

Non-Site Survey on Monticello Mountain

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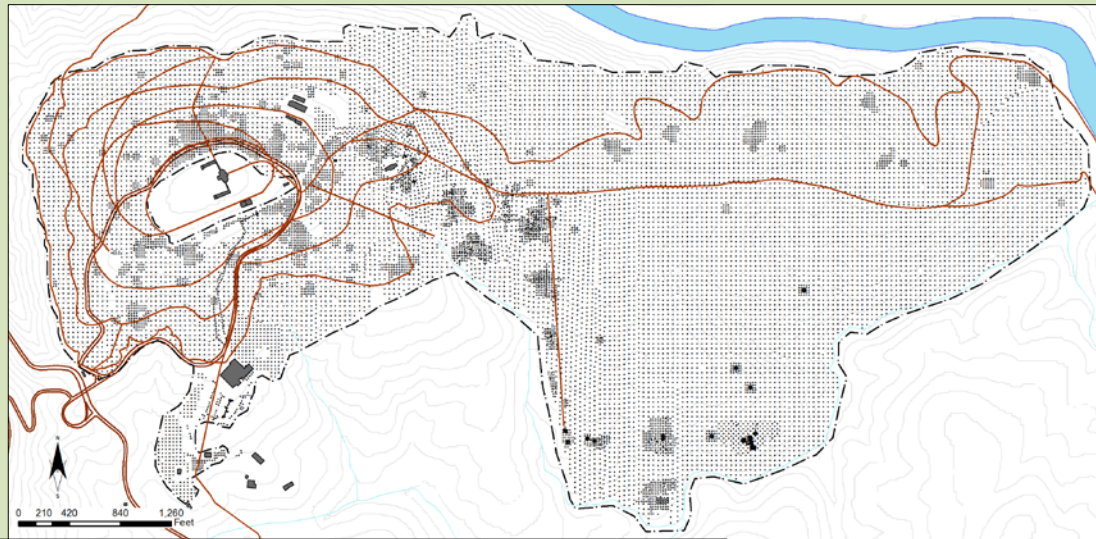
1. Monticello Plantation Survey

Beginning in 1997, Monticello's Archaeology Department designed and implemented a research project called the **Monticello Plantation Archaeological Survey**. The spatial focus of the survey is a 2,000-acre tract of land along the Rivanna River currently owned by the Thomas Jefferson Foundation. This tract comprised the core of Thomas Jefferson's Monticello Plantation.



In this poster, we briefly describe our approach to archaeological survey of the Monticello Plantation. We then focus on our efforts to empirically reconcile the archaeological record, portrayed as a scatter of artifacts whose density varies continuously, with the tendency of archaeologists (including us!) to think of it in terms of **discrete sites**.

The Plantation Survey is an example of a systematic **non-site survey**.¹ We have discarded the notion of site to provenience the artifacts we find in the field. Rather, artifacts are provenienced to shovel test pits (STPs) from which they were recovered. The location of each STP is mapped, whether the unit yields artifacts or not.



A map of STPs on Monticello Mountain. The survey area covers 505 acres and includes 17,000 STPs.

STPs are dug on 40-foot centers along north-south transects and recorded using the Virginia State Plane Coordinate System, which facilitates combining our survey data with other georeferenced datasets.

