Amache Garden Testing - Archaeobotanical Analysis

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Introduction

Gardens and garden related features are some of the most remarkable aspects of Camp Amache as an archaeological site. While standardized, government-issue architecture formed the vast majority of the built environment, Amache internees were able to transform the intermediate spaces into those of meaning and expression. The 2008 University of Denver excavations in the camp included testing of three separate areas of gardening activity within the camp boundaries. As part of the testing program, numerous samples were taken in the field and later processed using water flotation methods (Streuver 1968, Pearsall 2000) to recover botanical remains and other fine-scale materials. This report details the identification and interpretation of archaeobotanical remains present in the samples.

Methodology

Field Sampling

Three primary garden areas were tested: an ornamental or recreational garden in block 9L, the Amache elementary school's entry garden in block 8H, and finally a presumably horticultural "Victory" garden in block 12K.

Samples in the field were taken generally as point-provenienced "bulk" (Lennstrom and Hastorf 1992, 1995) samples, with a 20 liter target volume. Field sampling proceeded using a 'blanket' sampling methodology (Pearsall, 2000), meaning that nearly every excavated context was sampled. All samples were floated, but a subset of the field samples was later chosen for analysis.

The samples were measured in the field, and then re-measured before flotation. Each 20L sample was divided into two 10 liter samples for convenience and ease of processing using a comparatively small flotation tank.

The samples were processed in a SMAP-style small flotation machine, using standard protocols as outlined in Pearsall (2000). Light (buoyant) fractions were dried, bagged, and later analyzed at the Colonial Williamsburg Foundation archaeobotanical lab in Williamsburg, Virginia. Heavy fractions, which can occasionally contain some botanical material, were not included in this analysis. Based on the paucity of wood charcoal present in the light fractions, the lack of heavy fraction data likely does not affect the

interpretation in any significant way, although these components could be included in future analysis if necessary.

Lab Processing

Light fractions were processed in the lab according to the following procedure. Each light fraction was weighed, and then sifted through nested geological sieves, with apertures of 4mm, 2mm, 1mm, and 0.5mm. Each size fraction, and the smaller than 0.5mm residual, was weighed and separately bagged. Each size fraction from each sample was then sorted under a binocular dissecting microscope, at magnifications between 7 and 60X. Wood charcoal was saved from size grades 4mm and 2mm (smaller material is typically not identifiable). Both charred and uncharred seeds and seed-like structures (caryopses, achenes, etc) were removed from all fractions other than the residual. Partial seeds were pulled from the samples if they appeared to be more than half complete, to avoid potential double-counts. In a few cases, where little other material was present, identifiable fragments that were less than 50% complete were pulled and counted. In most cases these were individual specimens, so double-count skewing is still not evident. *Opuntia* (pricklypear cactus) embryos were also pulled as identifiable even when the surrounding testa was absent. Some uncharred "whole" seeds recovered may be mostly seed coat (testa), with little internal contents remaining, but were not extensively broken to determine this. All seeds were pulled and stored in nalgene cryo-tube vials and labeled with provenience and size fraction information.

SS (Soil Sample) 313, from 12K was processed specially. This small-volume sample, presumed to be a feature remnant related to a planting pot in the 12K victory garden, was not floated, but processed in the lab to accommodate the small volume (1.8L) with maximum botanical recovery. The sample was dry-sieved through nested geological sieves consistent with the flotation light fraction sizes (4, 2, 1, 0.5mm). Dry material smaller than 0.5mm was saved, as was a general, unsieved archive soil subsample. The material remaining in the screens was then gently washed with water to break up soil peds and clean botanical material for sorting and identification. Thus, there is no light fraction for this sample, but rather it was processed as a very fine-scale wet screened sample. In general, the methodology should give results comparable to flotation; if any bias is present it would be toward *increasing* botanical recovery, in that the "heavy fraction" component from a standard flotation sample is included in this method.

Identifications were based on reference collections, as well as standard identification resources (Davis 1993, Martin and Barkley 1961, Fishel and Bradley 2005, Young and Young 1992, Garcia and Sarukhan 1997, the USDA PLANTS online database [plants.usda.gov]), using A.C. Martin's (1946) identification and classification system for seeds. In general, identifications were made conservatively, often to the genus level in the absence of compelling evidence to be more specific. There is often intra-species variation in the structure of individual seeds that can make definitive species-level identification problematic in the absence of a larger population to observe. In general, one or two damaged and distorted archaeological specimens are a poor pool from which

to draw species level conclusions. In most cases at Amache, genus-level identification was sufficient to address and infer cultural and environmental explanations for plant presence in the samples. Only counts are reported for the botanical material; densities using counts are most appropriate because the identified material consists mostly of complete or nearly complete seeds rather than material that breaks apart, such as wood or parenchyma, where weight measures would be used as a complementary measure.

