

## Early Paleoindian Subsistence Strategies in Eastern North America: A Continuation of the Clovis Tradition? Or Evidence of Regional Adaptations?

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**O**n a continental scale, Clovis subsistence strategies are often characterized by the hunting of large game. Although differences in early Paleoindian subsistence choices between western and eastern North America appear to exist, this assertion remains controversial. While no one would attempt to define “Clovis” by subsistence strategy alone, subsistence practices have figured prominently in discussions of Clovis adaptations and behaviors (e.g., Kelly and Todd 1988; Martin 1973; Mason 1962). For these reasons, identifying variation, or lack thereof, in Clovis subsistence strategies becomes essential to our understanding of whether the continent-wide presence of “Clovis” technology represents a homogenous adaptive strategy or a combination of different regional adaptations and subsistence choices. Further, we must understand whether Clovis subsistence adaptations are really different from those associated with later fluted point traditions. Without exploring these issues it is difficult to better understand Clovis, which is the focus of this volume. In this brief paper, the goal is twofold: review subsistence data from fluted point sites in eastern North America and compare these data to our current understanding of Clovis adaptive strategies.

### *A Note on Eastern Fluted Point Technology and Geographical Area*

As demonstrated by the chapters in this book, there is a well-established Clovis occupation in eastern North America. For much of the Northeast, however, the early fluted point period consists of fluted projectile point technologies that are arguably distinct from western Clovis forms. These point styles include: Bull Brook, Gainey, Kings Road/Whipple, and Vail/Debert. While some of these point styles may be contemporaneous with Western Clovis technology, many of the dates associated with these point types are around 10,700 <sup>14</sup>C BP or later (Table 1). Nevertheless, many of these styles appear to represent the first populations in the region, which are followed by later well-dated Barnes or Michaud-Neponset styles which cluster around 10,200 <sup>14</sup>C BP. Although this volume focuses on Clovis archaeology, we cannot characterize Early Paleoindian subsistence activities without discussing later sites. Therefore, the sites discussed in this chapter include all fluted point sites from eastern North America containing subsistence residues, which span a period from ca. 11,000 <sup>14</sup>C [[see above]]BP to 10,200 <sup>14</sup>C BP. Our geographical area in this study includes all sites east of the Mississippi and north to the Great Lakes area.

**TABLE 1.** Hypothesized Cultural chronology for eastern North America\*

<i>Period</i>	<i><sup>14</sup>C BP</i>	<i>Major Cultural Components</i>
Early Paleoindian	11,500–10,700	Clovis, Gainey, Debert-Vail, Redstone, Whipple-Kings Road, Bull Brook?
Middle Paleoindian	10,600–10,200	Cumberland, Suannee, Bull Brook? Barnes, Michaud-Neponset
Late Paleoindian	10,200–10,000	Quad, Beaver Lake, Crowfield, Dalton, Plano,

\*Table compiled from Anderson et al. 1996, Bradley et al. 2008, and data in Miller and Gingerich 2013.

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### *Subsistence remains from eastern North America*

Unlike some areas of North America, preservation of organic materials, including bone, is extremely poor in the east. Faunal collections from the region are sparse, highly deteriorated, and yield comparatively few data compared to western Paleoindian sites with superior bone preservation. Preservation of plant remains in the east is equally problematic. Despite these factors, the data is not as bleak as many would expect; there are currently 24 Paleoindian sites from eastern North America that contain floral or faunal materials, which may be evidence of subsistence activities (Table 2). Some of these sites show the use of a wide range of species compared to western Paleoindian sites. These remains have contributed to a long debate in American archaeology that questions whether Paleoindians were subsistence “specialists” or “generalists.” It is our intention to use the subsistence data from eastern North America to explore further whether these data support arguments for a universal Paleoindian subsistence strategy.

### *Evaluating the Subsistence Data from Eastern Fluted Point Sites*

The data presented above suggest that a number of plant and animal species were used during the end of the Pleistocene. While much previous work has focused on the diversity of fauna used across the Americas during the Paleoindian period (e.g., Cannon and Meltzer 2004, 2008; Waguespack and Surovell 2003; Surovell and Waguespack 2009), few studies have incorporated the presence of plant remains from Paleoindian contexts to examine how these residues may contribute to our understanding of foraging activities. The exclusion of these remains is likely due to their small quantities and their rare occurrences at archaeological sites. In this paper, we examine plant remains by region and in concert with other subsistence remains (i.e., fauna) to see what patterns emerge.

## Floral Remains

Shawnee-Minisink is perhaps the best known site for producing a large and well-dated inventory of plant remains from Clovis contexts. Although Gingerich (2011) has argued that some of these plant remains may not represent subsistence activities, for purposes of this paper we adopt a less conservative approach. Here we assume that all of the floral and faunal remains from Shawnee-Minisink are the by-products of human foraging activities. Because Shawnee-Minisink is a well-dated Clovis site, we use the inventory of subsistence remains from this site to compare with other (presumed) later Paleoindian sites from the region (Table 1 and 2).

With the exception of Shawnee-Minisink, most sites offer limited evidence of plant use. Cactus Hill has Clovis dates and diagnostics, but has produced only a small number of hickory nutshells. Hedden and Michaud, which are both post-Clovis in age, have produced seeds representing fruits. The Colebrook site has produced macrobotanical remains from a hearth feature, and a few of these remains may also represent fruit seeds (Kitchel 2008; 2010), though a positive identification is needed. Finally, a single charred water lily seed was recovered at the Jefferson III site. From this meager dataset, the only pattern that recurs is the presence of fruits and possibly herbaceous species (Table 3).