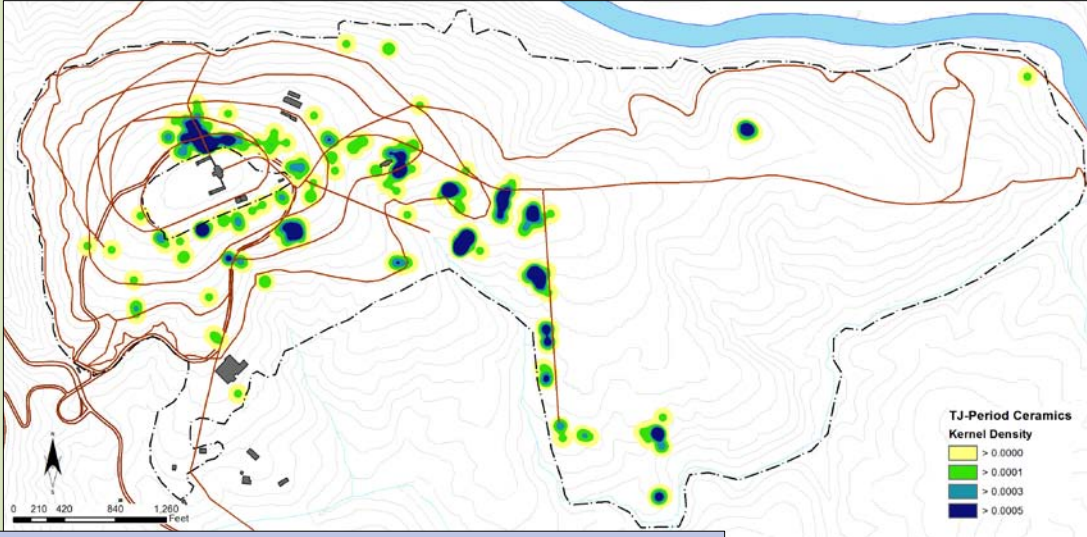
When a positive STP is encountered on the 40-foot grid, eight adjacent STPs are dug on a 20-foot grid to surround it, a process that continues until **all positive STPs are bounded** by STPs 20 feet away.

¹ Dunnell, Robert C. and William S. Dancey (1983) The Siteless Survey: A Regional Scale Data Collection Strategy. *Advances in Archaeological Method and Theory* 6:267-287.

2. Modeling Continuous Density Surfaces with KDEs

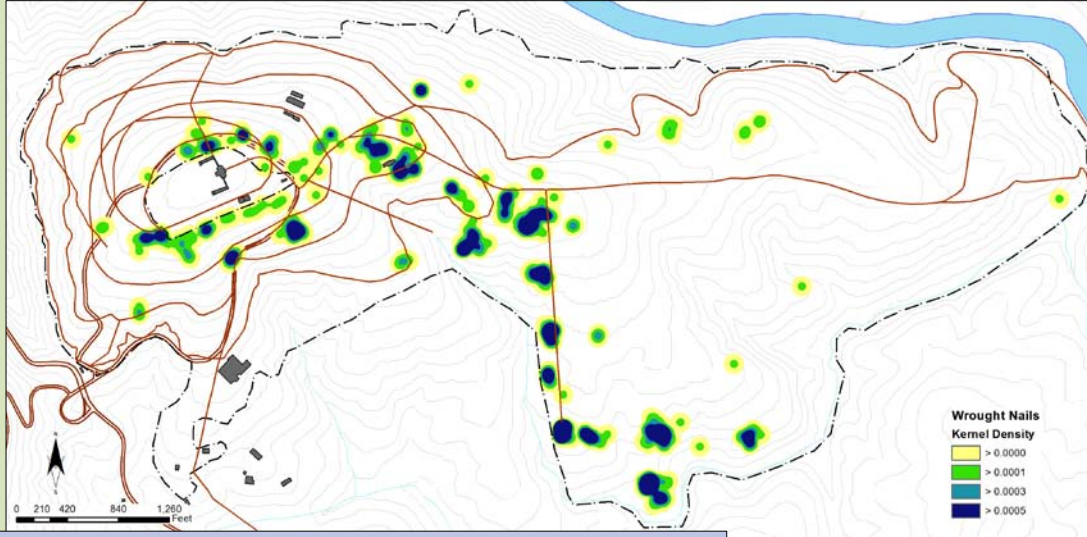
A non-site approach allows us to portray the archaeological record as a scatter of artifacts whose **density varies continuously** across the landscape. Density is affected by intensity and duration of use at places as well as regularity of traffic between places. At Monticello these variables include:

- multi-year sedentary occupations by multiple households
- shorter occupations by individual households
- non-domestic agricultural and industrial activities
- travel routes between the plantation's fixed places
- loss of artifacts at random locations
- any combination of the above



