Chapter 12
Status of Geoarchaeological Investigations at New Philadelphia Historical Landmark

M. Kathryn Rocheford[1]

Background

Soil is the medium upon which the interactions of cultural land-use activities and the “natural” environment are imprinted. Landscape modifications for early historic land-use activities began with the clearing and burning of “natural” vegetation. Yet little work has been done to document how Midwestern soils have responded to the early stages of historic land-use. In addition, the landscape at the National Historic Landmark of New Philadelphia, Illinois has been moderately disturbed by later agricultural activities. However, archaeological investigations have revealed buried features and cultural material with excellent preservation in the soil below the modern plow zone. Further, the physical, biological and chemical processes of soil are differentially impacted by different land-use activities which are preserved long-term in cultural soils and can be observed and quantified. Contrasting between an undisturbed soil and that of various land-use areas will reveal any differential effect from anthropogenic modification of the landscape. These data are used to reconstruct the history of land-use activities, not discernible from historic records, and provide important insights into the activities of the inhabitants of New Philadelphia.

Initial archaeological and geological investigations at New Philadelphia indicate the landscape has been modified extensively during three distinct stages of historic activity. The first stage was clearing the land for settlement and occupation of a racially integrated merchant community. According to census records the town had an integrated population of European and African descendants, reaching its peak population in 1865 (King 2007). Having been bypassed by a regional railroad, the population dwindled to four farmsteads by 1890 (Walker 1983). A 1939 aerial photograph of the town site illustrates that the town was largely abandoned with only two farmsteads remaining (Figure 12.1). However, it also clearly outlines orchards and large subsistence agriculture plots, and marks the beginning of the second stage during which most of the buildings were moved or razed and the land was converted to small-scale agricultural use. Also visible in the image are small tributaries on the east and west sides of the platted town and landforms nearby indicate that soil erosion was somewhat problematic. By the mid-1990s the tributary on the west side of town had been dammed forming a large pond, and erosion control terraces had been constructed (Figure 12.2). This marks the beginning of the third stage of landscape modification.

[1] University of Iowa.

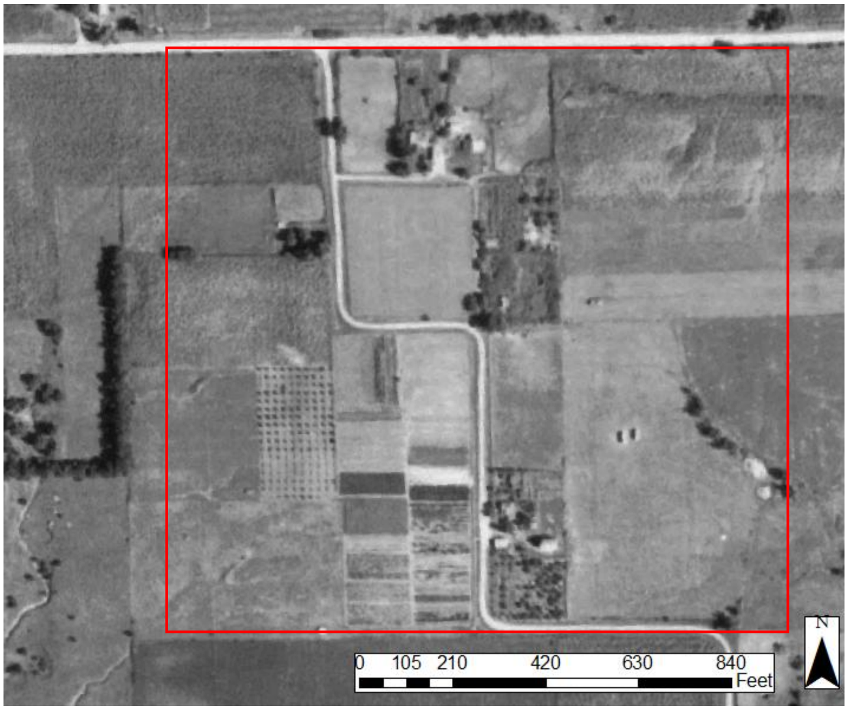

Figure 12.1. *1939 Aerial photograph of New Philadelphia town site (outlined in red), see text for features of note (Photograph from U.S.D.A. Aerial Photographs Collection).*

In 2008, a series of two-inch diameter soil cores were extracted along the ridges of erosion control terrace 1, 2, and 3 (Figure 12.2) using an AMS Inc. slide hammer soil corer. Fennell's interpretation from this testing was that "terrace 1 was created by digging out adjacent swales without bulldozing soils and sediments in a jumble onto the ridge-top" and suggested terrace 1 might be targeted for future investigation (Fennell 2009). Methods and other interpretations from soil core sampling in 2008 are detailed in Chapter 7, "Core Sampling of Terraces West of Broad Way," of Fennell (2009), which is available online at: www.anthro.illinois.edu/faculty/cfennell/NP/2008ReportChap7.pdf.