Tree fragments (SS#28) from the 9L garden planting hole were also examined separately without flotation. These matched the wood anatomy of Ulmus *parvifolius* (Chinese Elm) wood growing on the site.

Analysis

General Observations

One of the peculiarities of dealing with a site as comparatively recent as Amache, from an archaeobotanical perspective, is the question of how to interpret uncharred seeds. Minnis (1981), Miksicek (1987) and others have questioned the durability of so-called 'green' seeds in archaeological deposits. Generally, in prehistoric contexts, they are often ignored as 'noise' or contamination. However, given the dry edaphic conditions, recent age, and observed presence of other preserved, uncharred organic materials (e.g., the Chinese Elm remains recovered from the planting feature in 9L), it is likely that many of the uncharred seeds from the flotation samples represent original deposition rather than later "contamination". All uncharred seeds were sorted and counted from the Amache samples; additionally, very few charred botanicals were present at all. The well-documented availability and use of coal as a fuel source at Amache (also in evidence in SS 15 Flot 8) seems to have precluded much use of wood fires; very little wood charcoal was present on site, another unusual archaeobotanical circumstance.

The overall assemblage from Amache is appropriately dominated by seeds from scrubby, tough colonizers of disturbed or open plains-type ecosystems. The site surface today hosts primarily sage (*Artemisia tridentata*), yucca (*Yucca* sp.), and pricklypear cactus (*Opuntia* sp.), with occasional rabbitbrush (*Chrysothamnus* sp.), prickly poppy (*Argemone* sp.), and various bunch-grasses and forbs. It is not surprising that many of these are found in the flotation samples; aside from the planted Chinese Elms and the remains of cottonwoods on-site, there is little to distinguish the site vegetation from its neighboring southeast Colorado surroundings for many miles around. Moreover, there is little to suggest that aside from the deliberate plantings by the Amache internees, that there was any notable ecological habitat difference at Amache between the early 1940s and the present.

Samples Processed – Selection Criteria

The samples chosen for analysis were intended not only to target important excavated features, but primarily as an aid to assessment of the level and quantity of archaeobotanical preservation in the Amache garden features, as a test case for future excavation, sampling, and research strategies on-site. Each of the three excavation areas was examined, including layers, and, where appropriate, feature fills (sensu Harris 1979). The raw data is provided in the appendix, the following discussion summarizes the major findings in each testing locus.

Ornamental or Recreational Gardens in 9L

Three major features were assessed from the block 9L excavations. The major surface feature targeted was a pair of oval beds constructed with split concrete blocks. Several 2 by 2 meter excavation units were placed in and around the garden feature, revealing a fire installation or coal cinder ash dump immediately outside the concrete border (Feature 9L-3), a small tree-sized planting hole (Feature 9L-1A), including remains of the tree itself (SS 28), and possible stake holes and training wire for the small tree. Flot samples from each of these features were analyzed, as was one sample of the feature fill itself.

Soil Sample (SS) 28 – Tree Fragments

The (mostly root) remains of the tree planted in the garden were still present, and were recovered just as a bulk sample without flotation during the excavation. Based on the wood anatomy, in particular the distinctive "ulmiform" parenchyma arrangement unique to elms, It was possible to identify the tree as *Ulmus parvifolius*, or Chinese Elm, many of which are still growing on the site today after being planted during the camp occupation by Amache internees.

Chinese elms, like the cottonwood remains on site, are incredibly fast growing trees, growing up to 30 feet in 5 years, making them wise functional choices (to quickly provide shade in the treeless landscape, and well adapted to poor soil conditions). Moreover, Chinese Elm was also perhaps aesthetically and culturally significant, the being native to and used economically and symbolically in both China and Japan (e.g., the species is often used for Bonsai).

Flot 9 – SS 27 – 9L-1A Feature Fill Level 1 and
Flot 4 – SS 20 – Feature 9L-1 Inside L3

Upon excavation, it appeared that the original state of the garden was an *above-ground* bed, based on the absence of a trench to sink the individual block fragments into, and the presence of mortar between blocks (unnecessary in a below-ground construction). Thus, most of the upper excavated deposit was likely post-abandonment infilling.

Flot 9 consisted of the hole fill around the tree planting; i.e., what was dug to plant the tree, then quickly refilled around what was very likely a small sapling. As such, it is one

of the primary deposits representing the period of the garden's construction. Flot 4 was the deepest non-sterile level within the garden feature.

