

# A Comparison of Invasive and Non-Invasive Site Location Methods at Oakland Plantation, Natchitoches, Louisiana

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## ABSTRACT

Non-invasive site location methods are attractive alternatives to subsurface testing over large tracts of land. Several studies have been conducted over the years examining the value of different techniques for historical archaeology. Of the non-invasive techniques available, magnetometry is one of the most attractive tools due to the overwhelming presence of metals and other magnetic materials used in the construction of historic structures. At Oakland Plantation, Natchitoches, Louisiana, both an auger-testing survey and a magnetometer survey were undertaken, allowing for a comparative assessment of results. The potential of each technique for locating buried features on plantation sites is examined. Suggestions for future use in site location and delineation are presented.

## Introduction

At Oakland Plantation, Natchitoches, Louisiana, a systematic auger investigation was conducted by the Southeast Archaeological Center of the National Park Service in 1997. Based on findings from that project, a magnetometer survey examined areas associated with a pre-Civil War cotton gin and a slave/tenant quarter. Objectives for this project were to verify results of the auger tests and to assess the practicality of both techniques for site identification. In this paper, the results of the magnetometer survey are presented, and the benefits and limitations of both survey techniques are assessed in light of budget and time constraints.

## Context and Previous Fieldwork at Oakland Plantation

Pierre Emmanuel Prud'homme established Oakland Plantation on a Red River land grant in 1789. The Prud'hommes were the first to raise cotton successfully

in the Louisiana colony, and the plantation prospered and grew considerably during the early-19th-century cotton boom (Prud'homme Haynie 2001:15; Miller and Wood, 2000:17). Between 1820 and 1860 the slave population at Oakland expanded from 74 to 145 (Miller and Wood 2000:17–19). The plantation raised livestock and continued to cultivate cotton, employing sharecroppers and tenant farmers after the Civil War. In the 1990s, the National Park Service acquired a portion of the plantation for public interpretation, including all standing structures (Prud'homme Haynie 2001:96).

The plantation today incorporates several buildings, including a main house made of *bousillage* on lathe between posts raised on brick piers. This is typical of local Creole construction and was used for other structures as well. Documentary sources refer to a pre-Civil War cotton gin in the northern portion of the Oakland property that was burned during the 1864 Red River Campaign (Prud'homme Haynie 2001:52). Unlike the “new” gin constructed by 1860, there are no visible signs of the earlier structure, nor are there known historic maps denoting its location. The slave/tenant quarter consists today of two standing structures and another in ruins. The latter belonged to Gabe Nargot, the last slave in residence at Oakland. An assessment of the standing cabins places their construction between 1850 and 1860 (Miller and Wood 2000:74). The Nargot cabin is believed to be earlier (Estes 1969).

From May to July 1997, Dr. Bennie Keel headed archaeological investigations at Oakland Plantation. He carried out an auger test excavation project to locate areas of archaeological significance that might be affected by impending construction and site restoration by the National Park Service (Miller and Wood 2000:13). Two hundred and ninety-six auger tests were dug at 50 ft. intervals and another 1,364 tests were dug at 25 ft. intervals (Miller and Wood 2000:14). Each test was 1 ft. in diameter and terminated at culturally sterile soil; all were excavated using

