FARM WOODLOTS IN THE SOCIAL LANDSCAPE:
HUMAN AGENCY IN A STRUCTURED LANDSCAPE

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This thesis entitled
FARM WOODLOTS IN THE SOCIAL LANDSCAPE:
HUMAN AGENCY IN A STRUCTURED LANDSCAPE

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How did the social landscape influence the historical distribution of woodlots in Wayne County, Ohio? Using GIS software, historical maps, and census schedules, this thesis examines the relationship between farm woodlots and the physical and social features of the nineteenth century agricultural landscape. In Wayne County, woodlots are found adjacent to parcel boundaries, not near streams or soils with wetness problems, and at distances greater than 1,000 feet from the farmstead core. The standard layout of the farm is for the woodlot to be on the opposite side of the property from the house. In terms of agricultural variables, there is a positive correlation between farm acreage and the total wooded acreage. It is suggested that the existence of farm woodlots was the result of farmers having more acreage than they needed to run a profitable farm operation, which they then were able to use less intensively.

Approved

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Introduction

Farm woodlots, a significant part of the rural Midwestern landscape, are largely the result of human actions decades in the past. As one subset of Non-industrial Private Forests (NIPFs), farm woodlots are an important source of timber for America’s wood products industries (Guest and Stevens 1967; Best 2001). As patch habitats in an agro-urban landscape, farm woodlots are necessary to the survival of plants indigenous to the eastern deciduous forest that those farms displaced (Corry and Nassauer 2002).

The ecological importance of woodlots has only relatively recently gained prominence in what the historical geographer Michael Williams (1989, 353) describes as the “complex and many-faceted relationship of mankind with trees.” Traditionally the farm woodlot has been the preoccupation of agricultural and forestry scientists (Cheyney 1914; Barton 1919; Berry 1923; Matoon 1925; Den Uyl, 1938; Zaslavskaya 1962; Binkley 1981; Arnold and Dewees 1995; Nadeau and Bouthillier 1995); however, they have recently become of interest to ecologists and ecologically-oriented biogeographers interested in anthropogenic impacts on the geographical distribution of flora and fauna (Auclair 1976; Domon, and Bergeron 1987; Clements and Jamnick 1989; Domon et al. 1993; Collinge 1996; Bouchard and Domon 1997; Boutin and Jobin 1998; Crow et al. 1999; Belanger and Grenier 2002; Bellemare et al. 2002; Betts et al. 2002). Part of this interest stems from the recognition that human modifications of both vegetation and the physical environment linger even after overt human activities in an area cease (Russell 1997; Foster, et al. 1998; Dupouey et al. 2002).
As one of these historical ecologists points out, however, “the study of landscapes is a study of the societies which both fashion and reflect those landscapes” (Whitney 1994, 121). Thus, historical social science researchers have useful contributions to make and receive from this type of research. Understanding the farm woodlot as part of the social landscape of an agricultural county gives us a more complete understanding of the geography of woodlots.

*Woodlots in agricultural location theory*

The historical removal of forest cover in the Midwestern United States has been well documented at the landscape level by research going back nearly fifty years (Curtis 1956; Guest and Stevens 1967; Auclair 1976; Rodgers and Anderson 1979; Dorney and Stearns 1980; Hill 1985; Whitney and Somerlot 1985). For the most part, what explanation there has been for the location of farm woodlots—the last vestiges of forested habitat that once dominated the area—have followed the evolution of the dominant paradigms in geographic thought. The first speculations on why woodlots were located where they were are best exemplified by Curtis (1956). In examining Cadiz Township in Green County Wisconsin (Figure 1), Curtis hypothesized that the original settlers selected the best agricultural land first and later more marginal lands were cleared as the population rose. He also stated that, after the forest cover had been reduced to less than 10% of the total surface area, wooded areas would primarily be confined to rocky outcrops, thin-soil hilltops, steep slopes, and other areas unsuitable for agriculture. Such a model, however, has several problems. For one, as Morgan and Munton (1971) point out, while environmental variables are clearly restraints on agricultural activity at gross continental and national scales, the relationship between the physical environment and
the location of agricultural activities at smaller scales is far more complex. This model undervalues economic and cultural valuations of land and of land uses.

**Figure 1.** Change in forested land cover through time, Cadiz Township, Green County, Wisconsin. Curtis explained the location of the subsequent woodlots as the result of the unsuitability of the land in those areas for agricultural activity. Figure from Curtis 1956.

With the re-introduction of von Thünen’s (1826) model of the isolated state to the English-speaking world during the 1960s, when economic determinism began to displace regionalism in academic geography, explanation of location in agricultural geography largely began to reflect a concept of economic rent. So too, explanations about the location of woodlots on the agricultural landscape began to reflect the thought that
location was largely determined by the relative cost of using that land. This is reflected in the Soil Survey of Wayne County Ohio, where the author states that “the steepest, wettest, or least accessible parts of the farm have typically remained wooded” (Bureau 1984, 80).

**The social landscape’s historical legacies**

In the Midwest, the social landscape plays a powerful role in shaping land use (Croissant 2004; Field et al. 2003). This Midwestern social landscape was shaped largely by three historical processes. First, there is what Kniffen (1965, 551) rather unfortunately dubbed “initial occupancy.”¹ This might be better viewed as two distinct processes: (1) the process of settlement at the scale of the farmstead, largely shaped by the land use *habitus*² of groups originating in the cultural hearths along the Atlantic coast and (2) the process of alienating the land along the lines of the Public Land Survey³. In addition to

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¹ Kniffen claims to have borrowed the phrase, if not the exact idea, from McIntire (1958) who used the term “initial occupation” in reference to prehistoric groups in the Mississippi delta. Initial occupation is a standard archaeological term for the earliest archaeologically visible human habitation at a site or in a region. Kniffen’s (1965, 551) concept, which has some awkward eurocentric overtones in the modern academy, refers to “the first postpioneer [sic], permanent settlement imprint established in the several sections of the wooded eastern United States by migrants from seaboard source areas, an epoch ending about 1850.”