Figure 12.2. *1998 Aerial photograph of New Philadelphia town site (red square), illustrating erosion control terraces and large pond on west side. Excavation trench outlined in yellow (U.S. Geological Survey, Aerial Photographs Collection).*

Initial geologic investigations were conducted during the summer of 2010 and subsequent laboratory analyses ensued. The findings and recommendations are detailed in (Rocheford 2011), which is available online at www.anthro.illinois.edu/faculty/cfennell/NP/2010ReportChap6.pdf. Based on the initial investigations and additional evaluation of historical documents, a research plan was developed for additional fieldwork during the fall of 2010 in collaboration with Fennell.

Trench Excavation

In the mid-1990s ridge and swale terrace features were constructed on the west side of the town site to decrease erosion. This location has a Natural Resources Conservation Service (NRCS) soil classification of Downsouth silt loam with 5-10% slope, a mesic Oxyaquic Hapludalfs (Soil Survey Staff, 2006). These are soils with moderate development of soil horizons that developed under broadleaf forest in humid, temperate climate conditions. Soils that develop under forests typically have a thin A-horizon at the surface that overlies a zone that is significantly lighter in color due to leaching of minerals and clay size particles. Below these horizons is a zone of accumulation that is easily identifiable due to prominent color mottling within the soil from natural soil processes and is generally considered to be culturally sterile.

Results from the 2010 field school suggest that the eastern most erosion control ridge was built up. Therefore, a back hoe trench bisecting terrace 1 (Figure 12.2) to determine the potential for buried and/or disturbed archaeological features was excavated. A 4 ft x 12 ft trench was excavated and from the highest elevation of the terrace a profile of the soil measuring 4 ft, 4 in. was exposed (Figure 12.3).

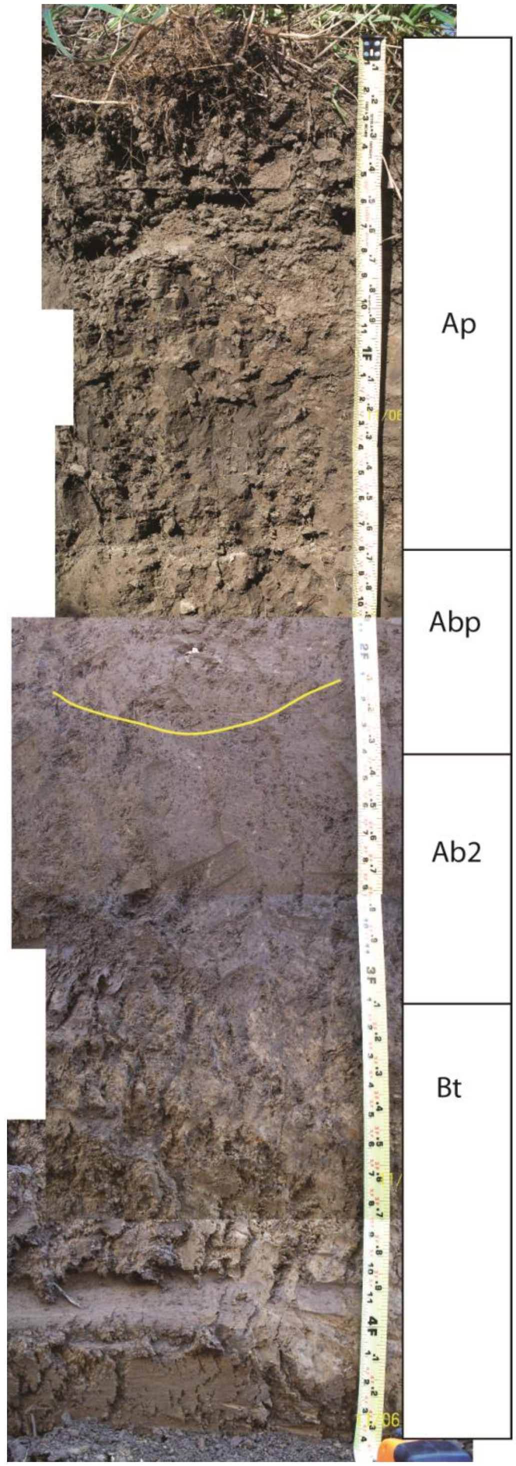

Figure 12.3. *Composite image of soil profile of erosion control terrace 1 with sketch of soil horizons on right. Note white mineral accumulation demarcating boundary between cultural fill (Ap) above and buried surface (Abp) below with plow scar (yellow).*

The soil profile description (Table 12.1) reveals a thick organic rich horizon (Ap) with a jumble of cultural artifacts that thins with distance from the apex of the terrace. The Ap horizon overlies a buried surface horizon (Abp) at about 20 inches below the surface (inbs). This horizon appears to have been scalped near the eastern end of the trench suggesting that some of the surface soil was borrowed from that area to build up the terrace, at least in this particular location along the terrace. Bulk soil samples were collected from each horizon for later geochemical analyses which would enable a more detailed comparison between the two locations.