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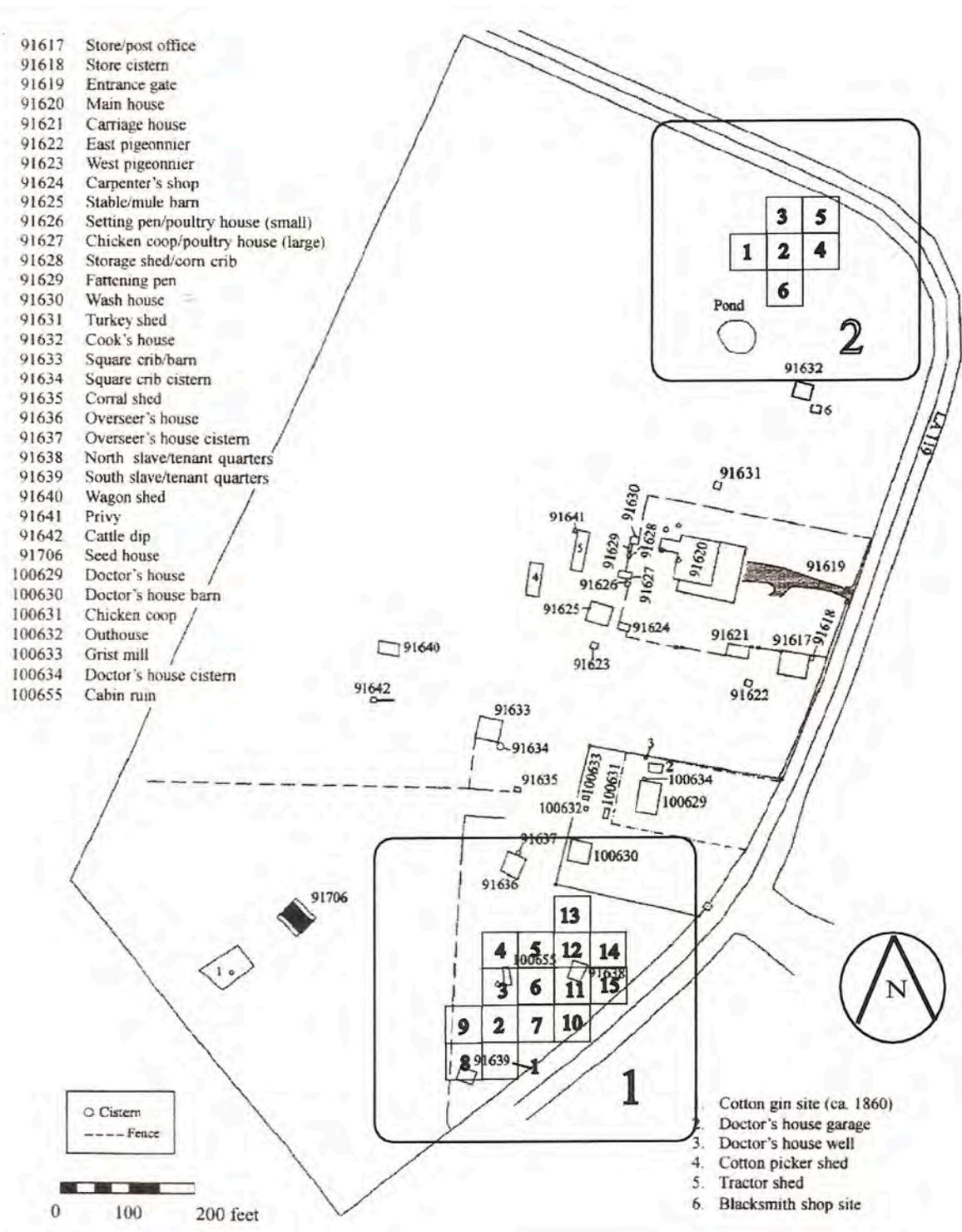


Figure 1. Survey Map showing the location of the Slave/Tenant (area 1) and the pre-Civil War Cotton Gin (area 2) grids (Adapted from the 1997 augur survey map, on file at Oakland Plantation, courtesy of the National Park Service).

a tractor-mounted auger and the soil was sifted through a ¼ in. mesh screen to ensure the recovery of cultural materials (Miller and Wood 2000:14). Although several features were located, the auger survey was not able to determine the layout of the slave/tenant quarter or the number of former cabins. Based on artifact patterning, it did identify the potential location of the original cotton gin. A high concentration of materials from the “structures group,” including metal hardware, brick and mortar was recovered here (Miller and Wood 2000:43, 73).

### Magnetometer Survey at Oakland Plantation

In August 2002 the National Park Service requested a magnetometer survey at Oakland to verify Keel’s potential location of the pre-Civil War cotton gin and to provide further information on the layout of the slave/tenant quarters. Based on Keel’s results, grids of 20 x 20 m squares aligned to magnetic north were established in the two areas (Figure 1). Magnetometer survey of 6 adjoining squares was carried out in the gin area and 15 in the slave/tenant quarter area. To facilitate comparison between Keel’s results and the magnetometer survey, major standing structures were used to establish the 2002 grid and tie areas to the 1997 map.