² Following Bordieu (1977, 82–83), *habitus* is defined as:

*a system of lasting, transposable dispositions which[,] integrating past experiences, functions at every moment as a matrix of perceptions, appreciations and actions and makes possible the achievement of infinitely diversified tasks, thanks to analogical transfers of schemes permitting the solution of similarly shaped problems.*

A “fundamental effect” of *habitus* is in the creation of a practical, “common sense” weltanschauung buttressed by common group symbolism and reinforced by daily experience (Bourdieu 1977, 80). *Habitus* cannot be defined as the product of objective, functional relations reflecting shared cultural codes and stable frames of meaning, but rather of the unarticulated rhythms of everyday life” (Winland 1993, 4). People’s actions are ordered by a “coherent logic of practice” in the parallel pursuit of similar, but not entirely collective, outcomes (Bourdieu 1977, 80). Applying this to cultural and social actions on the landscape, we can see cultural regions as the product of individuals pursuing parallel outcomes informed by a common logic of practice rather than “superorganic” cultural traditions.

³ In contrast to the idea of a ‘coherent logic of practice’ in the pursuit of parallel outcomes originating from a “common sense” weltanschauung, the PLSS was clearly a product of what Scott (1998) would label a
the theoretical justifications outlined in the footnotes the historical literature clearly points out the activities of the surveyors and of settlers were really two distinct social processes that sometimes were roughly contemporaneous. Indeed, the actions of the federal government on the western frontier were largely reactionary, driven largely by the demands of settlers. Although the Act of 1807 provided legislation for the removal of squatters from lands that had not been opened for sale, those provisions were largely ignored in practice. In some cases, entire towns existed on land where no homesteaders legally held title to the land (Meinig 1993). More significant from the perspective here, the rectilinear pattern of the survey would not become apparent on the landscape until that first phase of post-pioneer occupation was almost over.

The third critical legacy is the subsequent agricultural development in the region. Although there is a general relationship between agriculture and environmental constraints at gross continental scales, local agricultural land use below the regional scale doesn’t necessarily reflect environmental variations. In Ohio there were strong regional differences in the type of farming practiced from the earliest period (Jones 1983). These differences were largely tied to, again the agricultural *habitus* that had evolved in the areas from where the settlers originated. The Upland southerners who settled in the Scioto Valley, for instance, emphasized cattle as their primary market crop, which was typical of pre-coal mining Appalachian areas like West Virginia and Kentucky (Otto 1989).

In the case of Wayne County, throughout both centuries it has been among the top five agricultural counties in the state. The first effective settlement of Wayne County was

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“high modernist” schema for dividing territory according to a manner guided by the theoretical principles of a central bureaucrat with a map rather than in a manner guided by the local expert knowledge.
by settlers from the Mid-Atlantic cultural hearth—many of whom were Pennsylvania Dutch—who brought with them a mixed farming tradition that emphasized wheat as the primary cash grain. This type of agriculture was initially very successful in a seven county region of northeastern Ohio known as the “Old Wheat Backbone.” By the latter half of the nineteenth century, however, farmers in Wayne County were emphasizing dairying and cheese as their primary source of revenue. This change was largely due to competition with wheat producers from the western states who were more efficient at growing crops, but also due to the growth of Canton and Akron as nearby urban centers and shifting consumption patterns in the late nineteenth century, particularly the rise of milk drinking in urban populations.

The central question of my thesis then is this: how did these historical processes: the land-use habitus of the initial settlers, the Public Land Survey System, and subsequent agricultural development influence the location of woodlots in nineteenth century Wayne County, Ohio?

The study area

In addition to being one of the most productive agricultural counties in Ohio since the early nineteenth century, Wayne County is also an excellent study area because of the excellent historical documentation extending back to the nineteenth century, and because

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4 Although this ethnic group is often referred to as “Pennsylvania Germans” in the academic literature there are two reasons why I do not use it here. First, and most significantly, people of this ethnic extraction refer to themselves as “Pennsylvania Dutch” and do not think of themselves as “German.” This is in opposition to many German Americans who are usually quite proud of their German ancestry. In dialect, a Pennsylvania Dutch speaker would say “ish schwaeetz deitsch, net Cherman.” (I talk dutch, not German.) Second, German is a national identity, not an ethnic one. When the Pennsylvania Dutch settled in the hinterland of Philadelphia, there was no German nation-state, and there are, even to this day, significant German-speaking populations in Europe who are not Germans.

5 The term Backbone referring to the fact that these counties were located on or near the watershed divide between Lake Erie and the Ohio River.
both Wayne County and the State of Ohio have been studied previously. According to some accounts, Wayne County was created in 1794 when the governor of the Northwest Territory created a Wayne County within the Territory. This territory basically encompassed the entire area promised to the Native American tribes by the Treaty of Greenville (Figure 2, inset map). The modern origins of the county, however, might be more accurately traced to the act of the State Legislature which organized the County in 1812 (Douglas 1878, 68–69). This Wayne County lies roughly 62 miles west of Pennsylvania and 36 miles south of the coast of Lake Erie (40°45′N 82°W) and is rectangular in form, being 22 miles, north to south, by 25 miles, east to west, as seen in Figure 2. The county was surveyed as part of the Public Land Survey and was consequently laid out in the characteristic grid pattern, containing 16 Townships. Only nine of these townships, however, are the standard 36 sections. In the westernmost range, townships have 42 sections as a result of the creation of Ashland County and the adjustment of township boundaries. And in the southern tier of townships, townships are comprised of only 24 sections as a result of the creation of Holmes County.