Table 12.1.
Description of soil profile from trench excavation of terrace 1

Horizon	Depth (inbs)	Color	Texture	Description
Ap	0 - 20	10YR 3/2	Silt loam	Dark brown 10YR 3/2 silt loam; weak, fine platy; very friable; abundant medium to coarse roots; common brick and mortar fragments; common 3-6 cm chert pebbles; non-effervescent; wavy boundary marked by light gray 10YR 6/2 calcic coatings.
Abp	20 - 28	10YR 3/2	Silt loam	Dark brown 10YR 3/2 silt loam; strong, medium subangular; friable; few fine roots; non-effervescent; sharp, wavy boundary.
Ab	28 - 37	7.5YR 3/2	Silty clay loam	Dark brown 7.5YR 3/2 silty clay loam; strong, medium prismatic; firm; common fine to medium roots; non-effervescent; gradual boundary.
Bt	37 - 52	10YR 5/3 & 6/6	Clay loam	Brown 10YR 5/3 and brownish yellow 10YR 6/6 mottled clay loam; strong, medium prismatic; very firm; abundant, very dark grayish brown 10YR 3/2 filled macropores; common, medium redoximorphic features with black 10YR 2/1 manganese coatings; non-effervescent.

Giddings Cores

The NRCS provides georeferenced electronic files that illustrate the geographic extent of soil classification (Figure 12.4). These maps are computer modeled from select soil sampling locations, topographic maps, and modern land-use records. The area for NP indicates that only the north central part of the town site has an area that contains soil of the Wakenda Series, which is classified as a mesic Typic Argiudoll. These are soils that develop in grassland (prairie) areas of humid, temperate climate that have weathered sufficiently to produce a thick, organic-rich horizon and deeper horizon that is enriched in clays transported by water and gravity down profile. The remaining areas contain soils of the Downsouth and Winfield Series, which are classified as mesic Oxyaquic Hapludalfs (Soil Survey Staff 2006). These are soils with moderate horizonation developed under broadleaf forest in humid, temperate climate conditions. Subsequently, observations of significantly different thicknesses of the A horizon in locations may indicate areas of different "natural" vegetation or differential preservation of the "natural" soil profile due to anthropogenic and/or natural processes such as mechanical leveling or different erosion rates.

Eight soil cores, three inches in diameter were extracted from locations within the town site to represent different soil classifications, landscape positions, and land-uses at the site (Figure 12.4, Table 12.2). These cores were wrapped in plastic and aluminum foil and transported to the University of Iowa for processing.