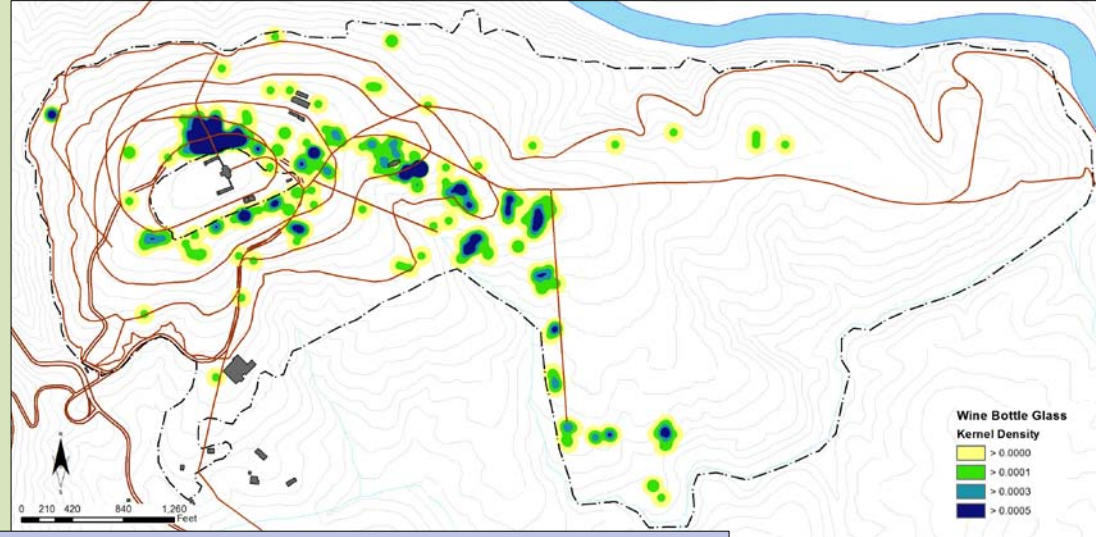
A kernel density surface of Jefferson-period ceramics with a cell size of 5 and a radius of 80 feet.

Can we parse this continuous surface into discrete activity areas? We map **three artifact classes**: Jefferson-period ceramics (ca. 1740-1830), wrought nails, and wine bottle glass (WBG). We use kernel density estimates (KDEs) to convert STP artifact counts into continuous density surfaces ($r = 80$ ft).²



A kernel density surface of wrought nails with a cell size of 5 and a radius of 80 feet.

Domestic occupations of high intensity or long duration should result in **high-density patches** for all three artifact classes. Non-domestic occupations of high intensity or long duration should result in high-density patches *sans* ceramics. Discard of artifacts between occupations will result **low-density scatters**.



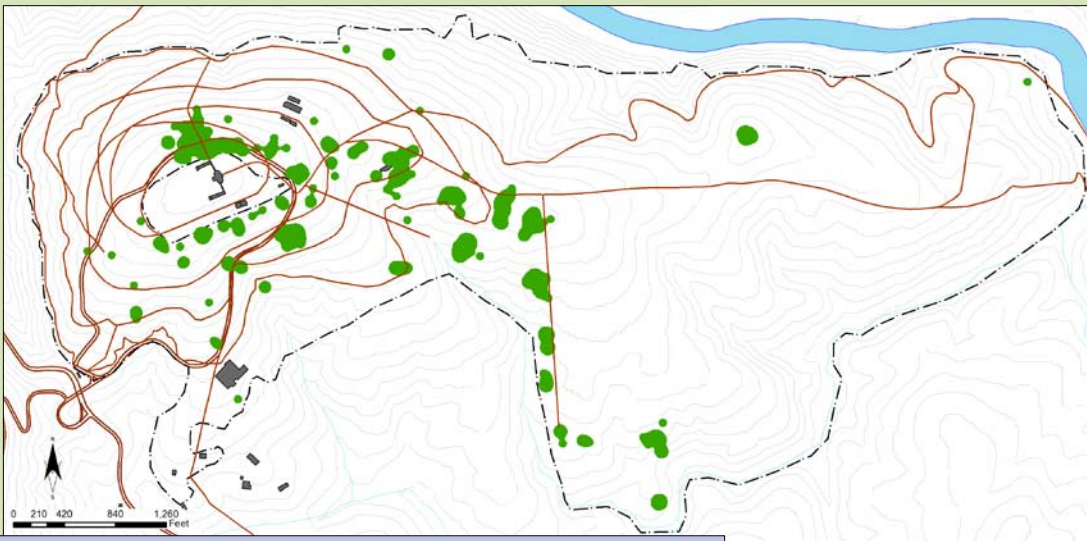
A kernel density surface of wine bottle glass with a cell size of 5 and a radius of 80 feet.