The three townships that I selected for examination were Baughman Township on the eastern side adjoining Stark County, Green Township immediately to the west of it, and, finally, Plain Township on the western border of the county adjoining Ashland County. Again these were largely chosen on the basis of modern differences in

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6 This County was named after General Anthony Wayne, whose Kentucky Volunteers defeated Tecumseh’s Indian alliance at the Battle of Fallen Timbers in August of that year. That battle, along with Jay’s Treaty, which ended support from the British, forced the Tecumseh’s alliance of tribes to the negotiating table. These tribes had not recognized the 1768 Treaty of Fort Stanwix, in which the Six Nations of the Iroquois had ceded the Kentucky lands (which didn’t belong to them), to the King of England. The treaty of Greenville promised to the Indians the lands north and west of the Treaty line, basically northern Ohio, the northeastern corner of Indiana and most of Michigan. The treaty did not pose much of a hindrance to White settlement, but the treaty was not formally abandoned until after the War of 1812 when relations between the United States and the British Empire were normalized.
agriculture. The three townships were chosen primarily because of the availability of legible historical records, to minimize environmental differences and to try and capture economic differences within the county.

Figure 2. Townships studied, Wayne County, Ohio. Wayne’s townships depart from the Township and Range ideal in the west and south, due to the creation of Ashland and Holmes Counties and the subsequent reorganization of townships. Source: ESRI Data & Maps, 2004.
Literature Review

Recently, several studies have examined the relationship between land use and forest fragmentation in eastern North America (Foster 1992; Medley et al. 1995; Vogelmann 1995; Mercer and Aruna 2000; Belanger and Grenier 2002). Three of these studies are particularly relevant to our present discussion of the location of woodlots. First, at the regional scale, Belanger and Grenier (2002) studied the role of agricultural intensification and forest fragmentation in the St. Lawrence Valley of Quebec. They found that population was the most significant predictor of forest fragmentation at a regional scale, which replicates the findings of Vogelmann (1995). They also found a gradient in the amount of fragmentation from dairying (lower degree of fragmentation) to cash-grain farming (higher degree of fragmentation).

The differing degrees of fragmentation based upon the type of agriculture practiced could possibly be explained by reference to Hart’s (1968) study of field patterns in Indiana. His examination of differences in field patterns in areas with the same system of land division and relatively homogenous topography found that there were differences in field size and shape that correlated with differences in the type of agriculture practiced. These ranged from traditional square fields in a corn-hog county to large, elongated fields in a cash-grain county. This was due largely to the increasing mechanization of cash-grain farming and the restructuring of fields to make more efficient use of larger farm machinery. Hart (1986) subsequently documented the same elongated fields in formerly corn-hog county after farmers there began to emphasize cash-grain farming.
In a similar manner, technological change was a significant variable in Medley et al. (1995), a study that focused on the changes wrought by the rise of specialized cash-grain agriculture on the landscape structure in post-World-War-Two-era Preble County, Ohio. This study found that better equipment and family traditions of farming were the most significant influences on the size of the farm and management practices on the farm. Landscape patterns were most significantly influenced by these factors operating at the farm level coupled with meso-scale variations in the watershed.

More directly examining the question of location, Foster (1992), in examining the pattern of land use in mid-nineteenth century Petersham, Massachusetts, stated that the location of agricultural activities in the period that it was farmed could best be explained by reference to soil drainage characteristics and proximity to houses and roads. Woodlots were generally located on poorly drained soils in areas not easily accessible from the houses or roads. In Petersham, then, the location of farm woodlots would seem to be the outcome of an agricultural decision-making process was constrained by environmental variability that directly affected how the farmers could use the land profitably.

**Decision-making and Agricultural Location Theory**

In Wayne County, Ohio, however, land use decision-making related to nineteenth century agriculture might be better explained by the social landscape created through the Public Land Survey, the initial settler’s cultural traditions and the course of economic development. Probably the most visually apparent to the modern eye, the impact of the Public Land Survey on the rural landscape of the Midwest has been extensively discussed in both the natural and social sciences. In his classic study of forest fragmentation in the Midwest John Curtis (1956) decried “the unfortunate system of land survey which
resulted in square landholdings independent of terrain” (Curtis 1956, 727). Curtis’s maps from 1882 and 1902 (see Figure 1) clearly show the impact that the straight lines of the parcel boundaries had on where trees had been cut.

Directly relevant to a discussion of Wayne County would be Whitney and Somerlot’s (1985) study of land cover change through time in Baughman Township, shown in Figures 3 and 4, which demonstrated a similar progression through time. From the initial nearly completely forested landscape in 1806, the rectilinear shapes of the property boundaries had emerged onto the landscape by 1850. By 1897, forest land cover in the township had reached less than 10% of total land area in the township. Interestingly, woodlots are spread fairly uniformly across the township. By 1940 many of the smaller woodlots were gone and many of the larger ones have changed shape, although they haven’t necessarily gotten smaller.

**Figure 3.** Forested land cover, Baughman Township, Wayne County, Ohio in 1806 and 1850. In 1806 the county was first opened to settlement; By 1850, half of the land was cleared for agricultural or urban land uses. Note the swamps marked on the map in 1806. Figures from Whitney and Somerlot (1985).
Both Cadiz and Baughman Townships clearly demonstrate the impact of rectilinear property lines on the shape of the remaining wooded areas. Overall, both Townships had virtually identical land clearance chronologies. In both places, the total area of forested land had dropped to between 10 and 15% within two generations of settlement (Whitney and Somerlot 1985).

In other ways as well, the Public Land Survey had a powerful influence on land management practices. For instance, Johnson (1957) points out that the 40 acre quarter section quickly became embedded in federal laws concerning the public sale of land. In her study of the impact of the PLSS on vegetation in Winona County, Wisconsin, she points out that settlers were constrained to only nineteen possible shapes to come up with forty contiguous acres of land. Of course, such size restrictions did not affect private land
sales, but the basic square pattern continues to exercise a powerful influence on the shape and location of agricultural activities and patch habitats even today.

Within the constraints of the rectilinear parcels that were the PLSS legacy in the Midwestern United States, the literature suggests that cultural traditions and agricultural development also played a significant role in determining the external structure of Midwestern farms. Understanding decision-making has attracted increased attention from people interested in both ecology and traditional forestry, especially with the increasingly diverse group of landowners with NIPFs.