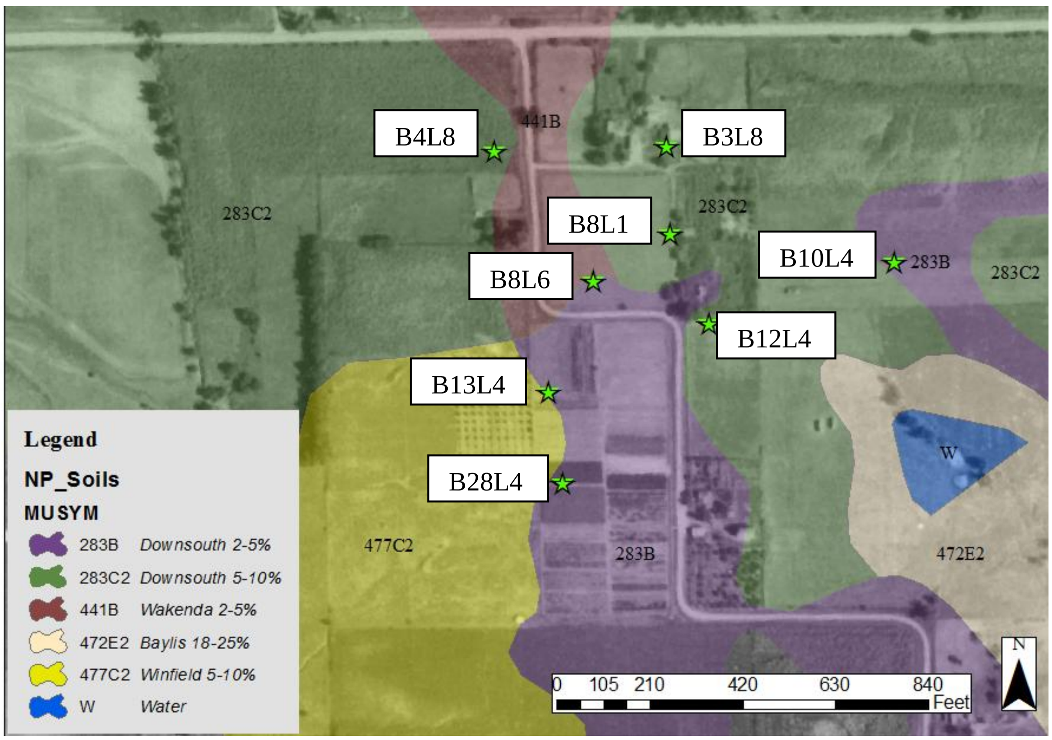

Figure 12.4. *1990 Soil classification map overlain on 1939 Aerial photograph with locations of Giddings soil cores extracted in November 2010.*

Table 12.2.

Soil classification, depth to base of soil core, landscape position and Historical land-use for the Giddings soil cores extracted in November 2010.

Locale	Soil Classification	Depth	Landscape Position	Land-use
B10L4	Downsouth 2-5% slope	17 ft	Shoulder, convex	Pasture/Agriculture
B8L1	Downsouth 2-5% slope	4 ft	Summit	Unknown/Agriculture
B18L4	Downsouth 2-5% slope	4 ft	Summit	Residential
B12L4	Downsouth 2-5% slope	4 ft	Side slope, concave	Residential/Agriculture
B3L8	Downsouth 5-10% slope	4 ft	Side slope, concave	Residential
B8L6	Wakenda/Downsouth	12 ft	Summit	Unknown/Agriculture
B4L8	Wakenda/Downsouth	4 ft	Summit	Residential/Agriculture
B13L5	Winfield/Downsouth	4 ft	Summit	Pasture/Garden/Agriculture

Two cores with the same soil series classification with two very different land-use histories were selected for preliminary geochemical analysis: B3L8 and B10L4.

Block 10, Lot 4 (B10L4) – B10

This soil core is from a location that is now an agricultural field. This block was not developed and was ceded from the town site into agricultural land-use in 1885 (Hadley township tax assessments, transcribed by Claire Fuller Martin and available online at http://www.anthro.illinois.edu/faculty/cfennell/NP/taxmenu.html). The surface horizon appears mixed to a depth of ~15.5 centimeters as evidenced by weak soil structure and a sharp lower boundary, likely produced by plowing (Figure 12.5). This location is on the shoulder of a convex slope with a 2-5% gradient that receives direct sunlight throughout the day.

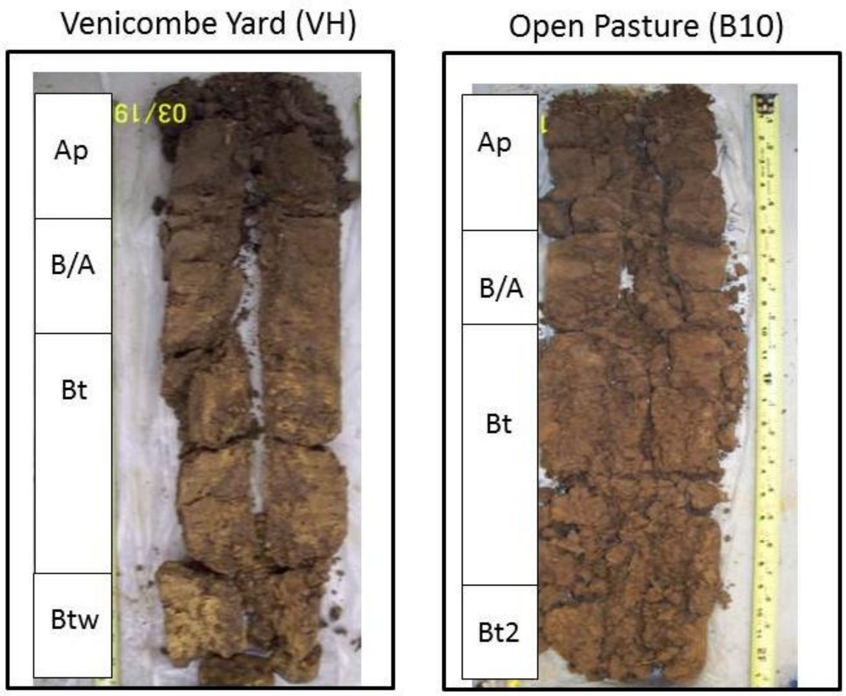

Figure 12.5. *Photographs of the two-foot soil cores from the B10 and B3L8 locations with sketch of soil horizons illustrating physical differences between the two locations.*

Block 3, Lot 8 (B3L8) – "Venicombe" house (VH)

This area is associated with above-ground foundations of a former residence, which was occupied until the mid-1990s, and associated outbuildings. Since then the house foundation has served as a collection area for miscellaneous metal implements. The soil core location is between the house foundation and a tree-lined wall constructed of fieldstone to the west. While the area has been mown periodically, it is protected from plowing. This location lies on a concave side slope with a 5-10% gradient that dips toward the northeast, effectively shielding the location from sunlight except when it is directly overhead.