If this is right, we need to distinguish patches from scatters and assess the **amount of overlap** in the spatial location of each kind of patch.

How might we distinguish scatters from patches empirically?

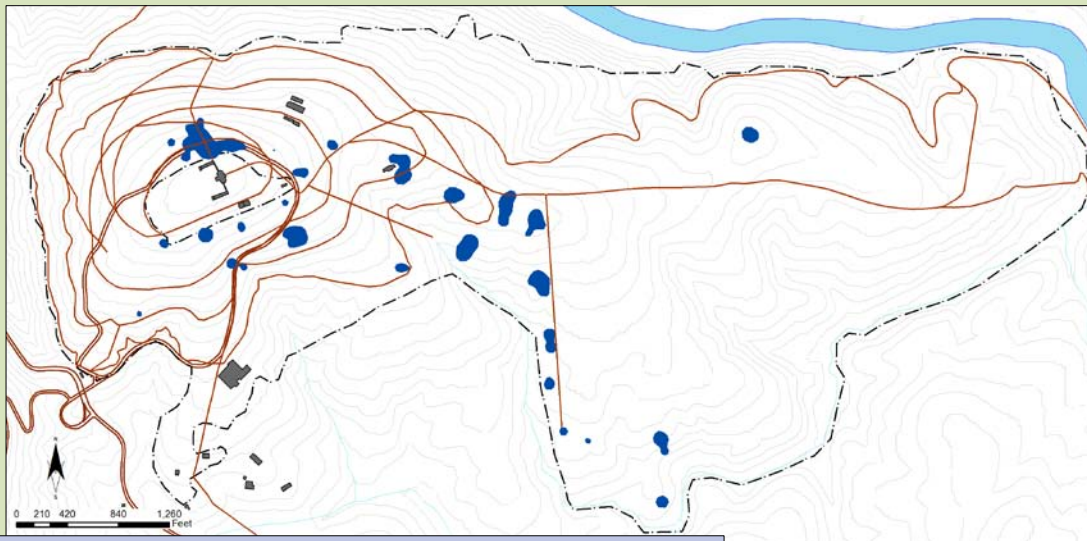
² Sheather, Simon J. (2004) Density Estimation. *Statistical Science* 19(4):588-597.

3. Modeling Patches with Density Thresholds



Individual polygons characterize areas with a greater than or equal to 0.0001 kernel density value of Jefferson-period ceramics.

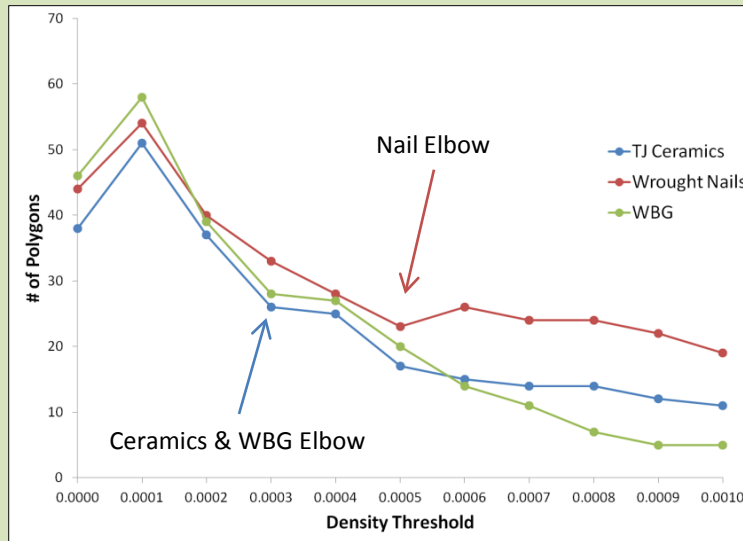
We experiment with **density thresholds**. KDE cells with values below a given threshold are considered scatters. KDE cells with values above the threshold are patches. On the original KDE surface, all cells with a density greater than 0 are patches. Incrementing the density threshold to 0.0001 (above) results in a smaller number of patches.



Individual polygons with a greater than or equal to 0.0003 kernel density value of Jefferson-period ceramics.