In this vein, Erickson, Ryan, and De Young (2002), studied a watershed where forested land cover has been increasing in the past several decades and where landowners came from a more diverse mixture of economic backgrounds. They found that aesthetic appreciation and environmental protection were the two dominant motivations for landowners to preserve woodlots in that Michigan watershed. In contrast to this Donnelly (2004), a researcher at CIPEC (Center for the study of Institutions, Population, and Environmental Change) examined a predominantly agricultural landscape in Indiana and found that spatial characteristics associated with agricultural land use, such as large parcel size, absence of subdivision, and lack of field drainage were critical factors in his decision tree model for the presence or absence of woodlots.

Histories of agricultural development in the United States and Ohio have made a point of stressing the fact that agricultural production was not a peasant activity. At least part of American agriculture was a for-profit venture from the very beginning of the English colonies. Certainly in the Northwest Territory farming was an entrepreneurial activity, where production was speculation on future demand (Cochrane 1979; Jones
1983). As Jones (1983, 40–41) points out while farmers would have had little surplus in the first few years, few markets, nor easy access to the markets that did exist in New York or Louisiana, even farmers living on the frontier still needed the means to buy such necessities as “tinware, cutlery, axe …, gunpowder, salt, spices and calomel,” as well as a variety of other items. In addition, a settler had to pay his taxes. Observers from the 1700s onward divided the frontier population into three main groups. Jones (1983, 22–23) has dubbed the first group the “land clearers,” frontiersmen whose process of capital making was to clear the land, raising its value on the land market. The second were the “ordinary farmers,” who could afford to buy a partially cleared farm and make further improvements to it\(^7\). The third group was the “strong-handed farmers,” who were wealthy enough to buy land and stock the farm properly. So even at the earliest stages of settlement, farmers were responding to market forces.

Although we in the twenty-first century are accustomed to thinking in terms of the market economies associated with industrialized agriculture, the picture in the nineteenth century is slightly different. Although agricultural historians have often explained the increased rates of productivity throughout the nineteenth century as the results of extensification of agriculture\(^8\) (Cochrane 1974) as well as intensification through mechanization (David 1975), the picture is in fact more complex. Productivity gains can also be explained as due to improved crops which were better able to survive in the agricultural ecology of North America (Olmstead 1975). More relevant here, according to Cosgel (1993), who examined the relative productivity of Amish farmers versus non-

\(^7\) Such as replacing a log cabin with a frame house, and more permanent out-buildings.
\(^8\) Meaning increasing the amount of goods produced by expanding the number of acres farmed.
Amish farmers in Iowa using Census data from 1850 through 1880, there was an inverse relationship between productivity and total acreage of farms.

In contrast to agricultural development, there has been relatively little written on settlement geography in the United States related to the spatial structure of farms. Kiefer (1972) was the most relevant example. In his study of the area around Bremen, Indiana (an area that was also glaciated and has a similar topography to Wayne County), Kiefer found that site selection for farm houses was strongly influenced by drainage and proximity to the road. The glacial deposits in the area produced small patches of well-drained upland soils that were both well-drained and relatively prominent. Seventy-five% of his study sample was located on such patches and the rest were on level ground. A survey of what local historians have written on the subject of the early settlement of Wayne County offered various opinions as to what factors were critical for a pioneer in this area, one of the most common was access to springs or another water source. Douglass (1878) claimed that early settlers had an initial preference for lower lying areas away from “oak barrens” and the less productive soil that they represented. In terms of fields, Collins (1971) found that topography does have some influence on the orientation of fields on the landscape. He found that areas where the geomorphology was dominated by drumlins, fields were oriented according to the orientation of the drumlins. In the area that he examined that was predominantly ground moraine, there was no predominant orientation.

Hypotheses

Based on the discussion in this chapter, we can break this down into four discreet sets of questions. First, what was the relationship between the location and orientation of
woodlots in relation to the environmental variables in the three townships? What role did topography and, most especially, drainage play in the decision to use a specific area of the farm as a woodlot? Second, what relationship is there between features of the social landscape (roads, houses) and the location of woodlots at the scale of the farm? Third, what was the relationship between socio-economic variables and the location of woodlots at the township scale? Is there a relationship between the size of farms and the presence of woodlots? Finally, as this GIS primarily relies on historical maps, one of the questions is what they leave out as well as what they depict. How do these maps compare to later air photos of the same farmsteads?

My hypotheses are, first, that variability in environmental characteristics such as drainage or topography were not a significant influence on where farmers chose to put their woodlots. Second, that woodlots will not be found near the core farmstead, nor near streams, but will be adjacent to edges of parcels. Third, that there is a positive relationship between the total acreage of a farm and the amount of wooded acreage. Fourth, that these maps will agree fairly well with the 1947 air photos.
Data and Methods

The application of Geographic Information System (GIS) software such as ESRI’s ArcGIS and ArcView products to historical research has recently emerged as a topic of interest in social science and historical circles (Knowles 2002). These software packages combine relational database architecture with sophisticated spatial analytical tools and graphic display capabilities that allow the user to query, statistically analyze, and visually explore geographical relationships among various sorts of spatially referenced information, such as vegetation and environmental features as well as more human-oriented features of the social and physical landscape. Despite the significant handicaps in relational database design for dealing with change over time, GIS is a powerful tool because it makes place an explicit focus of historical research.

Data Sources

I principally relied on two types of data for my analysis. The first type was historical information from the manuscript schedules of several Agricultural censuses. The second was spatial data recorded in an old county atlas and air photos from the 1940s in the possession of the Wayne County Soil and Water Conservation District. To supplement these data, I obtained the soils coverage for the county from the Ohio Department of Natural Resources Geographic Information Management System at http://www.dnr.state.oh.us/gims/default.htm.