Surveyed squares were divided into 1 x 1 m sections. North and south baselines were established by fiberglass metric tape laid out between established grid points; these were placed as guides for 20 m-long plastic ropes taped off at 1 m intervals. Ropes were moved as the surveyor advanced taking measurements. Readings were taken by walking at a steady pace with the instrument along a south to north heading, stopping every meter to log a point. At the end of each 20-point line, the individual returned to the southern baseline to repeat this process and keep readings consistent. If points on the grid could not be logged due to vegetation, high concentrations of aboveground metal, power lines, or standing structures, a maximum value ( $\pm 2047nT$ ) was entered.

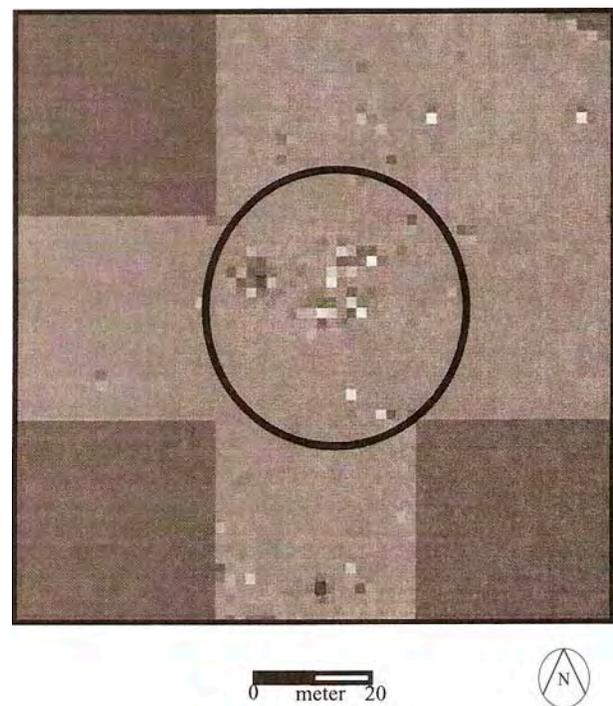
Magnetometer surveys conducted on United States historical sites have mainly employed proton magnetometers (Mason 1984; Von Frese and Noble 1984; Garrison 1996; Silliman et al. 2000). For this study, however, a fluxgate gradiometer was used. The fluxgate has several advantages over proton models, including the ability to take continu-

ous readings (Clark and Haddon-Reece 1972; Philpot 1973:99). The gradiometer is less susceptible to magnetic storms and other electrical disturbances (Allred 1964:15; Scollar 1990:461). One drawback is that it is not as rugged as proton models and often operates at a higher cost. Because the site was a level, maintained ground with a manicured lawn, vegetative or topographic conditions were not a factor in selecting an instrument (Philpot 1973:100).

Throughout the survey the weather was stable, the sky was clear, and the temperature ranged from the lower to upper 90 degrees Fahrenheit. The same individual operated the magnetometer for the entire survey. When vehicles passed, the surveyor stopped recording to avoid background noise. All data points were manually logged and downloaded from the magnetometer into the field laptop following the completion of each 20 x 20 m square. *Geoplot* software provided instant maps of anomalies.

#### *Pre-Civil War Cotton Gin*

The cotton gin survey consisted of six 20 x 20 m squares. The investigation produced a single, focused anomaly (Figure 2). The highest magnetic concentration is an oval in



**Figure 2.** Magnetic anomaly at the pre-Civil War Cotton Gin (Figure by author, 2002).

the northeast portion of the surveyed area. In addition to a high concentration of metallic debris, the magnetic signature at this locale may have resulted from the destruction of the original cotton gin by fire (Bevan 2006:34). The documented anomaly corresponds with the area identified by Keel as the cotton gin based on artifact distributions from the 1997 auger-testing program (Miller and Wood 2000:56, 73). The area identified by Keel is larger, however.