Given this inventory, how should we interpret the botanical materials recovered from Paleoindian sites in eastern North America? As highly mobile gathering populations operating at low population densities (Frison 1991; Kelly 1996; 1999; Kelly and Todd 1988; Pearson 2001), Paleoindians likely faced little if any pressure to include in their diet low return-rate subsistence resources such as small seeds. Furthermore, there is little if any evidence of plant processing tools in the Paleoindian record (Haynes 2002) that would facilitate the processing of large quantities of plant foods. These artifacts do not appear in the archeological record until the Early Archaic, around 8,000 BP (e.g., The Koster site, Waint et al. 2009). The occurrence of plant processing tools also corresponds to a dramatic increase in the number of plant subsistence remains from sites (e.g., Shawnee-Minisink, Dust Cave, Cactus Hill) where plant remains usually increase by at least tenfold. Fire-cracked rock, which is often a remnant of cooking technology involving the use of plants (e.g., Thoms 2009), is also absent in the Paleoindian period. These data all suggest that if plants played a role in Paleoindian diets they were likely foods that had low acquisition and processing costs, and minimal cooking requirements.

The use of optimal foraging and diet breadth models (e.g., Kelly 1995) provides a theoretical framework to infer Paleoindian dietary practices from the materials recovered at Paleoindian sites. Optimal foraging models predict what food resources will be taken based on caloric returns, processing costs, and encounter rate. Therefore, if the archaeological record suggests a pattern of species that require low processing costs, and there are theoretical reasons to expect Paleoindians to select only plants with high return rates, given factors of mobility and technology (Kelly 1996, 1999; Kelly and Todd 1988; Pearson 2001), we can define parameters to predict what plants might be included in the diet. For example, since berries occur in many sites

**TABLE 2.** Summary of Paleoindian subsistence remains in eastern North America.

<i>Site</i>	<i>Subsistence Residue</i>	<i>Counts (If Available)</i>	<i>Secure Assoc.</i>	<i>Date/ Period</i>
Boaz	Mastodon	1 mastodon	?	Early–Mid Paleo
Bull Brook	Caribou; unidentified mammal; castor	Caribou 3; Cervid 11; Castor 1; Large Mam. 3; Small Mam. 4; Unidentified/unk. 1000+	x	E. Paleo
Bull Brook II	Unidentified bone	1	x	E. Paleo
Whipple	Caribou; Cervid; unidentified mammal	Caribou 3; Cervid 15; Large to medium size mam. 36; Unid mam. 54; unidentified frags 242	x	E. Paleo
Michaud	Cervid; unidentified mammal; fruit berry	Cervid 4; Med to large mam. 7; unid. mam. 16; 1 berry seed Fragment	x	Mid Paleo Michaud-Neponset 10,200±200
Shawnee	Hawthorn; <i>Rubus</i> ; buckbean; Chenopod; amaranth; acalypha; smartweed; hackberry; grape; winter cress; hickory nut; fish and unid. bone	Hawthorn 150; Chenopod 23; Rubus 15; acalypha 13; hickory nut 5; grape 3; smartweed; buck bean 2; hackberry 1; amaranth 1 winter cress 1; Poss. fish 1; unid. bone 18	x	Clovis—avg. of 5 <sup>14</sup> C dates 10,935±15
Cactus Hill	Hickory nut; and cervid bone	Cervid? Large ungulate scapula fragment 1	x?	Clovis; 10,920±250
Hedden	<i>Rubus</i> sp.; bunchberry; bristly sarsaparilla ; grape	<i>Rubus</i> sp. 2; bunchberry 5; bristly sarsaparilla 3; grape 1.	x/?	Mid. Paleo
Colebrook	Unid. plant remains; possibly <i>Rubus</i> sp.; Cloudberry; <i>Vaccinium</i> & Chenopod; Unid. bone	3 possible fruit seeds; 1 poss. Chenopod; 1 bone of med. size mammal	x	Michaud-Neponset 10,290 ± 170; 10,220 ± 50 <sup>14</sup> C BP
Jefferson III	Water lily seed	1 water lily seed	x	E. Paleo
Coats-Hines	Proboscidean, deer, horse, muskrat, frog, turkey, turtle, canid.	2 excavated Mastodon; and a third unexcavated;	x	E. Paleo?

<i>Reference</i>	<i>Comments</i>
Palmer and Stoltman 1975	Possibly associated with fluted point—see references and Grayson and Meltzer 2002
Byers (1955); Spiess et al. (1998:210); Robinson et al. 2009	Calcine bone fragments directly associated with Paleoindian artifacts—caribou bones directly dated
Grimes et al. 1984	Locus E heavily eroded calcined bone frag.-unidentifiable
Curran 1984; Spiess et al. 1984:150	Approx. 350 calcined fragments—some from probable hearth area.
Spiess and Wilson 1987	Counts from concentrations VII and VI (Spiess and Wilson 1987: 84–85); Berry from dated feature (7a).
Dent and Kauffman 1985; Gingerich 2011, 2013	Bone, hawthorns, and nut fragments from dated hearths. Remaining plant material found in excavation matrix. For discussion see Gingerich 2011.
McAvoy and McAvoy 1997; Scarry 1997; Whyte 1997	Flotation of the Clovis level has produced small amounts of hickory nutshell—although some of these charred hickory nutshells may be associated with hearths, some Clovis age hearths contained macrobotanical remains that were partially charred and therefore considered to be down drift (McAvoy and McAvoy 1997; McWeeney 1997). One calcined scapula fragment from a large ungulate (deer?) was recovered from a Paleoindian context in Area B, Unit 0/9, Level 5 (Whyte 1997). A specific context for this specimen is not provided but this level and Unit did contain the Clovis hearth dated to 10,920±250 (Beta-81589). We accept the bone as it is no different from the other remains widely accepted which are only in rough association with artifacts/features (e.g., Bull Brook)
Asch Sidell 1999	These remains were recovered from within a 20 cm level containing Paleoindian artifacts. Charcoal from the Paleoindian component produced dates of 10,500±60 and 10,580±60 14C BP. Some species may not exhibit a clear association with artifacts or features, however, the occurrence of multiple berry species within the early occupation level may suggest human exploitation of fruits rather than a marker of site vegetation.
Bunker and Potter 1999; Kitchel 2008; Kitchel and Boisvert 2011	Paleobotanical remains recovered from hearth feature. At least 3 coarse reticulate seeds, as well as other probable seed fragments, of which some may represent fruits. Attempts to provide species-level designations have been problematic and are being reevaluated. Bone excerpted from hearth area
Boisvert 2012; McWeeney 2007	Recovered from feature associated with the Paleoindian artifacts. Because of distance from site to water it is assumed this wetland plant was collected for subsistence (McWeeney 2007:155).
Breitbart, et al. 1996; Broster et al. 2013; Deiter-Wolf et al. 2011	Debitage associated with Mastodon A and 8 tools and 24 resharpening flakes was associated with Mastodon B. Mastodon B also had cut marks on the spinous process of a thoracic vertebra. Other species found in excavation matrix—apparently no clear association.