Originally, most of my information on agriculture for the townships was to have been drawn from the manuscript schedules of Decennial United States Censuses for 1870 and 1880. Agricultural information for the 1870 Census was recorded in the third
schedule which were based on the schedule from the 1860 census, but revised to include several new questions including, most pertinent to the subject here, woodland acreage for each farm and the value of forest products sold that year (Gauthier 2002, 131). The Tenth Decennial Census of the United States in 1880 entailed a massive reorganization of the Census Bureau and a concomitant expansion in the questions asked. In the Agricultural schedules this included questions on farm tenure and principal crops, including acreages (Gauthier 2002, 132).

<table>
<thead>
<tr>
<th>Figure 5. Manuscript Schedule Page, 1870 Census. This page is the top half of page 9 from the Census manuscript schedule for Baughman Township in Wayne County, Ohio.</th>
</tr>
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</table>

The 1890 Census’s agricultural schedules would also have been a valuable resource, especially for linking with the 1897 map, but unfortunately those were destroyed in a fire at the Commerce department in the early Twentieth Century. As it turned out, I principally relied on the 1880 information as the 1870 data was simply too
old to be able to link to landowners in 1897. Even the 1880 Census schedules were
difficult to link to the map. According to Gauthier (2002), the censuses taken in 1900 and
afterwards again reflect the change in census priorities towards manufacturing concerns. I
photocopied the Census schedules and entered them into Excel spreadsheets.

The information on woodlots at the end of the Nineteenth Century and middle of
the Twentieth Century was drawn largely from two sources. The first of these is
*Caldwell’s Atlas of Wayne County, Ohio* (Caldwell 1897), which mapped the property
boundaries of each township, village and city in the county and which included such
details as locations of houses and major outbuildings (i.e., barns), orchards and farm
woodlots. The second source of information is aerial photography from 1947, which is
currently in the possession of the Wayne County Soil and Water Conservation District
Office located in Wooster, Ohio. Although Whitney and Somerlot (1985) used earlier
aerial photos in examining Baughman Township, these were the earliest that I was able to
find.

I also consulted the local histories that were available. There are at least three
general histories of Wayne County, which often contain a wealth of first hand
observations. One in particular which is worth mentioning here is Ben Douglass’ 1878
*History of Wayne County, Ohio*. Lehman (1967, 177–181) goes into a considerable
discussion of the work and its author. At a little over 850 pages in length, Douglass’
history is considered one of the most exhaustive county histories ever produced in the
state, and has often been relied upon by subsequent writers. It covers everything from
personal biographies of the people of the day and short vignettes of local communities
and churches to chapters on the natural history, geology, and physical geography of the county as well as a discussion of the prehistoric settlement of various areas.

There are a few notable biases in his writing. For one, Douglass had been a recruiter for the Union Army during the Civil War and active in Republican politics, both in Ohio and nationally, after the war and his biases as a staunch progressive Republican can be fairly obvious in some places. For instance, his description of the Mennonite community of Sonnenberg, who he described as people who liked horse-trading, decomposed cheese, applejack (i.e., hard cider) and painting doghouses as well as other “wholly un-American” habits, such as antagonism to education and opposition to war (Douglass 1878, 849).

Methods

In examining the hypotheses stated at the end of the last chapter, I felt the following order was the most logical. The first task was to analyze the spatial relationship between woodlots and other features of the human and natural landscape. This is broken into two steps: First, I examined the relationship between woodlot location and drainage characteristics. Second, the relationship between woodlots and historical cultural and physical features of the landscape were examined.

The second task was to examine the relationship between the location of woodlots and agricultural variable reported in the 1880 Census. In preparation for carrying out these analyses, the township maps and air photos were digitally scanned and rectified in ArcGIS 8.3. Then salient structures of the social landscape were abstracted from the scanned maps to create a Personal Geodatabase file of the historical cultural landscape.
for each township. These were property boundaries, streams, roads, houses, as well as the boundaries of the woodlots themselves.

To examine the relationship between woodlots and relevant soil characteristics, I overlaid the soils coverage with the woodlot geodatabase features. I first classified the soils according to the presence or absence of five characteristics from the soil survey (Table 1): a water table at a depth of six feet or more, a depth to bedrock greater than five feet, areas not frequently flooded, a k-factor between .24 and .40, and less than 25% clay in the first foot of soil. The best soils then would have all five characteristics present, the next best four, etc. I then counted the number of woodlots which fell on each class of soil. Next I compared the location of woodlots to the soil hydrologic group as well as to the ratings for septic tanks from the Wayne County Soil Survey (Bureau 1984). I then used the Natural Resource Conservation Service’s Land Capability Classification (LCC) to classify the soils as to their potential problems with wetness. The LCC is composed of eight classes, designated by Roman numerals. Helms (2002) present an informative history of the origins and development of the LCC, from which this discussion is largely drawn. The first four, I–IV are classes that are suitable for cultivation. The next three, V–VII, are suitable for pasture, grazing, woodland and other less-intensive uses. The final class, VIII, were not able to be used for agricultural purposes.