*Slave/Tenant Quarter*

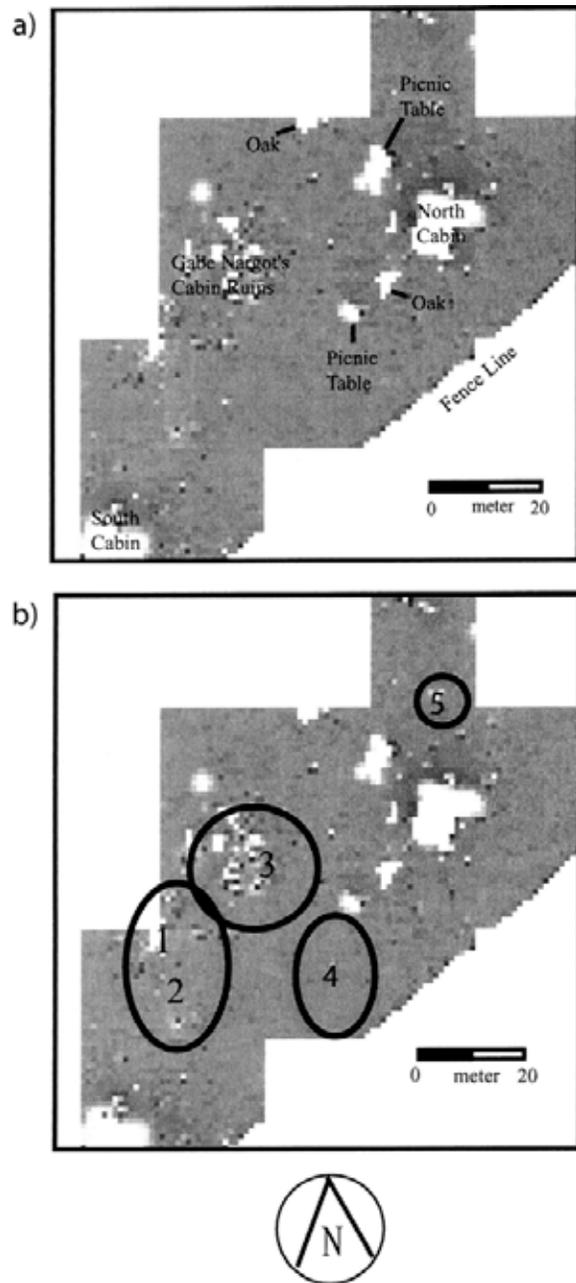
This slave/tenant quarter magnetometer survey included 15 squares of 20 x 20 m. This encompassed the two standing cabins as well as the ruins of Nargot's residence. Four anomalies were documented (Figure 3).

Anomaly 1, a roughly rectangular area covered with thick brush, may represent a buried cabin feature. The location is in line with the south cabin and that of Nargot, a placement that corresponds with the central yard arrangement identified from standing remains. The magnetometer readings for Anomaly 1 range from +5/-7 to +116/-193nT. These are similar to readings taken from brick at the ruins of Nargot's cabin. Exposed brick pier readings are low (+5/-6 to +30/-25nT) while those from brick scatter are higher (+100/-100 nT). The discrepancy between these may be from alignment or from brick manufacturing techniques, including sun drying (Prud'homme Haynie 2001:18). In general, higher readings, either negative or positive, are related to the presence of metal, while lower numbers and zero readings are due to properties of the natural soil suggesting the absence of cultural material (all magnetometer readings are designated by the nano tesla (nT) unit).

Anomaly 2 is associated with Anomaly 1 and is located northwest of the south cabin. This rectangular anomaly has readings that range from -120 to -44 nT. It is far enough away from the standing south cabin to discount background noise from its corrugated metal roof. There are no obvious depressions or changes in vegetation that provide insight to the feature's identity. The rectangular shape suggests it is a cultural rather than natural feature.

Anomaly 3 is associated with the front yard of Nargot's cabin. It covers a substantial area with values ranging from +2015/-1999nT to +62/-45. Unlike the relatively close-ranging readings from the brick, this suggests a variety of

metallic items. Anomaly 3 has three potential explanations. It could be from scattered nails and other structural debris resulting from the collapse of the cabin. It could come from an earlier fence line enclosing the yard that is visible in 1969 photographs. Alternatively, it may be a refuse midden associated with the cabin (Estes 1969).



**Figure 3.** (a) Magnetometry survey results of the Slave/Tenant Quarter Area; (b) Magnetic anomalies in the Slave/Tenant Quarter Area (Figure by author, 2002).