Generally, the contents of these samples feature fill are unremarkable, consisting of the expected prickly-pear, sage, prickly-poppy, etc. However, there is one exception. To date, of all Amache flotation samples analyzed, *Portulaca*-type (purslane) seeds occur *only* in these two samples. Portulaca or purslane in general would be an unremarkable taxon, as it is ubiquitous throughout the world as a weed, but for its remarkable abundance in these samples, and absence in all the other samples. There are 53 individual seeds in the planting hole fill (Flot 9), and 158 from the general fill of Flot 4. This strongly suggests that a *Portulaca* may have been deliberately grown as a ground cover for the garden feature, being a drought-tolerant, attractive choice for such a purpose. There are over 100 species of *Portulaca*, all with very similar seed structures, so a more precise identification is difficult without an extensive research investment beyond basic dissecting microscopy. *Portulaca* does not seem to have tremendous significance in Japanese gardening traditions, but as abundantly evidenced elsewhere, Amache internees were adept at substituting or being inventive with local materials, including plant materials.

The only other likely candidate for a deliberate garden planting in 9L would be sunflower, *Helianthus annuus*. There were 12 seeds identified in Flot 4; these *Helianthus* seeds are fairly ubiquitous throughout the Amache samples, making them difficult to tag precisely as either deliberate plantings, an ambient wildflower, or, possibly both. The size of these seeds is more consistent with a wild-type *Helianthus* than the commercial food and oil crop though.

Flot 8 – SS 15, Feature 9L-3

This burned feature seems to be either a coal ash dump or possibly a 'campfire' type of fire installation, immediately adjacent to the oval garden bed. In terms of its archaeobotanical content, it is primarily notable for having the largest number of wood charcoal fragments (10) identified from the Amache assemblage. The wood fragments may be either kindling wood remains, or woody vegetation burned accidentally by the coal fire.

Ubiquitous weeds such as *Euphorbia prostrata* (creeping prostrate spurge) and *Chenopodium* (goosefoot) were the largest contributors to the sample. The two *Helianthus* seeds were in better/more complete condition here than from other samples. The overwhelming abundance of coal clinker in the flotation light fraction made sorting this sample somewhat difficult; it is possible that amid the clinker there may be some additional amorphous or highly vitrified botanical material such as parenchyma, which would be difficult to distinguish from some of the cinder. However, all seed and wood charcoal material should be accounted for.

Schoolyard Garden – Block 8H

The garden feature in front of the elementary school (converted barracks) has the advantage of some historical documentation (Dumas and Walther, 1944) that the unrecorded garden in 9L does not. In the short article published in *The School Executive*, the authors, principal and teacher at the school, discuss having the Amache elementary school children, primarily sixth graders, plan and create an ornamental garden, in consultation with an unnamed "landscaping expert". Rocks were brought in from the "stone pit" (limestone quarry which is still visible at Amache), and a design was laid out. The final description of the garden suggests a ground cover of rye grass (*Secale*) with "blooming cactus, yucca, and small wild flowers arranged in neat balanced areas" The article also refers to "desert plants brought in by small groups of children" (p.41), again suggesting Amache internees were adapting the local rather than importing west coast or Japanese traditional plantstuffs.

Unfortunately, the archaeological record of the schoolyard garden is somewhat less pristine than the historical record. While rodent burrowing was noted in most locations, the rodent damage at the two schoolyard gardens was incredibly extensive, destroying any recognizable soil features such as planting holes that might otherwise be visible. Abundant rodent feces in the flotation samples added to the disappointment. Two samples were analyzed from the two separate garden areas 8H-1, east of the doorway, and 8H-2, west of the doorway. Based on abundant gravel in 8H-2, and the absence of gravel and abundant dried poured-concrete "slop" in 8H-1, it appeared that the two garden areas had separate arrangements or function.

Flot 13 – SS 206 – Feature 8H-1 L2 and Flot 12 – SS 204 – Feature 8H-2A L1

The usual contingent of weeds is present in both garden features. Flot 13, from 8H-1's deeper second excavated level was particularly thin, with few total botanical specimens recovered at all, suggesting that any garden remains were very near the surface and probably extensively disturbed. The sample from 8H-2A contained two interesting finds, one, a few uncharred softwood (such as pines or other conifers) fragments, absent elsewhere at Amache, possibly deriving from garden stakes (or also potentially construction detritus from the barracks). More interesting were *Ipomoea* or morning-glory seeds from 8H-2A, only four total specimens, but representing an unambiguous cultivated ornamental rather than a wildflower. Some historic photographs show morning-glories in doorway gardens, though they are not mentioned in the school article. Interestingly, rye grass was absent from the samples, perhaps suggesting that the ground cover was trimmed or maintained before the historically-documented rye grass could flower or set seed.