Initial geochemical analyses of soil samples from the B3L8 core location (Figure 12.4) revealed high levels of trace metals that have been translocated deep in the soil. Furthermore, the physical characteristics of this core suggest that the location is periodically saturated, which along with a temperate climate increases the solubility and mobility of these elements both within the soil and potentially into the groundwater. Therefore, analyzing additional samples from this location will determine the extent of this contamination and an appropriate mitigation strategy. In addition, comparison of this residential area with other residential areas will help elucidate their respective histories.

The 2011 NSF-REU Field Season

Geoarchaeological goals for the 2011 field season were two-fold: (1) obtain additional soil samples from representative land-use areas for physico-chemical analyses; and (2) train undergraduate students in geologic theory and methods. During the course of the field school, students were given hands-on instruction and had the opportunity to practice a variety of geologic methods used in geoarchaeological investigations. These included the basics of: map reading, use of a Brunton compass, use of a total data station, platting survey points and sampling locations, operation of a Giddings drill rig, soil description, soil sample collection, and flotation of soil samples.

Total Station & Brunton Compass

In geologic practice as in archaeology, use of a total station (TS), equipped with an electronic distance measuring device (EDM), theodolite (aka Transit), and an electronic field notebook, is extremely useful for mapping out a grid of the site and precisely recording the distance (x-northing and y- easting) and elevation (z) of sample collection locations in reference to a point of known latitude, longitude and elevation (datum). These data are subsequently uploaded to a geographic information system (GIS) so that the locations can be georeferenced and combined with other georeferenced maps and images of the site.

> I learned how to set up the transit station from taking it out of the bag to shooting in points. According to Chris [Fennell], a lot of these machines are similar and knowing one version will translate loosely to using other types. I found this super helpful and good to overcome my fear of this machine. - Amanda Burtt [NSF-REU student]

A Brunton compass and topographic map can also be used to determine one's position on a landscape, as well as sight survey lines, however the precision and accuracy is much less than with a TS and is subject to operator variability. The advantage of using a Brunton compass and topographic map is that they are much less expensive and more portable than a TS.

Oakfield Soil Sampling – Thermal "cold" anomaly

Soil sampling is also common practice in both archaeological and geologic field investigations. During the course of the 2011 field school, students learned how to collect a soil sample using an Oakfield soil probe, determine the color and texture of soil horizons and document any cultural artifacts (Figure 12.6).

Figure 12.6. *NSF-REU field school students describing Oakfield soil cores*

A large thermal infrared (TIR) anomaly in the northern half of Block 13, Lot 6 was selected for investigation. It was interpreted as a "cold" anomaly in the TIR 2008 survey conducted by Bryan Haley of the University of Mississippi and Tommy Hailey of Northwest State University. Students used the TDS and measuring tapes to determine the location of the corners of the lot from the reference TDS position.

Two parallel 75 ft lines were platted for a soil probe survey. One ran from the northwest corner of Block 13, Lot 6 to a point 45 ft south of the northeast corner, with the second line 20 ft south of the first line (Figure 12.7). Soil samples were extracted using an Oakfield one-inch diameter soil probe at one-foot intervals beginning at the 25 ft mark from the northwest end of each line. Detailed descriptions of the soil samples revealed very few cultural artifacts such as brick, mortar, and nails suggesting that this area was some distance from former building sites and that subsequent agricultural activity has not significantly transported and mixed materials from nearby building locations.