(continued)

**TABLE 2** (*continued*). Summary of Paleoindian subsistence remains in eastern North America.

<i>Site</i>	<i>Subsistence Residue</i>	<i>Counts (If Available)</i>	<i>Secure Assoc.</i>	<i>Date/ Period</i>
Tenant Swamp	Caribou; Cervid; otter?; unidentified mammal	Caribou 2; Cervid 1 med/large mam. 86; mam. or large bird 1; unid. bone 22; Poss. Otter 1	x	Mid Paleo (Michaud)
Sugarloaf	Cervid; unid mammal	Cervid 3; Med/large mam. 32; Unid. mam. 383; Unid bone 118	x	E. Paleo
Udora	Caribou, cervid, fox, hare, and unid. small, med. & large mammal	Caribou 3; cervid 3; fox 1; hare 3; med/large mam. 5; small mam. 7; unid. bone 268	x	Mid-Paleo
Holcomb Beach	Caribou	caribou 1	x	Mid-Late Paleo
Pleasant Lake	Mastodon	1 mastodon	x	Mid Paleo? 10,395±100
Schaefer	Mammoth	1 mammoth	?	E. Paleo?
Wacissa River	Bison, <i>odocoileus</i> , <i>palaeolama</i> , <i>Equus</i>		x	Early to Mid Paleo.
Little Salt Spring	<i>Sylvilagus</i> , <i>odocoileus</i> , <i>megalonyx</i> , <i>bison</i> , order <i>Proboscidea</i> , and Classes <i>Reptilia</i> and <i>Aves</i>		?	E. Paleo?
Hebior	Mammoth	1 Mammoth	x	E. Paleo
Sheriden Cave	<i>Platygonus</i> , Snapping turtle; Uniden. calcined bone		x/?	E. Paleo?
Hiscock	Mastodon; rodents, poss. fish, caribou	At least 8 mastodon	?	E. Paleo 10,990±100; 10,810±50
Guest	Mammoth	1 Mammoth	?	E. Paleo
Martin's Creek	Mastodon and Deer		?	?

Note: Brevity of this chapter prevented description of each site in detail; readers are encouraged to check provided references.

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*Reference**Comments*

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Goodby 2011; Spiess 2011	Most bone was found in direct association with Paleoindian tools and debitage
Gramly 1998	Bone from locus B excavated by Gramly in 1995
Storck and Spiess 1994	Identified bone comes from feature 1.
Fitting et al., 1966; Spiess et al., 1985	
Fisher 1984, 1987; Shipman et al. 1984	Although no artifacts were found, spatial patterning of the skeleton, disarticulation, disarticulation marks, and other evidence of bone modification argue for butchery/direct human interaction. [See Fisher 1984]
Overstreet and Kolb 2003	Two lithic artifacts associated with Mammoth remains and possible cut marks.
Webb et al. 1983, 1984	Projectile point embedded in bison skull. Other species may not be directly associated
Clausen et al. 1979; Holman and Clausen 1984; Also see Cannon and Meltzer 2004	All faunal remains from the sinkhole are not clearly associated with Paleoindian artifacts. One species that may be associated is giant tortoise, which was stabbed with a wooden spear or stake—the spear was dated to 12,030±200. [But see Discussion in Cannon and Meltzer 2004]
Overstreet 1998; Overstreet and Kolb 2003; Cannon and Meltzer 2004	Artifacts closely associated with mammoth bone.
Tankersley 1999; Tankersley et al. 2001; Redmond & Tankersley 2005	Contains burned platygonus bone and ilium that apparently has puncture wound? Vertebra of snapping turtle show chopping marks/cut marks. Other faunal material from cave may not be directly associated.
Laub 2002, 2003	Paleoindian artifacts and Mastodon occur within same level. Although bone tools made from mastodon provide evidence of human association and use of proboscideans in eastern North America, there is no clear evidence of subsistence use.
Hoffman 1987	Mammoth closely associated with artifacts.
Brush and Smith 1994	Artifacts found with bone—but may have been mixed from upper levels—blood residue from some o artifacts tested positive for Proboscidean blood. See also Grayson and Meltzer 2002

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**TABLE 3.** Plant types present at Eastern Paleoindian sites.