12K – Victory/Horticultural Garden

While agricultural work to provide basic food crops for the camp and an attempted economic self-sufficiency model was conducted outside the core area of the camp, historic photographs show gardens structured much more like vegetable or kitchen gardens than the ornamental and landscaping examples excavated previously. Close examination of photographs showing one such garden in block 12K appeared to indicate the presence of pots and perhaps burlap-and-stake border divisions, sectioning off areas within the garden plot. Three samples were examined from this garden area, two flotation samples and one bulk, small-volume sample which was wet-screened in the archaeobotanical labs at Colonial Williamsburg.

Flot 15 – SS 308- L2, and Flot 14 – SS314 – L2

Unfortunately, nothing in the way of identifiable crops, vegetables, or other plants of economic or food significance could be found in either sample. The only unusual taxa were one *Ambrosia* seed, apparently giant ragweed, and an unusual seed that may be *Echinocloa crus-galli*, or barnyard millet. It is a common, worldwide weed. Although *Echinocloa* has been argued as a prehistoric Japanese domesticate or incipient domesticate, its appearance in a flotation sample at Amache is certainly coincidental. Poisonous buffalo-bur nightshade (*Solanum rostratum*) was also present in these samples, very much NOT an edible plant!

Lab Wetscreen – SS 313 Feature 12K1-F

The small, 1.8 liter sample consisting of the material from the base of the presumed pottery vessel location was also sparse. A few fragments pulled from the wet-sieved material listed as “unidentified” are more correctly likely “unidentifiable”, but were saved because of the perceived importance of the sample as having potential to yield information on the contents of vessel.

Conclusions and Future Research

In at least a few instances, flotation and macrobotanical analysis was able to add significantly to the picture of the gardens created during Japanese-American internment at Amache. Given the limited scope of the test excavations, and considering the preservation condition of some areas of the site, the results of this initial study are encouraging and provide a path forward for future work at Amache. Garden archaeology is always somewhat more ambiguous and challenging than more traditional artifact-and-architecture research, and Amache is no exception. Also, archaeobotanical research in the historic period is rare enough, with analysis of 20th Century materials being almost unprecedented. There are multiple unresolved methodological issues without a long disciplinary track record to gauge “best practices”. Hopefully this initial work on such an important site, and such important contexts of expression and resistance opens additional opportunities and lines of research in the future.

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Appendices:

I. Volumetric Data
II. Latin Names/Common Names and abbreviations
III. Raw count data

Appendix I
Amache Sample Volumetric Data

	Flot Volume	Total Weight (grams)	4mm Wt	2mm Wt	1mm Wt	0.5mm Wt	Residual Wt
9L Samples							
Flot 9, SS27	37.5	50.12	6.61	3.2	5.33	6.49	28.37
Flot 4, SS20	9	13.3	2.3	0.56	1.01	1.91	7.4
Flot 8, SS15	11	355.95	259.28	15.62	13.03	17.43	50.07
8H Samples							
Flot 12, SS204	10	25.48	4.32	1.81	4.39	5.21	9.51
Flot 13, SS206	10	25.41	1.36	1.45	1.35	3.44	17.55
12K Samples							
Flot 14, SS314	10	33.87	5.57	2.42	3.55	4.4	17.77
Flot 15, SS308	10	22.46	2.6	1.11	1.94	3.28	12.78
SS313 Lab Wet Sieve	1.8	n/a	n/a	n/a	n/a	n/a	n/a

Appendix II – Latin Names, Common Names and Abbreviations

Acalypha sp. - Copperleaf
Agremone sp. - Pricklypoppy
Ambrosia sp. - ragweed
Artemisia flower – sagebrush; tended to preserve as dried floral structures rather than seeds
Asteraceae – sunflower family
Chenopodium sp. - goosefoot
Echinocloa crus-galli – barnyard grass, barnyard millet
Euphorbia (not *prostrata*) – there are many species of *Euphorbia*, less distinct than E. prostrata.
Euphorbia prostrata – Creeping Prostrate Spurge
Fabaceae indeterminate sp. – Bean/legume family (includes many wild weeds)
Helianthus annuus - sunflower
Ipomoea sp. - morning glory
Lepidium sp. – Virginia pepper-grass
Lithospermum arvense aka. *Buglossoides arvensis* – Corn gromwell
Opuntia – pricklypear cactus
Portulaca sp. – purslane
Salvia sp. – common sage
Solanum rostratum – buffalobur nightshade