There are some limitations for using Land Capability Classifications for this type of historical research. For one, the LCC emerged out of erosion research undertaken at agriculture experimental stations in the 1920s and 1930s and reflected the desires of soil scientists such as Hugh Hammond Bennett and others, such as the geographer Russell Smith, to perfect the science of agriculture to the point where it was possible to farm the
Table 1. Definitions of soil variables examined and amount of acreage of soils in them.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Definition</th>
<th>Acreage</th>
<th>Percentage of County</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Hydrologic Group</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Group B</td>
<td>Soils with a moderate rate of infiltration/water transmission when thoroughly wetted; main characteristics are: moderately deep to deep, moderately well drained to well drained soil with moderately fine to moderately coarse textures.¹</td>
<td>35,858</td>
<td>10.0%</td>
</tr>
<tr>
<td>Group C</td>
<td>Soils with a slow rate of infiltration/water transmission when thoroughly wetted; main characteristics are: a layer that impedes downward movement of water or moderately fine to fine texture.¹</td>
<td>293,075</td>
<td>81.7%</td>
</tr>
<tr>
<td>Group D</td>
<td>Soils with high runoff potential; main characteristics: clay soils with a high swelling potential, a permanent high water table, a claypan/clay layer at or near the surface, or shallow soils over nearly impervious material.¹</td>
<td>27,791</td>
<td>7.7%</td>
</tr>
<tr>
<td><strong>Septic Tank Drain Field Suitability</strong></td>
<td>Generally favorable conditions for septic system²</td>
<td>8,770</td>
<td>2.4%</td>
</tr>
<tr>
<td>Slight</td>
<td>Conditions are not favorable, but able to be overcome through increased maintenance²</td>
<td>22,039</td>
<td>6.1%</td>
</tr>
<tr>
<td>Moderate</td>
<td>Conditions require special design, increased construction costs and possibly increased maintenance costs. Excluding those soils that were classified as severe due to wetness, the primary limitations were slope, slow percolation, and depth to bedrock.²</td>
<td>325,087</td>
<td>90.6%</td>
</tr>
<tr>
<td>Severe</td>
<td>Soils that classified as &quot;severe&quot; where one of the primary limitations listed were wetness, flooding, or ponding.²</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wet</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Soil Ranking</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>Soils having none of the following: a water table at a depth greater than six feet, a depth to bedrock greater than five feet, not frequently flooded, a k factor between 0.24 and 0.4, and less than 25% clay in the first twelve inches of soil.</td>
<td>2,188</td>
<td>0.6%</td>
</tr>
<tr>
<td>2</td>
<td>Soils having two of the following: a water table at a depth greater than six feet, a depth to bedrock greater than five feet, not frequently flooded, a k factor between 0.24 and 0.4, and less than 25% clay in the first twelve inches of soil.</td>
<td>14,115</td>
<td>3.9%</td>
</tr>
<tr>
<td>3</td>
<td>Soils having three of the following: a water table at a depth greater than six feet, a depth to bedrock greater than five feet, not frequently flooded, a k factor between 0.24 and 0.4, and less than 25% clay in the first twelve inches of soil.</td>
<td>88,392</td>
<td>24.6%</td>
</tr>
<tr>
<td>4</td>
<td>Soils having four of the following: a water table at a depth greater than six feet, a depth to bedrock greater than five feet, not frequently flooded, a k factor between 0.24 and 0.4, and less than 25% clay in the first twelve inches of soil.</td>
<td>230,292</td>
<td>64.2%</td>
</tr>
<tr>
<td>5</td>
<td>Soils having five of the following: a water table at a depth greater than six feet, a depth to bedrock greater than five feet, not frequently flooded, a k factor between 0.24 and 0.4, and less than 25% clay in the first twelve inches of soil.</td>
<td>23,925</td>
<td>6.7%</td>
</tr>
<tr>
<td><strong>Land Capability Classification</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Class IIw</td>
<td>Soils that have some limitations that require moderate conservation practices. Tillage and Row Crop production should be limited.³</td>
<td>64,149</td>
<td>17.9%</td>
</tr>
<tr>
<td>Class IIIw</td>
<td>Soils that have severe limitations that require special conservation practices such as a more frequent planting of grasses and legumes in the crop rotation. Drainage systems might be needed.³</td>
<td>21,412</td>
<td>6.0%</td>
</tr>
<tr>
<td>Class Vw</td>
<td>Soils not suited to crop production primarily because of (a) frequent stream overflow or (b) ponded areas where drainage is not feasible. Often can be used for pasture.³</td>
<td>1,565</td>
<td>0.4%</td>
</tr>
<tr>
<td>Class VIIe</td>
<td>Severe limitation, restricted to controlled grazing, woodland, or wildlife.³</td>
<td>9,414</td>
<td>2.6%</td>
</tr>
<tr>
<td>Other</td>
<td>Other soil capability subclasses unrelated to the wetness subclasses.³</td>
<td>262,372</td>
<td>73.1%</td>
</tr>
</tbody>
</table>

¹(USDA 2003)²(Bureau 1984)³(Brady and Weil 2002)
land without the eventual loss of quality or quantity. So these capability classes are not so much areas where agriculture could not be pursued, but areas where agricultural land uses would either eventually or rather quickly lead to the degradation of the soil.

One further limitation is that these soil capability classes are relative. The characteristics of a class I soil in Wayne County is not necessarily the same as it would be somewhere else. Despite these limitations, however, the LCC is probably the best available assessment of the soil characteristics that might have been problematic at the end of the Nineteenth Century. My analysis focused on three classes of soils that were present in the townships examined: IIw, IIIw, and VIIe. Class IIw soils (or 2w) soils have “some limitations” and might require grassed waterways in order to be properly drained for modern agriculture (Brady and Weil 2002, 788). Class IIIw (or 3w) would probably have required drainage systems. These classes are found in the areas where Douglass (1878, 81–85) described the location of swamps in the early part of the nineteenth century. Class VIIe soils (or 7e) are restricted to controlled grazing or woodlands and pasture improvement is “impractical” according to the modern summary of USDA guidelines (Brady and Weil 2002, 789). Class VIIe soils would have been areas of steep slope, which would have been one of the few limiting factors for agricultural purposes in the Nineteenth Century.

For the analysis I grouped the woodlots into five categories, those that were on Class IIw soils, on Class IIIw soils, on Class VIIe soils, on soils that did not fall into those three classes, and woodlots that had multiple classes of soils. This analysis was done on woodlots in all three townships.
To examine the location of woodlots in relation to the rest of the human and natural landscape, I used several different approaches. I first performed a basic analysis of the relationship between woodlots and streams, roads, and the edges of individual parcels by examining the number of woodlots that fell within a 100 ft buffer of each of these features. Second, because I was not able to use Baughman as part of my later examination of socioeconomic characteristics and woodlot location, I used this township to explore the relationship between woodlots and the areas of farms the most remote from houses. This was done by first identifying parcels that had both houses and woodlots on them. These parcels were then used as an analysis mask for creating two cost-weighted distance surfaces, one for the roads and one for the houses using the GIS software. These surfaces were then reclassified into four categories: (1) Less than 1,000 survey feet; (2) 1,000 to 2,000 survey feet, (3) 2,000 to 3,000 survey feet, and (4) greater than 3,000 survey feet. These two surfaces were then combined to create a surface showing areas that were the most remote from houses and roads.