Incrementing it to 0.0003 (above) results in an even smaller number of patches that approximate what we intuited were "sites" before quantitative analysis.

How can we objectively determine **which density threshold** to use?

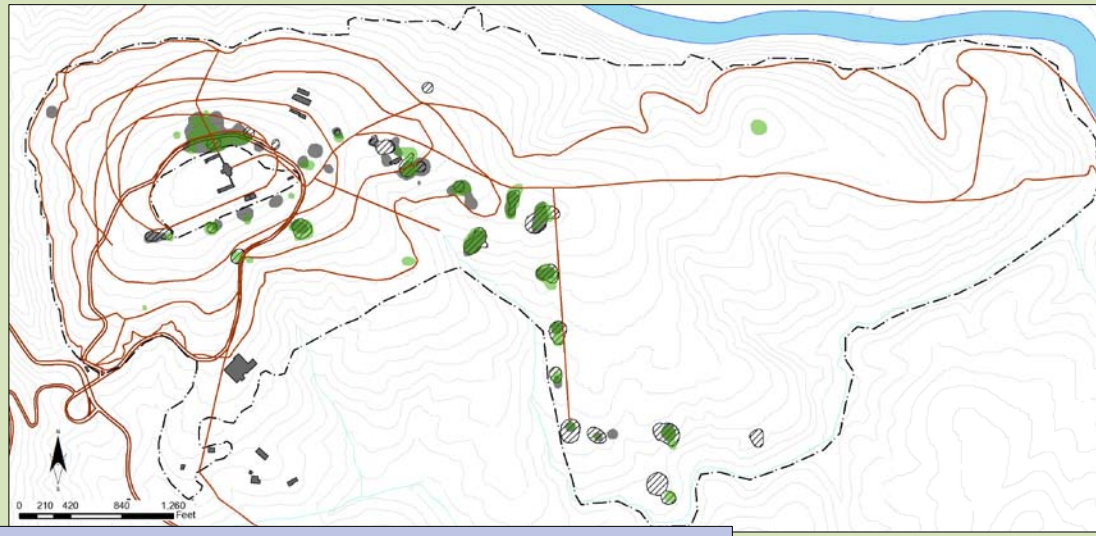


The **elbow** in the curve denotes the point at which the number of patches (called polygons in ArcGIS) stabilizes as the density threshold increases.

We can visualize the effect of density on how we define patches by plotting the number of patches obtained at a given density threshold for our three major artifact classes. If we take the elbow to be **the optimal point**, the pattern indicates an ideal density threshold of about 0.0003 for ceramics and wine bottle glass and 0.0005 for wrought nails.