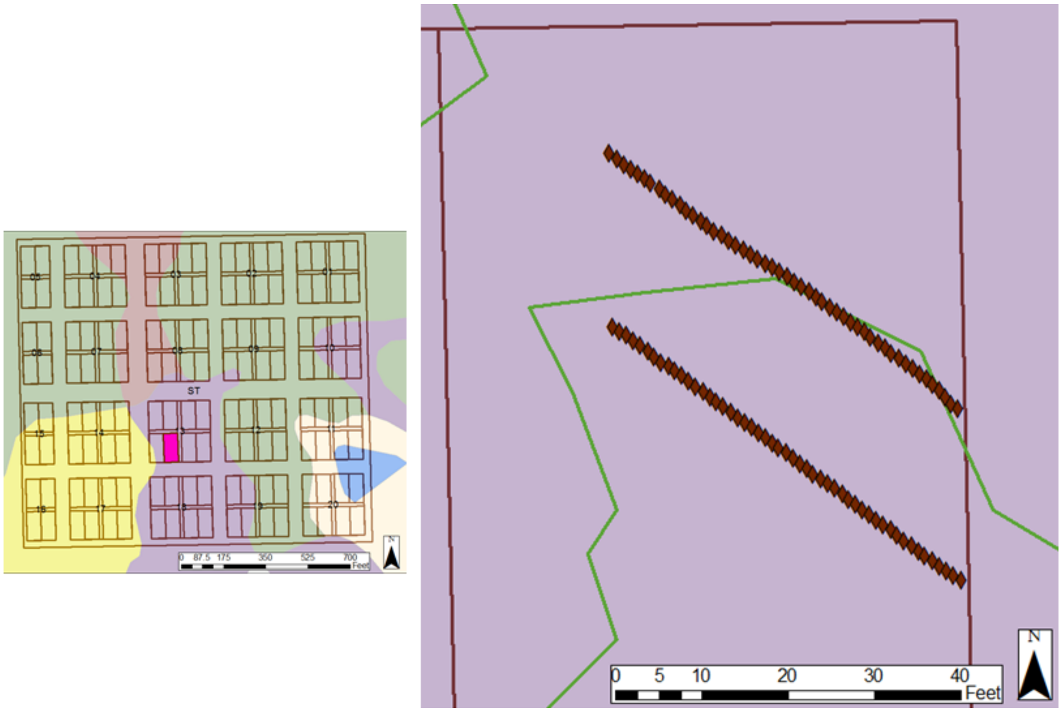

Figure 12.7. *Map of town site block, lot grid overlying the NRCS soil survey map. Block 13, lot 6 is highlighted in pink on left. Right image is close-up of northern half of lot 6, illustrating the GPS locations for the Oakfield cores (brown dots) in relationship to the thermal anomaly (green outline).*

Giddings Soil Core Collection

Based on preliminary findings from previous field work and lab analyses outlined above, four areas were identified for focused spatial analysis of soil properties. At each of the four locations detailed below, students used measuring tapes to map out a 20 x 20 ft grid and five-foot intervals within the grid. The trailer-mounted Giddings rig was maneuvered into position as close as possible to the flagged positions. The two-foot long, three-inch diameter, soil cores were extracted, wrapped in plastic wrap and aluminum foil, and labeled. The cores were transported to the University of Iowa for later description and sample preparation for physico-chemical testing. The geographic coordinates for each core location were "shot-in" with the TDS and these data were uploaded to a georeferenced database and are displayed in Figure 12.8.

Block 3, Lot 8 "Venicombe" house (VH)

RO-GC25 (VH, Figure 12.8) was extracted as part of the 2010 fall fieldwork and is described in "Background: Giddings cores: Block 3, Lot 8 (B3L8) – 'Venicombe' house (VH)," above. A 20 x 20 ft grid was positioned with this core location at the center and oriented between the house foundation and wall to permit maneuverability of the drill rig equipment.

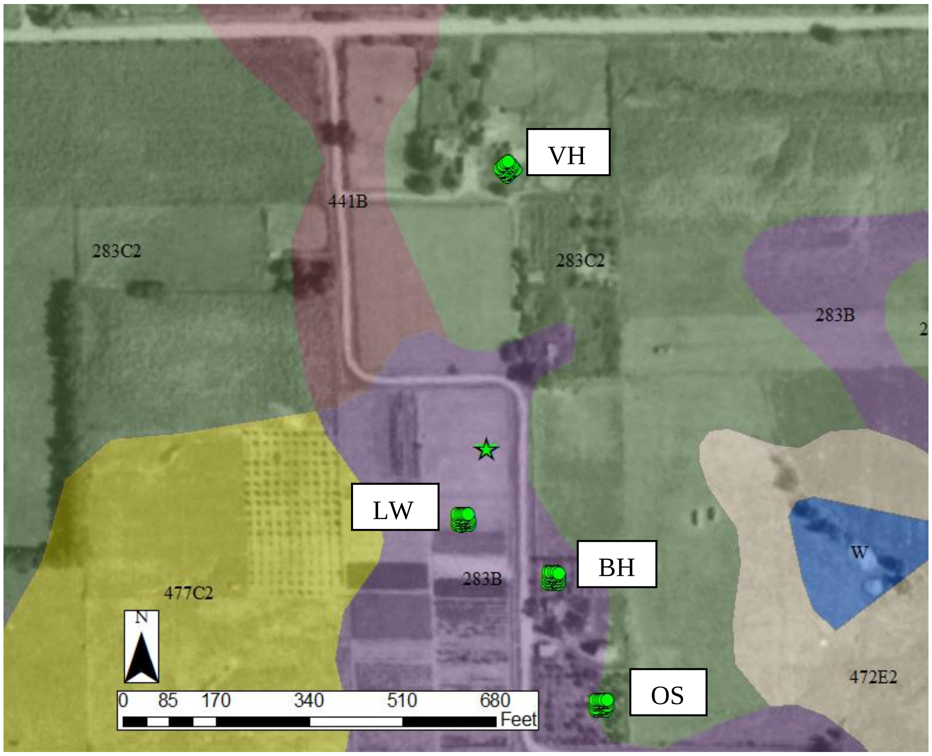

Figure 12.8. Locations of soil cores extracted from four 20 x 20 ft grids (clusters of green dots). Green star denotes the location of an additional Giddings soil core nine feet in depth.