Anomaly 4 in the northern section of the area consists of a series of low readings ranging from  $-5$  to  $+6 \pm 2$  nT, with a large number of 0 readings detected. This absence of metal or any other magnetic signature possibly relates to Gin Turn Row, a road leading to the 'new' gin that passed between Nargot's cabin and the southwest slave/tenant cabin. However, it is believed that the road was no longer in use by 1958 based on a series of aerial maps of the plantation.

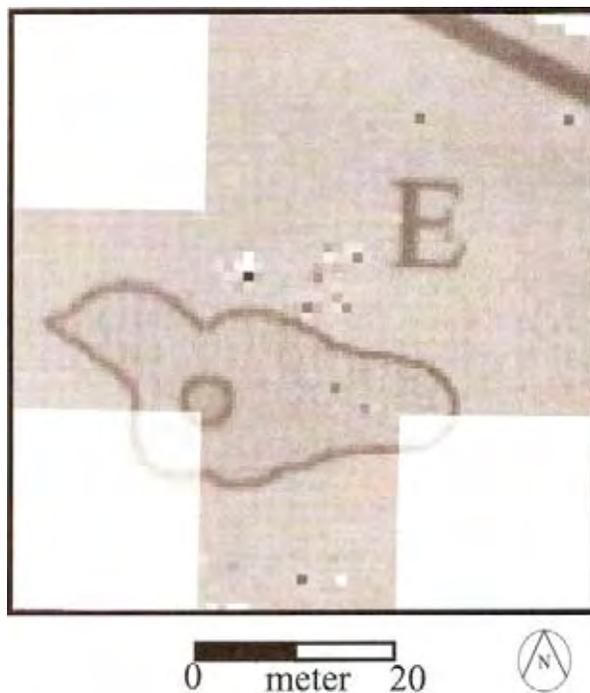
### Comparison of the Auger-testing and Magnetometer Survey Results

Both Keel's 1997 auger-testing project and the 2002 geophysical study placed the pre-Civil War cotton gin in the northern portion of the present-day Oakland plantation. The investigations yielded similar findings for metallic concentrations, although the area defined by Dr. Keel is much larger, and located slightly south of the anomaly identified by the magnetometer (Figure 4). This difference may be due to isolated artifacts found in Keel's outlying test

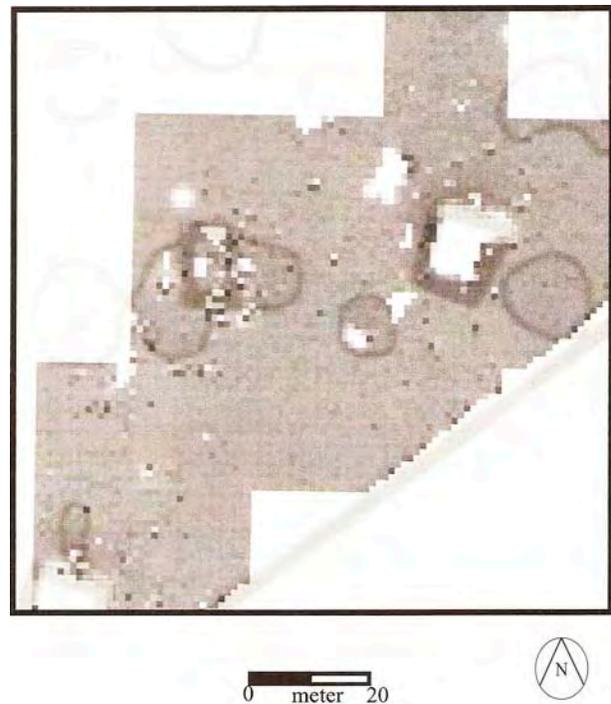
pits that were incorporated into, and defined the artifact distribution patterns.

In the slave/tenant area, Keel's structure and nail group results are similar to the magnetometer findings near Nargot's cabin (Figure 5). Predictably, the locations of cut and wire nail concentrations are associated with structures. The largest occurrence of cut nails is in the slave/tenant area (Figure 6). Two concentrations were found around Nargot's cabin and the north slave/tenant cabin. The entire central area between the three cabins has lower concentrations of nails. High magnetic readings around the structures are no doubt due to nails, with higher numbers expected near Nargot's cabin because of its collapse.