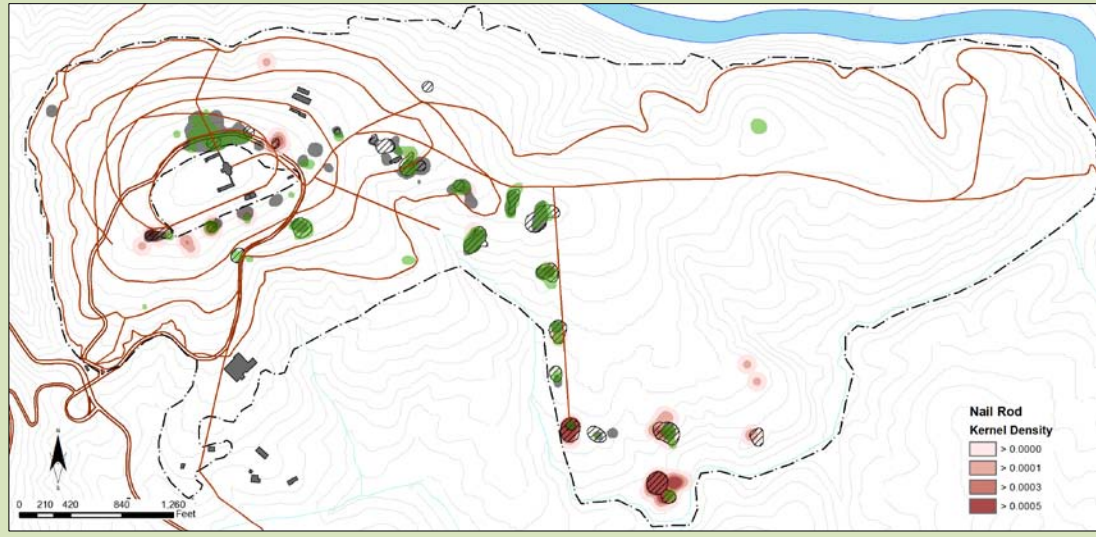
4. Characterizing the Patches

As shown by green polygons below, some ceramics patches overlap with patches of wrought nails (hatched polygons) and wine bottle glass (grey polygons). We would characterize these green patches as the locations of **multi-year residential occupation** of one or more households.

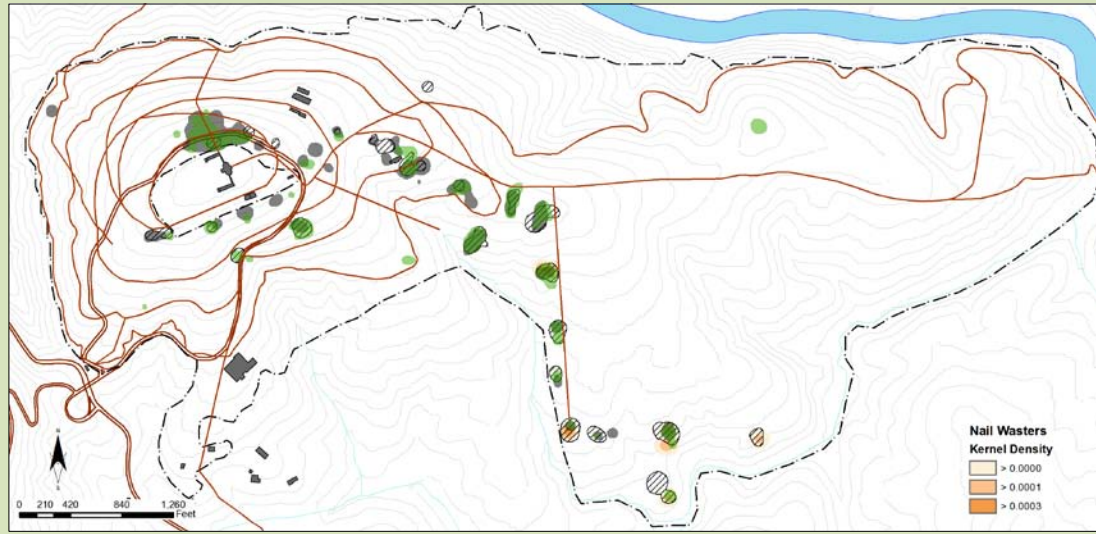


Green polygons mark areas where Jefferson-period ceramics, wrought nails (hatched polygons), & wine bottle glass (grey polygons) overlap. Ceramics and WBG are set at a threshold of 0.0003 and wrought nails at 0.0005.

But notice some patches that lack ceramics all together have substantial concentrations of wrought nails or wine bottle glass, or both. We think these areas most likely reflect **specialized activities** attached to fixed facilities, such as nail making (i.e., naileries), agricultural crop storage and processing (i.e., barns), or industrial storage (i.e., storehouses for iron).