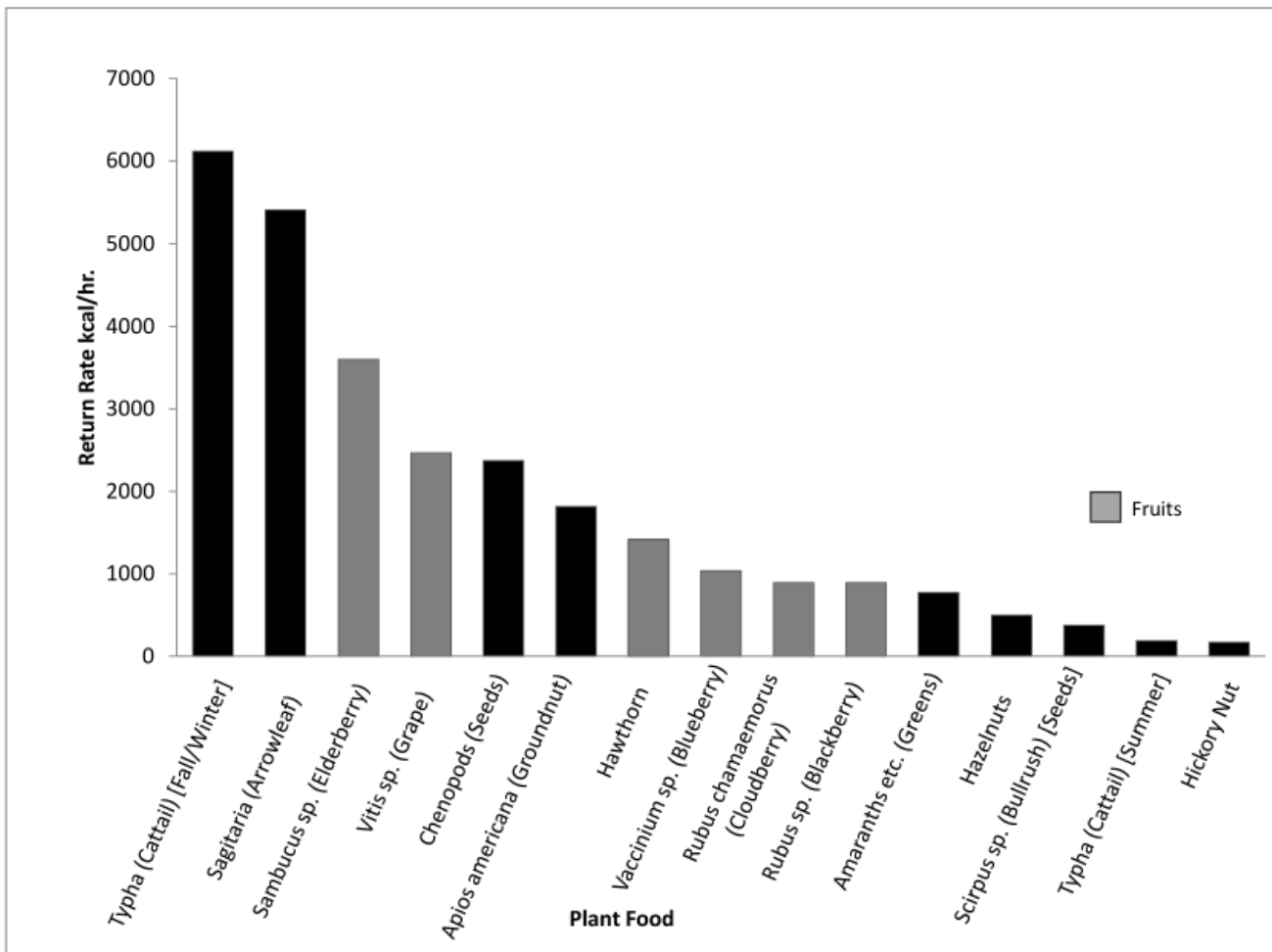
<i>Site</i>	<i>Fruits</i>	<i>Nuts</i>	<i>Herbaceous Sp.</i>	<i>Greens or Roots</i>
Shawnee-Minisink	x	x	x	x
Cactus Hill		x		
Jefferson III			x	
Michaud	x			
Colebrook	?		?	
Hedden	x			

and require no processing time, items that have higher caloric return rates, and negligible processing costs might also be expected to be present in the Paleoindian diet.

Using experimental and ethnographic data, we present the return rates of 15 plants, most of which have been found in the Paleoindian record (Figure 1; Table 4). If we only consider plants with low processing costs and high return rates, we get a list dominated by tubers and fruits (see Figure 1; Table 4). In this analysis, it is important to mention that some plants that exhibit high returns, such as tubers, are unlikely to be preserved in the archaeological record. It is also difficult to determine whether some of these species may have been avoided because of high opportunity costs. For instance, while rhizomes and tubers offer greater overall caloric return rates than berries, the minimum procurement and processing time of tubers exceeds that of berries, which incur zero processing cost. Therefore, the opportunity cost associated with gathering tubers and other root foods exceeds that of gathering berries. The inclusion of tubers in the diet then becomes a product, or evidence, of how much time Paleoindians were willing to devote to plant gathering. As dependence on plant foods increases, so would the importance of tubers in the diet, but these choices may also be influenced by seasonal caloric return rates.

Season of occupation is another factor that may influence accurate predictions of plant use based on caloric returns. Depending on the season, available plant portions and return rates can differ. This is especially true with both herbaceous species and tubers. Herbaceous species can be exploited for their foliage or for their seeds, which requires grinding and processing, or boiling to extract oils. Therefore, the presence of either plant species types in an archaeological site requires some speculation about season to infer their processing costs and caloric returns. A perfect example is chenopodium, which is reported at Shawnee-Minisink, possibly at Colebrook, and at many other later period sites. Chenopod seeds produce 400 calories per 100 grams compared to the foliage, which produces only 43 calories, a 90 per cent reduction (Scarry 2003, Table 3.3.). Additionally, the caloric return rates for species like cattail rhizomes differ dramatically between seasons. Cattail tubers gathered in the spring have experimentally derived caloric return rates of less than 400 calories per hour of processing, while cattail tubers gathered in the fall may have return rates of around 7,000 calories per hour (Madsen et al., 1997).





**FIGURE I.** Post-encounter return rates for a number of common species in eastern North America. Species with low processing costs and high return rates may be expected in Paleoindian sites. Note: This list is not exhaustive, but merely a list of common plant species that were both present in many locations throughout eastern North America and documented as being used by Native Americans. All data generated from values in Table 4.