9L Sample Data

SS27 Flot 9

Species	Count
4mm	
n/a	
2mm	
Wood Charcoal (softwood)	1
Opuntia sp.	8
Unid - seed/w fungal sclerotia	1
1mm	
Helianthus annuus ca. 50% or greater frag	2
Opuntia- embryo frags	3
Rumex cf. acetosella	2
Euphorbia (not prostrata)	1
0.5mm	
Argemone sp.	2
Euphorbia prostrata	14
Chenopodium sp.	8
Portulaca sp.	53
Lithospermum arvense aka. Buglossoides arvensis	9
Opuntia sp. Charred	1
Artemisia flowers	3
Unidentified, incomplete	1

SS 20 Flot 4

Species	Count
4mm	
n/a	
2mm	
Wood Charcoal (softwood)	1
Opuntia	3
1mm	
Helianthus annuus ca. 50% or greater frag	12
Chenopodium sp.	1
cf. Salvia sp.	4
Unidentified 1 (euphorbiaceae?)	2 charred, 1 uncharred
Unidentified 2	2 frags (from same seed - vitis?)
0.5mm	
Agremone sp.	7
Euphorbia prostrata	27
Chenopodium sp.	71
Portulaca sp.	158
Artemisia flowers	1
Unidentified/Other	3
Unidentified Charred Seed	1
Unidentified Charred material - rodent dung?	1

SS15 Flot 8

Species	Count
4mm	n/a
2mm	
Wood Charcoal	10
Opuntia embryo	1
Unid Seed	1
1mm	
Helianthus annuus	2
Euphorbia (not prostra	3
Unid (botanical?) frag	1
0.5mm	
Chenopodium sp.	20
Euphorbia prostrata	36

8H Sample Data

SS 204 Flot 12

Species	Count
4mm	
Wood fragments, uncharred	2
Seed fragments - Unidentified	2
2mm	
Helianthus annuus ca. 50% or greater frag	1
Opuntia sp.	23
Euphorbia sp. (not prostrata)	3
cf. Ipomoea (morning glory)	1
1mm	
Helianthus annuus ca. 50% or greater frag	2
cf. Ipomoea (morning glory)	3
Chenopodium sp.	4
Opuntia embryo frags	3
0.5mm	
Helianthus annuus ca. 50% or greater frag	1
Euphorbia prostrata	38
Lithospermum arvense aka. Buglossoides arvensis	2
cf. Lepidium sp.	3
Chenopodium sp.	8
cf. Artemisia flowers	15

SS 206 Flot 13

Species	Count
4mm	n/a
2mm	
Wood Charcoal (softwood)	1
1mm	
Fabaceae indeterminate sp.	1
Euphorbia sp. (not prostrata)	1
0.5mm	
Chenopodium sp.	5
Agremone sp.	1
Euphorbia prostrata	2
cf. Lepidium sp.	1

12K Sample Data

Flot 15 SS308

Species	Count
4mm	n/a
2mm	
Opuntia	17
cf. Asteraceae frag	1
Unid seeds (2 separate sp; 1 frag 1 whole)	2
root structure (grass?)	1
1mm	
cf. Artemisia flower	1
Opuntia embryo frags (greater than 50% of embryo)	4
cf. Acalypha sp	6
Helianthus annuus ca. 50% or greater frag	4
Solanum rostratum (buffalobur)	1
0.5mm	
Euphorbia prostrata	3
Chenopodium sp.	61
Portulaca sp.	1
Lithospermum arvense aka. Buglossoides arvensis	1
Agremone sp.	1
Unidentfied	1
cf. Lepidium sp.	7

SS314 Flot 14

Species	Count
4mm	n/a
2mm	
Wood Charcoal	1
Opuntia	3
Euphorbia (not prostrata)	1
1mm	
Euphorbia (not prostrata)	5
Chenopodium sp.	3
Helianthus annuus	4
Ambrosia sp (cf Giant ragweed)	1
Opuntia	2
cf. Echinocloa crus-galli	1
0.5mm	
Chenopodium sp.	27
Euphorbia prostrata	2
Euphorbia (not prostrata)	1
cf. Artemisia flower	1
Unidentified seed	2

SS 313 Wet Sieve

Species	Count
4mm	n/a
2mm	
Opuntia	1
Bract?	1
Unid Botanical	1
1mm	
Poaceae sp	1
Helianthus annuus less than 50% frag	1
Opuntia sp. Less than 50% embryo frag	1
0.5mm	
Chenopodium sp.	6
Unid seed frag	1