Keel found the distribution pattern of wire nails to be similar to cut nails in their association with standing or known structures, but absent from the pre-Civil War cotton gin area (Figure 7). His wire nail concentration located south of the northern cabin did not result in high magnetometer readings. The concentration southeast of the cabin ruins did coincide with the Nargot yard anomaly located during the magnetometer survey, however. Because Keel



**Figure 4.** Structures Group compared to magnetic anomalies in the pre-Civil War Gin area (adapted from Miller and Wood 2000:57)



**Figure 5.** Structures Group compared to magnetic anomalies in the Slave/Tenant Quarter Area (adapted from Miller and Wood 2000:57)

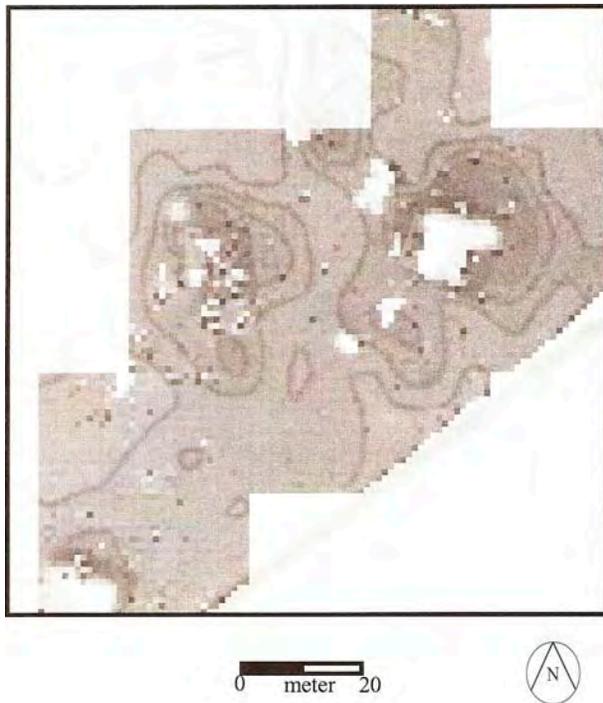
dug his auger tests at 25 ft. intervals here, it is possible that the scatter plotted by the auger project may have included isolated nails. Anomalies 1 and 2 are not associated with wire nail distributions, suggesting they were formed prior to the introduction of wire nail technology at Oakland Plantation. Thus, if Anomaly 1 is a cabin feature, it collapsed or was torn down prior to the 1890's when wire nails became the predominant type in America.

### Conclusions

The magnetometer survey required 2 individuals surveying for 3 days to cover 8,400 m<sup>2</sup>. The auger-testing project took 3 months to sample the entire 41-acre property. Though the auger project covered a larger area overall, a significant amount of time was spent excavating units without cultural materials. Of the 1,660 tests dug by Keel, 28% (n = 466) contained no artifacts and only 2.3% contained a sufficient concentration of materials to be designated a feature (Miller and Wood 2000:37). In terms of time and labor, a magnetometer survey conducted prior to any form of excavation would ensure that areas of little to no activity

would be located. This would ensure a more effective use of subsurface investigation efforts, as well as aid in defining the overall landscape (Kvamme 2003).

At Oakland Plantation, both methods located the site of the early cotton gin and found similar subsurface features/anomalies in the slave/tenant area. Because the auger project relied on artifact counts from 1 ft.-diameter holes located 25 or 50 ft. apart, the possibility of missing an anomaly is high. Comparatively, the magnetometer readings were taken at 1 m intervals leaving a minimal area of ground between readings unexamined; this system eliminates a potential margin of error for the original subsurface investigation. The magnetometer survey produced positive findings, yet was limited by the inability to ground truth these findings through excavation. Thus it is evident, that a geophysical survey is best utilized as a guide for shovel or auger-testing rather than as an alternative. If implemented with the original survey, large areas of the plantation most likely used for farming or grazing would have been eliminated from the auger-testing project, while high probability areas could have been tested more thoroughly.



**Figure 6.** Cut Nail Distribution compared to magnetic anomalies in the Slave/Tenant Quarter Area (adapted from Miller and Wood 2000:59).



**Figure 7.** Wire Nail Distribution compared to magnetic anomalies in the Slave/Tenant Quarter area (adapted from Miller and Wood 2000:60).

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