Further, many plants known to have been exploited extensively by later populations in the east, such as chenopod seeds, have large costs associated with procurement and processing technology, compared to their return rates. Chenopod seeds, for example, have gross return rates that are similar to fruits like grape (around 2400 calories per hour<sup>1</sup>), but the technological costs associated with each is quite different. This is also true with hickory nuts. Although evidence of boiling technologies have not been found at Paleoindian sites (e.g., fire cracked rock, or heatable containers), crushing and boiling techniques to extract nut meat produce return rates around 1870 kcal/hr (Talalay et al., 1984). Using this processing method, hickory nuts fall between the return rates for hawthorns and grape, which require no technological investment or processing and are available during the same season. Therefore, when initial investment in technology is considered (see also Bettinger

**TABLE 4.** Available return rate data on select plants used in this study.

<i>Plant Food</i>	<i>Calories/ 100kg</i>	<i>Man Hours/ 100 kg</i>	<i>Return Rate kcal/hr.</i>	<i>Reference</i>
<i>Typha</i> (Cattail) [Fall/Winter]	367000	60	6116.667	Madsen et al. 1997
<i>Sagitaria</i> (Duck potato)	123000	60	5405	Darby 1996
<i>Sambucus</i> sp. (Elderberry)	72000	20	3600	Reidhead 1981
<i>Vitis</i> sp. (Grape)	69000	28	2464.286	Reidhead 1981
Chenopods (Seeds)	362690	153	2370.523	Reidhead 1981
<i>Apios americana</i> (Groundnut)	109000	60	1816.666	Scarry 2003 <sup>a</sup>
Hawthorn	92000	65	1415.385	Reidhead 1981
<i>Vaccinium</i> sp. (Blueberry)	62000	60	1033.333	Scarry 2003 <sup>b</sup>
<i>Rubus chamaemorus</i> (Cloudberry)	—	—	900	Est. from other <i>Rubus</i> Sp.
<i>Rubus</i> sp. (Blackberry)	58000	65	892.308	Reidhead 1981
Amaranths, Chenopod etc. (Greens)	33870	44	769.773	Reidhead 1981
Hazelnuts	633980	1277	496.460	Reidhead 1981
<i>Typha</i> (Cattail) [Summer]	—	—	374	Simms 1987; Madsen et al. 1997
<i>Scirpus</i> sp. (Bullrush) [Seeds]			185	Simms 1987
Hickory Nut	672920	4000	168.23	Reidhead 1981 <sup>c</sup>

<sup>a</sup> Nutrient value taken from Scarry (2003) return rates estimated from tuber collection time by Darby (1996) and Madsen et al. (1997)

<sup>b</sup> Caloric value from Scarry (2003) slightly reduced man/hours based on the absence of thorns on blueberries compared to *Rubus* sp.

<sup>c</sup> For consistency Reidhead's data was used for hickory nut. A popular experiment by Talalay et al. 1984 only showed a slightly higher return rate of approximately 215 kcal/per hour using only a crack and pit technique.

et al. 2006), the simple presence of a charred subsistence remain at a Paleoindian site does not necessarily suggest that all plant species useful for human subsistence will be procured that have similar or higher return rates.

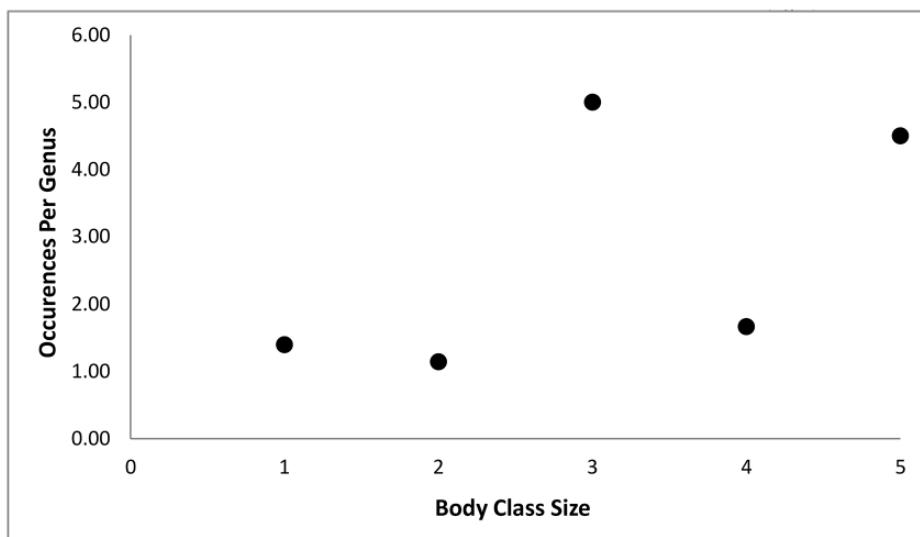
In sum, while some researchers argue that macrobotanical remains from Paleoindian sites indicate that early populations practiced a generalized foraging strategy, plant remains require thorough investigation, as ethnographically, items like berries and foliage are often included or expected in diets that are dominated by meat (Keeley 1995; Kelly 1995). However, since plants ethnographically exploited for their foliage are also utilized for their seeds, and require high processing costs along with technologies not present in the Paleoindian record, determining seasonality is critical. Shawnee-Minisink, which Gingerich (2011) interprets as a fall occupation site, may be a perfect example of this situation. Greens of herbaceous species are only available during the summer and spring, whereas seeds and other species requiring high processing costs are available during the fall (Scarry 2003). Given our discussion above it may not be surprising that fruits with low acquisition and processing costs are the only species that occur in high quantities in Paleoindian features at Shawnee-Minisink. Plants present in the Paleoindian level, which would have required higher processing costs are outnumbered by fruits four to one, and consistently occur outside of features and at random throughout the excavation matrix

(see Gingerich 2011). This brief example would seem to support our hypothesis that fruits and other low-cost items may be the items actual exploited and expected at Paleoindian sites.