I decided then to approach the analysis from the perspective of a question of Ortsgrundrissform, to see if there was a typical topological relationship between the elements of the farm landscape on the map. To that end parcels were identified that had both a house and a woodlot recorded in the 1897 atlas in Green and Plain Townships. There appeared to be a tendency for the core farmstead to be located close to one edge of the property, usually close to a road, and for the woodlot to be located adjacent to the

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9 An analysis mask is a layer that is used to define the area of interest when creating a raster surface.
10 This refers to the analysis of the form of settlement layout. More precisely, the location of residential structures in relation to agricultural areas.
11 I chose the two townships for this analysis because I wanted to link the results of this analysis to the Census data from 1880, which I only had for Green and Plain Townships.
opposite side of the property from the house (i.e., the “standard” layout). Each parcel was then examined using a grid overlay and classed as either a standard or non-standard layout farm (See Figures 12 and 13).

As the second task that I outlined above, I then analyzed the relationship between agricultural patterns in the county and the presence of wooded acreage. First I performed a bivariate regression analysis of the relationship between farm size and the reported “unimproved wooded acreage” for Green and Plain Townships using Microsoft Excel. This was to examine whether or not there was a positive relationship between the size of a farm and the amount of unimproved woodland (in the two townships there was virtually no unimproved land that was not wooded). I then examined one of the outliers, John Sidle, who reported a farm of 680 acres in the 1880 Census.

The next several analyses were driven by a desire to understand some of the economic motivations. I again performed a bivariate regression analysis, this time of the relationship between farm size and dollars earned per acre (DPA) in 1880. I then examined the Census data for other economic activities (or lack thereof) that would explain either their higher or lower income per acre.

After this, I revisited the parcels that had both houses and woodlots identified and linked them to the information recorded for individual properties in 1880. I broke the 1880 Census information down two different ways, first farms were classed according to their total acreage. Size classes were broken down in multiples of 20 acres (640–320 acres = class 1, 320–160 acres = class 2, 160–80 acres = class 3, 80–40 acres = class 4, 40–20 acres = class 5, 20–3 acres = class 6)\(^{12}\) I then classed the individual farms

\(^{12}\) 3 acres was the minimum farm size recorded for the 1880 Census takers.
according to their total value (calculated from reported values of land, machinery, animals, and products on hand). The farms put grouped into four classes based on whether or not they were above one standard deviation above the mean (class 1), between one standard deviation above the mean and the mean (class 2), between the mean and one standard deviation below the mean (class 3), and (class 4) those below one standard deviation below the mean I then linked these data to the standard and non-standard parcels from the 1897 map and performed a chi-square test to see if any differences between the standard and non-standard farms for Plain and Green townships.

Finally, I used a one-tailed t-test at the 95% confidence level to see if there was a differences between standard and non-standard layout farms in Plain and Green townships. These variables included total acreage, cultivated acreage, the number of swine, the number of sheep, the number of cattle, the amount of wooded acreage, and the dollars earned per acre. Finally, I examined what correspondence there was between the 1897 map and the 1947 air photos for Green and Plain Townships. This was to assess both the accuracy of the 1897 maps and provide some idea of change between these points in time.
The Social and Physical Landscape

Before launching into a discussion of my results, it might be beneficial to first discuss the limitations as well as the strengths of GIS as a historical tool. GIS software is incredibly useful for historical research, as long as the limitations of the data are kept in mind. In this case, the accuracy of the 1897 map is hard to verify and the process of abstracting the information in the map to a digital form—in this case, performing acts on a nearly century old bound volume that would cause a librarian to shudder—unavoidably introduced further error into the electronic data. There were methods of digitizing that would have reduced those errors, but at a socially-unacceptable cost.\(^{13}\) In rectifying the resulting images, my root mean square (RMS) error values averaged out to be about 594 real world inches per map inch (roughly 50 feet per inch). The recommended best practices RMS error would be under 79 real world inches per map inch (roughly 6 ½ real world feet per map inch. While the positional accuracy of these data isn’t spectacular, it is probably the best available.

Environmental Constraints on Farming

Probably the most widespread challenge for farmers in Wayne County in both the Nineteenth and Twentieth centuries would be the problem of excessive soil moisture. Too much water in the soil presents a variety of problems for farming, from equipment getting stuck in fields, to seeds rotting in the ground rather than sprouting, or seedling being drowned out. Understanding the constraints posed by the physical environment, however,

\(^{13}\) The Wayne County Map Office was kind enough to lend me their original copy of Caldwell’s Atlas on the recognizance of a relative. Destroying said century-old volume in the pursuit of better accuracy would definitely have kept me off the Christmas card list.
also means understanding not just the variability of the physical landscape, but the technology of the people occupying the area as well as their basic understanding of what were positive and negative attributes of the physical landscape. Even more fundamentally, it requires understanding the time scale in question.

Physiographically, Wayne is part of the glaciated Appalachian Plateau (Peacefull 1996) and its topography is usually described as a rolling upland with a few broad, relatively flat valleys. As might be surmised from the term “glaciated,” the Wisconsin glaciation, at the end of the Pleistocene, had a profound role in shaping the modern physical landscape of the county. This glacial legacy is easily observed in the topography. The maximum difference in elevation between the highest and lowest points in the county is approximately 500 feet; there are only a few hills in the southeastern portion of the county that are greater than 1,300 ft above mean sea level. As Conway (1940, 4) points out, the maximum relief in the county was a rise of 300 feet over a run of nearly two miles.

