ring-Porous Ct	Ring-Porous Wt	cf. Soft Ct	cf. Soft Wt	Unidentified Ct	Unidentified Wt
			Liters	%sorted																						
M1.1	TU M1, level 8-9	North	22	100	685.000	11.824	*656*	*10.469*	*0*	*0.000*	*0*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0*	*0.000*	*0*	*0.000*	*0.000*	*0.000*	*29*	*1.355*
M1.3	TU M1, level 6	North	9	100	27.000	0.154	*0*	*0*	*0*	*0.000*	*0*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*7*	*0.033*	*5*	*0.050*	*0.000*	*0.000*	*15*	*0.071*
M1.4	TU M1, level 7	North	10	100	19.000	0.530	0	0	16	0.515	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0.015
M2.1	TU M2, level 6, are	North	13	100	221.000	2.730	195	1.419	12	0.671	0	0	0	0	0	0	10	0.522	1	0.025	3	0.093	0	0	0	0
M2.2	TU M2, B1, area C	North	26	100	24.000	0.091	*4*	0.003	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*20*	*0.088*
M2.3	TU M2, No Ext, leve	North	12	100	626.000	3.853	*602*	3.033	*0*	*0*	*0*	*0*	*0*	*0*	*2*	*0.45*	*3*	*0.068*	*0*	*0*	*9*	*0.188*	*0*	*0*	*10*	*0.114*
M2.4	TU M2, B1, Ext, leve	North	26	100	843.000	7.722	*808*	6.647	*0*	*0.000*	*7*	*0.146*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0*	*0.000*	*19*	*0.699*	*0.000*	*0.000*	*9*	*0.230*
M2.5	TU M2, B1	North	52	100	756.000	4.177	*735*	3.907	*1*	*0.006*	*0*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*2*	*0.017*	*13*	*0.170*	*0.000*	*0.000*	*5*	*0.077*
M2.6	TU 26, B2, level 9	North	9	100	17.000	0.079	0	0.000	0	0	0	0	0	0	0	0	0	0	0	0	16	0.073	0	0	1	0.006
M2.7	TU M2, Fea. 37	North	29	100	182.000	1.907	144	1.118	0	0	12	0.229	0	0	0	0	13	0.297	0	0	0	0	3	0.077	10	0.186
F2.10	area B	South	32	100	395.000	4.020	231	1.587	141	1.808	0	0	0	0	0	0	0	0	0	0	6	0.215	2	0.076	15	0.334
F4.1	area 2	South	32	50	2034.000	39.049	1143	16.407	868	18.732	0	0	0	0	2	0.17	18	3.347	0	0	1	0.139	0	0	2	0.254
F5.19	zone 3	South	92.4	100	617.000	7.340	346	2.49	247	4.148	0	0	0	0	0	0	6	0.111	0	0	1	0.072	0	0	17	0.519
F5.20	zone 4, Basin	South	87.25	50	1081.000	13.383	538	4.573	515	6.65	9	0.628	1	0.074	2	0.419	0	0	0	0	7	0.469	0	0	9	0.57
F8.1	area A, Basin	South	77	100	852.000	11.209	554	5.22	268	3.852	0	0	0	0	0	0	7	0.362	1	0.063	21	1.58	0	0	1	0.132
F12.1	level 3, areas B-D,	South	7	100	48.000	0.189	17	0.062	11	0.066	0	0	0	0	0	0	0	0	0	0	0	0	0	0	20	0.061
F13.1	area A, Basin	South	22	100	537.000	8.560	464	3.583	47	3.797	0	0	0	0	0	0	12	0.497	0	0	0	0	2	0.112	12	0.571
F23.3	area A, Basin	South	6	100	64.000	0.354	0	0	20	0.168	0	0	0	0	0	0	0	0	0	0	11	0.108	0	0	33	0.078
F23.4	area B, Basin	South	12	100	165.000	1.762	*0*	*0*	73	0.852	0	0	0	0	2	0.053	0	0	0	0	4	0.052	0	0	86	0.805
F32.5	level 2, area A	South	18	100	311.000	3.297	*205*	*1.401*	74	0.896	0	0	0	0	0	0	0	0	5	0.029	19	0.725	0	0	8	0.246
F50.1	FT, level 2	South	2	100	186.000	3.804	*110*	*0.918*	38	0.444	0	0	0	0	0	0	35	2.407	0	0	0	0	0	0	3	0.035
F50.2	Basin	South	28.67	33.33	1733.000	33.943	*1274*	*19.264*	408	6.621	0	0	0	0	4	0.233	30	7.719	0	0	17	0.106	0	0	0	0
F52.4	Basin	South	68	100	4257.000	44.994	*3710*	*33.447*	515	9.53	0	0	0	0	21	0.996	1	0.155	7	0.549	0	0	0	0	3	0.317
F53.3	zone 8, Basin	South	18	100	1751.000	31.667	*0*	*0*	1751	31.667	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
F55.8	Fea. 55, level 9	South	14.5	100	2067.000	27.317	*1643*	*15.706*	391	8.964	0	0	0	0	15	1.507	0	0	6	0.364	8	0.503	0	0	4	0.273
Total	**n/a**		**724.82**		**19498.00**	**263.96**	**13,379**	**131.25**	**5,396**	**99.39**	**28.000**	**1.00**	**1.00**	**0.07**	**48.00**	**3.83**	**135.00**	**15.49**	**29.00**	**1.08**	**160.00**	**5.24**	**7.00**	**0.27**	**315.00**	**6.34**