### Evaluating the Faunal Remains

The faunal data compiled in this paper shows that over 80 percent of the sites that contain faunal remains are dominated by the remains of larger species (> 45 kg). While the species that are often represented in this study are not necessarily the largest species available on the landscape, these data do not support the idea that a wide variety of animals are commonly represented at Paleoindian campsites across North America. A long-standing critique of the evidence for big-game exploitation during the late Pleistocene is that the Paleoindian record is biased because most sites are kill or scavenging sites (Meltzer 1989, 1993; Waguespack and Surovell 2003). This argument suggests that if more campsites and non-kill sites were found, the archaeological record would show a greater range in foraging activities (Cannon and Meltzer 2004; Waguespack and Surovell 2003, 334).

To test this assumption Surovell and Waguespack (2009:96–97) analyzed faunal data from fourteen non-kill sites across North America and found that there is no difference between the occurrence of large game and site type. Using our database, which includes additional eastern sites and more campsites, the same pattern occurs. In the east, the most common faunal type present is body size class 3, dominated by the Cervidae species (Caribou and Deer). To control for taxonomic diversity within body class size, we used the same measure as Surovell and Waguespack (2009, 92), and divided the total number of occurrences by the number of genera represented within each size class (Figure 2 and Table 5). This analysis, which provides a measure of body size and archaeological abundance, demonstrates that medium-size mammals are the most common species present in eastern fluted point assemblages (see also Surovell and Waguespack 2009). Even if we use a more conservative approach,



**FIGURE 2.** Body size class versus archaeological abundance standardized to taxonomic diversity for all sites containing faunal remains in eastern North America. Note: Size classes range from 5 (largest) to 1 (smallest). Common examples would include: Class 5 = Mammoth; Class 4 = Bison/Horse; Class 3 = medium ungulates (deer, caribou); Class 2 = Rabbits; Class 1 small rodent-sized animals and insectivores.

**TABLE 5.** Number of occurrences of animal species standardized to taxonomic diversity by body class for all sites containing faunal remains in eastern North America.

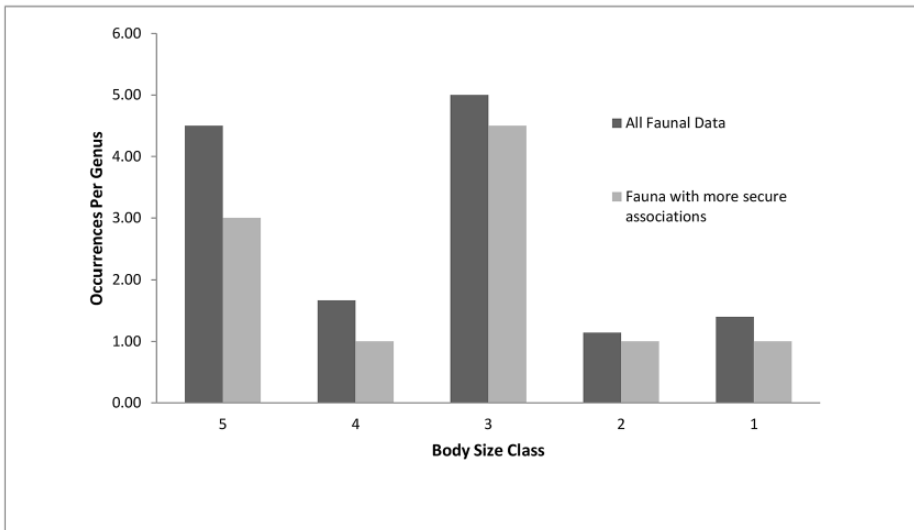
<i>Body Size</i>	<i>Occurrences</i>	<i>Genera</i>	<i>Occurrences per Genus</i>
5	9	2	4.50
4	5	3	1.67
3	15	3	5.00
2	8	7	1.14
1	7	5	1.40

which removes all sites that contain faunal remains that may not be subsistence residues, or are inadequately documented, the same pattern is shown—a higher number of Cervids (Class 3) is represented (Figure 3). From our sample of 24 sites containing faunal remains in eastern North America there is no evidence that smaller species were more frequently exploited than Cervids or larger species. This pattern is also consistent through time as a comparison of the proportion of large to small fauna with secure associations from early and later fluted point assemblages showing no statistical difference (Data from Table 2; Fisher's Exact Test,  $p = .604$ ).

#### **Is there bias in faunal assemblages from eastern North America?**

A major difference observed in the subsistence databases from eastern and western Paleoindian sites is a strong positive relationship between body size and archaeological abundance (Waguespack and Surovell 2009, Table 5.10). In the east, this relationship is caused by fewer proboscideans or body size class 5 individuals in the sample (see Figure 2 & 3). Although this might suggest that there is a bias in the number of site types, as most proboscideans occur at kill sites, difference in site type between the east and west is not statistically significant (See Table 6;  $\chi^2 = 1.86$ ,  $df = 1$ ,  $p = .172$ ). These results suggest that there may be some true differences in mammal exploitation between eastern and western sites (see also, Cannon and Meltzer 2008). However, the record in eastern North America may be biased owing to poor preservation of larger-bodied individuals, as opposed to that of western North America.

Except for a few cases, preservation of faunal material from eastern North America is a product of bone calcination. Calcined bone is more resistant to acidic soils and is therefore likely to be the only residues preserved in the east. As argued by Stork and Spiess (1994, 131–132), calcination of bone introduces several biases into the archaeological record. Two major considerations are that 1) landmarks are more likely to be preserved on small animal bones, which should result in the more frequent identification of small species and 2) calcination requires high temperatures, so only bones thrown in or exposed directly to a fire are likely to be preserved (see, Stork and Spiess 1994, 132 for discussion). In both these scenarios bone from larger



**FIGURE 3.** Graph of occurrence per genus when only sites with secure subsistence associations are considered. These data correspond to our judgment of secure associations in Table 2.