Block 19, Lot 4 – Burdick Residential Yard

Another 20 x 20 ft. grid is located in the "Burdick" manicured front lawn (BH, Figure 12.8) just west of the existing "Burdick" house and directly north of a previous house. The existing house was built in 1941 and occupied intermittently until the present. Contrary to the soil classification mapped at this location (Downsouth), the center soil core from this grid, BH-GC14, contains a dark, organic rich horizon throughout (Figure 12.9), which more closely relates to the soil profile description for the Soil Survey classification of the Wakenda soil series that forms under prairie vegetation. This appears to suggest either a discrepancy in the classification map or that cultural fill has built up the thickness of the organic rich soil. Initial geochemical analyses of soil samples from the BH-GC14 soil core indicate similar provenance of the mineral components to those of the B3L8 and B10 soil samples. However, slight peaks in calcium concentrations with associated peaks in iron oxide and zinc concentrations may be the result of lawn fertilizer applications. Therefore, additional analyses of the surrounding cores will help clarify the preliminary results and subsequent interpretations of the land-use history at this location.

Figure 12.9. *Photograph of two-foot soil core, BH-GC14, with sketch of soil horizons*

Block 19, Lot 5 – Burdick "Pasture"

The Burdick "pasture" area (OS, Figure 12.8) is associated with and south of an existing, dilapidated barn. In the 1939 aerial photograph, this area appears to be fallow with a few small trees. However, present day there are no trees, suggesting some additional disturbance of the soil from their removal. As the soil cores were being collected, it was noted that the organic rich soil horizon appears thicker in cores from the west side of the grid, which is somewhat surprising because the west side is slightly uphill from the east. Analyses of soil cores from this location will help elucidate the relationship of elevation change with soil horizon thickness and its potential cause(s). Furthermore, because this area appears to be undisturbed by modern agriculture, the geochemical effects of early historic land-use may be preserved.

Block 13, Lot 7 – McWorter "Pasture"

This area is associated with the Louisa McWorter house and outbuildings and may have been used for pasture or gardening during New Philadelphia's early-historic occupation, but was clearly being used for subsistence garden plots by 1939 (LW, Figure 12.8). This area has undergone modification for modern agriculture since the mid-1900's. Therefore, comparison of soil characteristics from this location with those from the "unmodified" Burdick pasture will assist in distinguishing modern agricultural effects from early-historic land-use.

Shovel Test Pits

The "Square" (Matteson 1964) in Block 8, Lot 1 may have had buildings in the mid-1880s as historical tax records indicate this area was "improved," but by 1888 it was not being taxed as improved (Hadley township tax assessments, transcribed by Claire Fuller Martin and available online at http://www.anthro.illinois.edu/faculty/cfennell/NP/taxmenu.html). In the 1939 aerial photograph (Figure 12.8), the "Square" appears to be an open grassy area. Since the mid-1900s it has been modified by modern agriculture. Comparing this area's soil characteristics to the soil profiles from areas that have not witnessed modern agricultural use (BH, BP & VH, Figure 12.8) may enable a differentiation between early-historic land-use and modern agriculture impacts.

During the 2011 NSF-REU field school, a 20 x 30 ft grid for shovel test pit (STP) excavations at five-foot intervals was platted in Block 8, Lot 1 for archaeological investigation. At 10 ft intervals starting with the STP in the southwest corner, 2 cm soil samples were collected from nine of these STP units to a depth of 40 cm, at which point all STP units were in the subsoil (culturally sterile horizon). Each sample was placed in a WhirlPak bag, sealed and stored at <75°F for later physico-chemical analysis. Detailed soil descriptions are in Chapter 14, "Unit Summaries," with the archaeological findings.

Cemetery

The cemetery is mapped as Winfield silt loam, 5 to 10% slopes, eroded (USDA-NRCS, 2006c). Like the Downsouth series, this soil series is classified as a mesic Oxyaquic Hapludalf, which forms under deciduous forest, but the E horizon is not as well expressed as in the Downsouth Series. The 1872 township map indicates this area was wooded (Figure 12.10a) and a 1939 aerial photograph (Figure 12.10b) indicates the location was on the boundary of an agricultural field. Furthermore, the lack of large, old trees in the present indicates it may have been disturbed by clearing of vegetation.