APPENDIX D: WASHINGTON IRVING RAW DATA

Features	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**
Total Wt. Charcoal (g)	16	1	5.7	4.4	119.3	10.1	0.2	4.6	1.9	2	0.3	7.6	0.5	0.2	0.1	0.1	325.8
Flot Volume (L)	47	16	31.8	48.2	119.1	86.4	22.7	39.1	4.5	7.3	7.3	641.5	85	79	12.5	47	1180
Nut (total frag.)	48	10	21	180	637	18	4	34	4	14	6						29
Carya spp. (hickory)	41	9	6	44	261		3	15		1	4						6
Carya illinoensis (pecan)	4				1			10									
Corylus americana (hazelnut)	1				106					3							21
Juglans nigra (black walnut)	2		1	2	1			1									
Juglandaceae (walnut/hickory family)		1	10	20	268	18	1	8	4	10	2						
Quercus sp. (acorn)			4	114													2
Wood (total frag)	###	164	600	545	11548	1729	22	40	294	135	37	167	28	24	8	10	9188
Acer sp. (maple)						1											
Carya sp. (hickory)	1	1	4	1	11	1	1	9	4	1		2					2
Fraxinus sp. (ash)		1			1	2											
Juglans sp. (walnut)											1						
Morus rubra (mulberry)						1											
Pinus sp. (pine)					1.0												
Quercus sp.(white oak fam)	39	26	53	35	141	43	3	27	15	18	7		11	14	6	9	16
Quercus sp. (red oak fam)				2	2			1		1			2				
Quercus sp.												10					
Platanus occidentalis																	
Diffuse porous					1									2			
Ring porous		1	3	1	2	1		3	1		1	8	13	4	2	1	2
Unidentified					1	7					1						



Features	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Ring porous		1	3	1	2	1		3	1		1	8	13	4	2	1	2
Unidentified					1	7					1						
Seeds (total carbonized)																	
Amaranthus sp. (amaranth)			1														
Ambrosia sp. (ragweed)					1												
Asteraceae (composite fam)			1	1	46			2					13				
Chenopodium sp. (goosefoot)					3												
Crataegus sp. (hawthorn)			2														
Desmodium sp. (tick-trefoil)						2											
Fabaceae (legume family)			1														
Galium sp. (bedstraw)					1		1	1									
Iva annua (sumpweed)					2												
Nelumbo lutea (American lotus)			5	41	2			2									5
Poaceae (grass family)				1	2												
Hordeum pusillum																	
Rubus sp. (bramble)					2												
Scirpus sp. (bullrush)								1									
Vaccinium sp. (blueberry)					2												
Vitis sp. (grape)			2	1													
Unidentified		1		4	2.0									1			1
Tropical Cultigens																	
Cucurbito pepo (squash-rind fragment)	2				19.0					2	5						3
Zea mays (maize)																	
(cupule frag)	18	5	7	23	380.0	9		5			6	1					2
(kernel frag)	23	7	1	12	15.0	103					2	2					4