**TABLE 6.** Paleoindian Sites containing subsistence remains, listed by site types.\*

<i>West</i>		<i>East</i>	
<i>Site</i>	<i>Site Type</i>	<i>Site</i>	<i>Site Type</i>
Blackwater Draw	Kill Site	Pleasant Lake (MI)	Kill Site
Escapule (AZ)	Kill Site	Coats-Hines (TN)	Kill Site
Lehner (AZ)	Kill Site	Boaz Mastodon (WI)	Kill Site
Leikem (AZ)	Kill Site	Guest (FL)	Kill Site
Manis (WA)	Kill Site	Hebior (WI)	Kill Site
Murray Springs (AZ)	Kill Site	Martin's Creek (OH)	Kill Site
Naco (AZ)	Kill Site	Schaefer (WI)	Kill Site
Colby (WY)	Kill Site	Wacissa River (FL)	Kill Site
Dent (CO)	Kill Site	Hiscock (NY)	Kill/Scavenge Site
Domebo (OK)	Kill Site	Cactus Hill (VA)	Campsite
McLean (TX)	Kill Site	Michaud (ME)	Campsite
Miami (TX)	Kill Site	Bull Brook (MA)	Campsite
Lange-Ferguson (SD)	Campsite	Holcombe Beach (MI)	Campsite
Gault (TX)	Campsite/Quarry	Little Salt Spring (FL)	Campsite
Jake Bluff (OK)	Campsite	Shawnee-Minisink (PA)	Campsite
Kincaid Shelter (TX)	Rockshelter	Udora (ON)	Campsite
Lewisville (TX)	Campsite	Whipple (NH)	Campsite
Aubrey (TX)	Campsite	Colebrook (NH)	Campsite
Charlie Lake Cave (BC)	Campsite	Sugarloaf/Dedic (MA)	Campsite
Wally's Beach (AB)	Campsite	Jefferson III (NH)	Campsite
		Tenant Swamp (NH)	Campsite
		Sheriden Cave (OH)	Campsite

\* Western Data and kill site data from Surovell and Waguespack (2009)

animals should be underrepresented and bones from small animals should be overrepresented. Nonetheless, this is the opposite of what we see in the archaeological record.

Limited to an inventory of calcined bones, preservation provides a particular challenge to the recovery of proboscidean bone and to the detection of megafauna kill sites in the east. Despite the many megafauna kill sites in the west, few if any contain burnt proboscidean bone. This aspect is also true for campsites. Therefore, because of cultural practices that apparently rarely, if ever, introduce proboscidean elements into fire, mammoths and mastodons are likely underrepresented in the east when compared to other regions that have more alkaline soils. Furthermore, the places where proboscideans have been recovered in the east are places that are difficult to survey or that otherwise have experienced comparatively little archaeological investigation. These areas include bogs, underwater contexts (i.e., Florida) and other special environments, where bone is well preserved. This record is different from the west, where preserved proboscidean bones on many landscapes led to the discovery of many Paleoindian sites (Meltzer 1989). Although we caution speculating about parts of the record that may or may not exist; given the considerations above and the evidence from eastern North America, we agree with Spiess et al. (1998) and others that prehistoric peoples could have hunted proboscideans more often than the archaeological evidence for this activity might suggest.

### *Discussion*

Without question we see different assemblages of subsistence remains in eastern North America when compared to Paleoindian sites in the west. The two major differences are a large number of medium-sized ungulates and the presence of plant remains in the east. Although some medium-sized animals occur in western assemblages, evidence of plant exploitation during the Paleoindian period is rare. Despite our small sample of sites containing plant remains, these assemblages can contribute to our understanding of subsistence practices during the Late Pleistocene. Returning to the focus of this volume, which is to better define Clovis, we ask: should plant remains be expected in early Paleoindian assemblages across North America? Or is their occurrence in sites throughout eastern North America evidence of regional adaptation, expanding diet over time, or are they evidence of what we may have missed at other Clovis-age sites? Here, we argue that the latter is the more probable.

Focusing only on subsistence residues, evidence for regional variability in Paleoindian diet can be examined in several ways. The most common approach is to determine whether different species are present in early Paleoindian assemblages across North America (e.g. Meltzer and Smith 1986; Cannon and Meltzer 2004, 2008; Surovell and Waguespack 2009). The extensive work on this subject often provides conflicting results (e.g., Waguespack and Surovell 2003; Cannon and Meltzer 2004; Byers and Ugan 2005), perhaps best illustrated by Surovell and Waguespack (2009), who demonstrate that not only are datasets between researchers comparable, but they can result in different interpretations of the data. In some cases these differences are created by methodologies or questions of association, but the under-

lying problem is sometimes based in semantics or precisely how researchers define certain terms or research questions (see Surovell and Waguespack 2009:81).

In this paper, we argue that the presence of diversity in the Paleoindian record does not necessarily indicate that the people were generalized foragers. It is well-accepted that hunter-gatherers throughout the world display variation in foraging activities. This diversity in foraging activities may occur at single localities or may vary by season. We should, therefore, expect diversity in food remains between sites, but it should still be limited if early Paleoindians were specialized hunters and exceedingly diverse if they were not. While our definition is not different from those used by other researchers, we suggest a slightly different framework to evaluate Paleoindian foraging activities and develop expectations for what should be found in campsites across North America. This framework is similar to Cannon and Meltzer (2004, 6) who try to move past “characterizing Paleoindians as specialists or generalists, but are rather concerned with documenting the relative degree of diversity [or similarity] in diets.”

As we have argued in other papers (Gingerich 2011; Kitchel 2008), treating floral and faunal remains as part of a single homogenous subsistence strategy will confound interpretations of the subsistence residues from these sites. While plants undoubtedly have lower return rates compared to many faunal resources, as argued by Michael Jochim (1988), one must account for potential divisions of labor when considering Paleoindian diet breadth; certainly not every Paleoindian man, woman and child was engaged in the procurement of large-bodied mammals. While Waguespack (2005) has argued, based on ethnographic analogy to modern and historically documented hunters and gatherers, that Paleoindian women may have spent a great deal of time provisioning male hunters as the proportion of meat in their diet increases, the proportion of meat in the Paleoindian diet remains speculative. Considering that diets may vary and hunting is not always successful, it is reasonable to ask what resources Paleoindian women and children gathered themselves. Again, working from ethnographic data, it is plausible that this subsistence contribution would have consisted of plant foods and/or small animals. While these contributions may have varied by location, season, and social obligations—plants and small animals were likely a part of the general inventory of foodstuffs procured during central place foraging. Therefore, using the presence of plants and small animals as evidence of a “specialist” or “generalist” diet not only reinforces a false dichotomy, but diminishes our ability to recognize seasonal and site specific variation in foraging activities.