Figure 12.10. *Maps illustrating relationship of McWorter cemetery to NPHL: (a) on the right - portion of 1872 Pike county map illustrating cemetery in forested area; and (b) on the left – 1939 aerial photograph (cemetery outlined in red; NPHL in yellow; blue star is STP location).*

On the slope summit in a small opening among trees just outside the eastern boundary of the McWorter cemetery, a 2 x 2 ft shovel test pit was excavated to a depth of two feet by 2011 NSF-REU students Liz Usherwood, Amanda Burtt, Thomas Glantz (Figure 12.11). The team demonstrated their knowledge of soil descriptions by describing the color and texture of the soil profile of the west wall (Table 12.2). The team assisted in the collection of soil samples at 2 cm intervals for physico-chemical analyses and micromorphology samples of in-place soils for thin section examination.

Figure 12.11. *Top: 2011 NSF-REU students, left to right: Liz Usherwood, Amanda Burtt, and Tom Glantz with 2 x 2 foot shovel test pit near McWorter cemetery; bottom: 2-foot soil profile of shovel test pit.*

XRF Testing

A portable hand-held x-ray fluorescence (XRF) spectrometer was loaned by Bruker AXS for use during the field school. XRF is a fast, non-destructive analysis tool that can be used to characterize chemical composition of the surface of archeological artifacts, such as glass and ceramics, as well as for geochemical survey of *in situ* soils. However, given the heterogeneity of soils across a landscape like at New Philadelphia, and limitations of the equipment without the vacuum functionality the XRF analysis revealed that characterizing the elemental composition of soil would not yield the precision necessary to differentiate the effects of land-use from variation inherent in natural geochemical processes at different soil locations. The vacuum functionality expands the detection limits of the XRF so elements important to soil geochemical processes, such as aluminum and magnesium can be measured. A better geologic use of this equipment would be determining the presence and spatial extent of environmental contaminants, such as heavy metals, that would not require the use of the vacuum.

I demonstrated the use of the equipment and interpretation of the data produced from some of the "unidentified substances" found inside what appeared to be apothecary bottles from the cellar excavations as well as different glazes on pottery sherds. Arsenic was one of the dominant elements associated with the ceramic sherds and a little bit of internet searching revealed that arsenic was used in ceramic glazes to produce certain colors. However, while XRF is non-destructive to the sample, it does not penetrate the surface of the artifact. Therefore, if the objective is to identify the composition of the ceramic, better analytical results would be obtained by preparing a powder of the artifact.

Future Research

To date, nine deep soil cores and 100 two-foot soil cores have been extracted and will be described and samples will be collected from each soil horizon. In addition, soil samples from shovel test pit units on Block 8 and near the McWorter cemetery, and bulk soil samples from a trench excavation have been collected. Physical and chemical analyses will be performed on select soil samples to elucidate variability of soil characteristics due to landscape position, slope, aspect, and land-use. Specifically, variability across the landscape, or at a macro-scale, will be delineated by examination of the physical descriptions of the nine deep soil cores and one two-foot soil core from each of the four 20 x 20 ft grids. Soil cores from each of the grids will be examined to describe any meso-scale variability of soil characteristics. Finally, micro-scale analysis of physical and chemical data produced from micromorphological thin-sections and incremental soil samples within the specified land-use areas: residential, pasture, and garden plots, will reveal geochemical signatures that are related to and differentiate past land-use activities that will help to elucidate the history of this cultural landscape and resulting soil changes.

References Cited

Fennell, Christopher C., ed.
2009 New Philadelphia Archaeology Project: 2008 Archaeology Report. http://www.anthro.illinois.edu/faculty/cfennell/NP/2008ReportMenu.html.

King, Charlotte

2007 New Philadelphia Census Data: Center for Heritage Resource Studies, University of Maryland, College Park. http://www.heritage.umd.edu/chrsweb/new%20philadelphia/New%20Philadelphia/censusfiles/CensusDataMenu.htm. Accessed November 17, 2010.

Matteson, Grace E.

1964 *"Free Frank" McWorter and the "Ghost Town" of New Philadelphia Pike County, Illinois*. Pittsfield, Illinois: Pike County Historical Society.

Rocheford, M. Kathryn

2011 Geoarchaeological Investigation of New Philadelphia: Soil Core Testing of Thermal Infrared Anomalies. In New Philadelphia Archaeology Project: 2010 Archaeology Report. A.S. Agbe-Davies, ed. http://www.anthro.illinois.edu/faculty/cfennell/NP/2010ReportChap6.pdf.

Soil Survey Staff

2006 Soil Survey Geographic (SSURGO) database for Pike County, Illinois: Natural Resources Conservation Service, United States Department of Agriculture. http://soildatamart.nrcs.usda.gov/ . Accessed May 21, 2010.

Walker, Juliet E. K.

1983 *Free Frank: A Black Pioneer on the Antebellum Frontier*. Lexington: University Press of Kentucky.

Return to 2013 Archaeology Report Menu