Features	17	18	19	20	21	23	24	26	27	28	29	30	31	32	33	35/36	37	TOTALS
Total Wt. Charcoal (g)	325.8	0.3	0.4	2.2	0.3	1.7			0.65	0.1	0.1			1.3	0.7	0.1	0.9	**508.45**
Flot Volume (L)	1180	93	69	291	26.5	70	6	4	79		5.5			85	96	4.5	16.5	**3321.1**
Nut (total frag.)	29	3	2	4								1		1				**1016**
Carya spp. (hickory)	6	2		3								1		1				**397**
Carya illinoensis (pecan)																		**15**
Corylus americana (hazelnut)	21	1																**132**
Juglans nigra (black walnut)																		**7**
Juglandaceae (walnut/hickory family)																		**342**
Quercus sp. (acorn)	2		2	1														**123**
Wood (total frag)	9188	15	36	131	26	55			35	8	5			41	52	14	121	**26650**
Acer sp. (maple)										3								**4**
Carya sp. (hickory)	2													1	2			**41**
Fraxinus sp. (ash)																		**4**
Juglans sp. (walnut)																		**1**
Morus rubra (mulberry)																		**1**
Pinus sp. (pine)																		**1**
Quercus sp.(white oak fam)	16	6	35	39	5	13			14	5	3			6	15	11	16	**631**
Quercus sp. (red oak fam)				2										6				**16**
Quercus sp.																		**10**
Platanus occidentalis						2												**2**
Diffuse porous				1		2					2						3	**11**
Ring porous	2	6		8	6	2			2	2				3	3			**75**
Unidentified		3	1	10	1	1			1	1				1		3	1	**32**

Features	17	18	19	20	21	23	24	26	27	28	29	30	31	32	33	35/36	37	TOTALS
Ring porous	2	6		8	6	2			2	2				3	3			**75**
Unidentified		3	1	10	1	1			1	1				1		3	1	**32**
Seeds (total carbonized)																		
Amaranthus sp. (amaranth)																		**1**
Ambrosia sp. (ragweed)																		**1**
Asteraceae (composite fam)			1															**64**
Chenopodium sp. (goosefoot)		1		1														**5**
Crataegus sp. (hawthorn)																		**2**
Desmodium sp. (tick-trefoil)																		**2**
Fabaceae (legume family)																		**1**
Galium sp. (bedstraw)																		**3**
Iva annua (sumpweed)																		**2**
Nelumbo lutea (American lotus)	5	1																**56**
Poaceae (grass family)																		**3**
Hordeum pusillum														1				**1**
Rubus sp. (bramble)																		**2**
Scirpus sp. (bullrush)																		**1**
Vaccinium sp. (blueberry)																		**2**
Vitis sp. (grape)																		**3**
Unidentified	1		3	1	1												1	**15**
Tropical Cultigens																		
Cucurbito pepo (squash-rind fragment)	3										2							**33**
Zea mays (maize)																		
(cupule frag)	2																	**456**
(kernel frag)	4	1		11	1	3					1						1	**187**

APPENDIX E: ROBINSON RESERVE SEED PHOTOS

Note: Photos edited by Curran M. Fitzgerald

Above: Unidentified genus of Composite family (Asteraceae) seeds.

Above: Poaceae (cf. *Hordeum pusillum*) seeds.

Above: Knotweed (*Polygonum* sp.) seeds.