In this respect, the diversity that we see in the Paleoindian period is not indicative of distinct regional adaptations, but of an expected pattern of variation between sites. Despite variation at some localities, the Paleoindian record is dominated by the remains of larger game. In the east, the faunal record is dominated by deer and caribou, which after mammoth and mastodon, and excluding species like musk ox, giant beaver, and short-faced bear, are the next largest species on the landscape. Given the patterns seen in the west and the potential biases related to preservation in the east, one can argue that despite somewhat fewer incidences of proboscideans, which may be due to lack of bone calcination, patterns of species exploitation

are rather comparable. Of course, if we take a more regional view we may see some differences represented by the presence of caribou in the far Northeast and Great Lakes, but again this is likely related to availability.

We are also unwilling to accept that plant remains with low processing costs (as argued above) are evidence of expanding diets during the Paleoindian period or should not be present in western Paleoindian assemblages. Even carbonized seeds representing nothing more than burned grass seeds with no direct link to subsistence activities should be present in western sites. The absence of even these remains, suggests recovery bias, in that very few excavations from the west have employed recovery methods that include flotation. Until such practices are routinely conducted we cannot confidently say that plant remains are only a phenomenon at Paleoindian sites in eastern North America—in fact, we predict that plants with low acquisition should occur more often.

### *Conclusion*

In conclusion, despite the number of sites discussed in this paper, the best known Paleoindian subsistence residues are the remains of extinct megafauna recovered from the western United States (Cannon and Meltzer 2004; Surovell and Waguespack 2007; Surovell and Waguespack 2010). While biases in preservation or survey techniques (see Meltzer 1989, 1993; Cannon and Meltzer 2004) may influence how we interpret the archaeological record, there is no doubt that mammoths and other large animals were part of the Early Paleoindian diet. The question of whether Early Paleoindians were subsistence “specialists” or “generalists” is not just about what people ate, but part of our broader understanding of how megafauna became extinct during the terminal Pleistocene (Martin 1973, 1984) and how people rapidly colonized the Americas (Kelly and Todd 1988; Mason 1962). For these reasons, Paleoindian subsistence strategies are part of how some researchers define Clovis archaeology (For discussion, see Cannon and Meltzer 2008; Holliday and Meltzer 2010; Meltzer and Smith 1986; Meltzer 1993). Therefore, summarizing subsistence data and recognizing variation, which has been the focus of this paper, becomes critical to how we understand and define Clovis adaptations.

By using the Paleoindian sites that contain floral and faunal remains from eastern North America, we argue that the record is compatible with models where hunting of large game was a primary activity during the Late Pleistocene. Unlike western North America, which contains large numbers of bison after the Clovis period, the next largest animals, after proboscideans, on the landscape that would have been hunted by Paleoindians in the east are medium-sized ungulates. The remains of these individuals, representing caribou and deer, occur in sites from Maine to Virginia. Evidence of human interaction with megafauna occurs in the Southeast and Great Lakes region, but may be limited due to preservation factors. Small animals rarely occur, and there are a total of four identified species from three sites in the Northeast. These specimens, which represent fur-bearing animals, may have been hunted just as much for their fur as for their contribution to the diet (Gramly and Funk 1990; Spiess et al. 1998). The remains of fish, turtle, and possibly bird are also



present in the record, but again only represent three specimens in the entire record from eastern North America.

The presence of plant remains, rare in sites across the continent, appears to occur solely in eastern Paleoindian assemblages. While we might expect to see some differences between the forested environments of eastern North America and the plains and deserts of the west, some of these differences may be explained by a lack of systematic methods to recover floral materials. Nonetheless, the existence of these remains in the east should not be surprising, especially as many specimens represent berries that require no processing. Elsewhere and here we argue that Paleoindians targeted plant resources with low processing costs (Gingerich 2007, 2011, 2013; Kitchel 2010). These remains may have constituted an important though episodic part of the Paleoindian diet, which was likely contingent on site context and season of occupation. Given that the ethnographic record documents that fruits and foliage are often the first and only plant foods included in the diet of hunter-gatherers who rely heavily on hunting (Keeley 1995), these remains are compatible with both a specialist and generalist view of Paleoindian subsistence activities.

As shown in this chapter, we can use simple optimal foraging models to predict what items with low acquisition and processing costs might be expected in the Paleoindian record. Using this approach we may also be able to better characterize what items really represent broader foraging activities and expansion of diet breadth. We therefore, caution quickly interpreting plant remains as evidence of a broad-spectrum Paleoindian diet, though equal caution must be taken when characterizing Paleoindians as specialized hunters, especially when seasonality, division of labor, and modes of processing are not considered. What is clear is that more data are not needed to resolve this debate, but rather that a shift in theoretical perspective better able to incorporate the presence of both floral and faunal remains in Paleoindian sites can provide a more holistic view of early Paleoindian life. Beyond the extinction of proboscideans, the current data indicate that there are no major shifts in subsistence strategy between the early and later fluted point populations. Thus, seeking to incorporate a particular subsistence strategy into a definition of “Clovis” is difficult and certainly is not characterized by exclusively hunting megafauna.

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### *Notes*

1. Values on chenopod processing can vary greatly depending processing technique. One ethnographic study cited by Gremillion (2004) suggests a 433 kcal/hr return rate. Even if this is more accurate, our argument holds as chenopod is placed within the return rates of many fruits and require more technological investment.

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