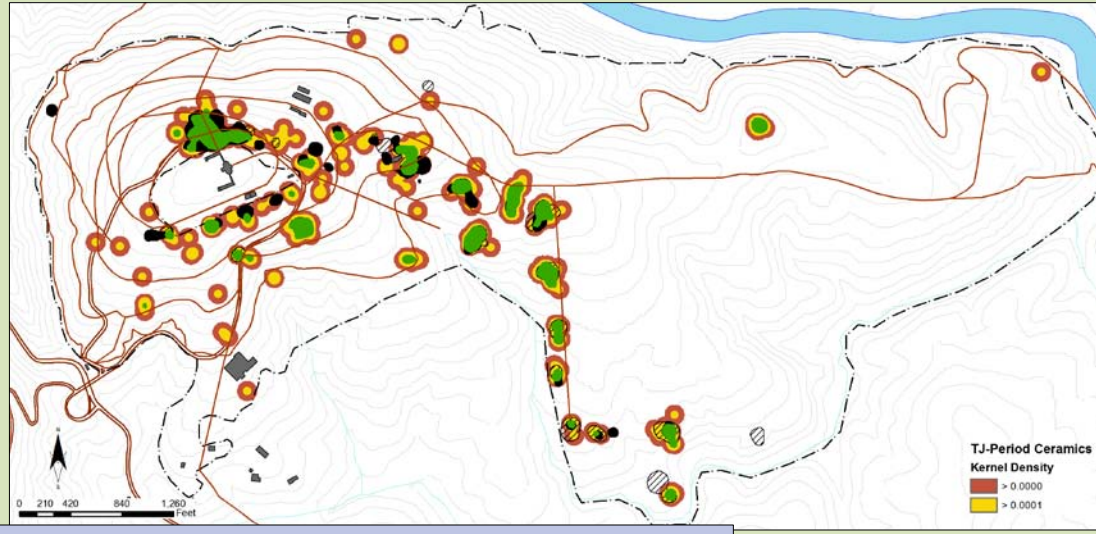


We can test this idea further by mapping the distributions of nail rod (above) and nail wasters (below) — the raw materials and waste from nail making. Areas which lack ceramics but have high concentrations of **nails, nail rod, and/or nail wasters** are most likely naileries.



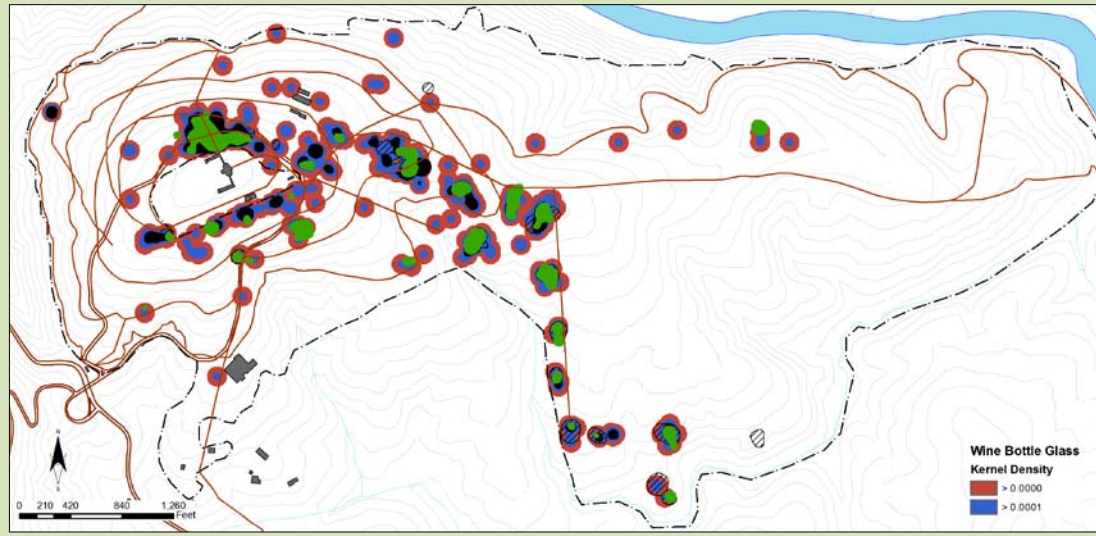
5. Characterizing the Scatters

As we just saw, we can identify areas where regular and repeated activity occurred. We also can confidently discuss what sorts of activities characterize these places. But, what are we to make of the **low density scatters** and isolated blips in between — densities less than our artifact thresholds?



Green polygons mark areas where Jefferson-period ceramics, wrought nails (hatched polygons), & WBG (grey polygons) overlap.

Low density scatters adjacent to the highest road encircling the mountaintop are more likely to denote **high-traffic areas** in between fixed-facility places. Future work will address the nature of the deposits in this area. Isolated finds occur across the mountaintop, though many appear on or adjacent to Jefferson-period roads.



6. Summary

Systematic non-site survey methodology allows us both to portray the archaeological record as a continuous surface of varying density and to experiment with how we define sites.

This exercise reveals that what we think of as sites (at Monticello) typically are domestic sites of moderate to high intensity or naileries where intensive industrial activities took place regularly.

Exploring variation in density thresholds makes it clear that there are high and low traffic areas in between places that also merit attention.