Drainage patterns in Wayne were less profoundly affected, at least in comparison to some other watersheds in Ohio (e.g., the Cuyahoga), however, the retreat of the glaciers still left behind numerous swamps and marshes in the county. As shown in Figure 7, the County’s three principal streams still flow southward, eventually reaching the Ohio River via the Muskingum, but the soils surrounding them all have some problems with wetness. The most notable stream is the Killbuck, which meanders through the marshes and swamps (the Class Vw soils on the map) at the bottom of the Killbuck Valley running from just south of Wooster down through Holmes County. This stream drains a significant amount of the western and southern portion of the county,
including the eastern portion of Paint Township. The western portion of Paint is drained by the Kiser Ditch. Baughman and Green townships drain into Newman’s Creek and the Sugar Creek, all of which are surrounded by Class IIw and Class IIIw soils.

**Figure 6.** Streams and Drainage, Wayne County, Ohio. There are three principle streams in Wayne County, the Killbuck, Sugar Creek, and Chippewa Creek. The Killbuck stream runs from north to south through the western half of the county. Sugar Creek runs southeast from Green Township through Sugarcreek Township in the eastern section of the county. Chippewa Creek runs east from Milton township through Chippewa in the northeastern portion of the county. Baughman’s primary drainage is Newman’s Creek which runs east from the modern city of Orrville to Stark county.

The parent materials for Wayne County’s soils were largely derived from glacial drift from the Wisconsin glaciation. These soils are generally low to medium in lime content and have good to moderate drainage. The Wooster and Canfield silt loams are
both prominent in the county and are considered excellent land for wheat and potatoes (Conway 1940, 5). The Canfield series has a fragipan between roughly 1.5 and 2.5 feet (~.5 meters) which lowers the available water capacity for plants. Although there are minor variations, most of the soils in the County are considered prime farmland by the Department of Agriculture (Bureau 1984). As was shown in Table 1 in the previous chapter, almost a quarter of the County’s total acreage has some falls into a Land Capability Classification because of excessive wetness. Another 2.7% is in class VIIe.

Of the three townships I am studying, Baughman had two large swamps in the early part of the Nineteenth Century, one surrounding Fox Lake and another along the course of Newman’s Creek. Ben Douglass (1878, 83) described Newman’s Creek swamp as the “wildest, most inaccessible and dismal” area of the county. It was usually called the Dismal Swamp or even more luridly the “Shades of Death” (For locations see Figures 3 and 4). As the 1850 map in Figure 3 shows, the “Shades of Death” had completely disappeared by that time. Douglass (1878, 85) describes it thus: “For six miles is a landscape of unbroken plain, divided into cultivated fields, broad meadows, with here and there clumps of native woods.” Douglass (1878, 81) also notes that the swamp around Fox and Patton Lakes in the northeastern portion of the township, which were still extant at the time of his writing, could be “drained to the north with little effort” as, in deed, it eventually was. Although Douglass marveled at the diversity of plants and animals found in these wetlands, he, like most people in the nineteenth century, regarded wetlands as a nuisance and impediment to the most fundamental role that God had ordained for humanity, which was, as Douglass (1878, 648) put it succinctly elsewhere in
his tome: “God having placed him in the garden of delights, commanded him to cultivate it.”

Clearing these swamps was, like clearing the rest of the forest, largely the activity of individual property owners acting on their own initiative. Ditch digging was a common activity in Wayne County in the nineteenth century, even in areas where there weren’t swamps. Douglass mentions some of the strange items that farmers had found while engaged in such activities. One farmer in Plain Township found buffalo skulls and horns and “remains of human bodies of immense size” (Douglass 1878, 647-648) while digging a ditch on part of his property. More commonly found were cedar trees, which don’t grow natively in the area (at least since White settlement), some of which were preserved well enough that they could be sent to the sawmill (Douglass 1878, 647).

The point of clearing swamps was to “improve” the land, a cultural imperative with both religious and economic motivations. To White settlers in the Nineteenth Century, this idea that God had commanded the cultivation of the land lay at the heart their justification for removing the Native Americans to reservations and seizing their lands. Improving the land was humanity’s role in Creation and if the Native Americans were not going to do this, then it was God’s will to remove the Native inhabitants and replace them with European-descended settlers. In the introduction to his history of Wayne County, Douglass opens with this statement:

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14 In deed, maintaining those ditches and the tiled fields that flow into them is a perennial concern with farmers in the county, based on my own informal observations having lived in a rural part of the county for twenty years. For instance, when I was at the NRCS office scanning in the 1947 air photos last year, all three of the people who came in for consultations were concerned about whether they could clean out or repair drainage systems for their fields without running afoul of soil conservation regulations.

15 Which would indicate that they had been preserved in an anaerobic environment, where no oxygen was present to facilitate decay, in this case that would mean the area where they fell was well-saturated and perpetually so.

16 Meaning not just literally farming but also the idea of “taming” the land and creating a civilization.
At the time Sebastian Cabot discovered North America in 1498, the print of the foot of the White man was not upon its soil...It was the empire of the native American, barbaric hordes who roamed like untamed beasts over its extensive domain and secreted themselves in its shady groves and cloistered valleys, unrestrained and ungoverned by any of the rules which regulate civilized life (Douglass 1878, 14).

In contrast to this Douglass describes Wayne County in 1878 thusly:

To the observer is presented a great theater of farming industry, elegant houses, extensive barns, fields of waving grain, orchards of the choicest fruits, preserved forests of native wood and the pure and never-failing streams flowing on and on in clear and sparkling waters (Douglass 1878, 76)

For this present discussion, perhaps the most striking element in Douglass’ description of the well-ordered agricultural landscape are those “preserved forests of native wood.” As Michael Williams (1989b) points out, the 1880 census had revealed that almost three-fourths of Ohio had been cleared in the roughly eight decades of white settlement17 and both the rate and degree of clearing alarmed both members of the farming community and the State government. While they were struggling with the first indications of how rapidly humans could negatively alter their environment, what is perhaps most noteworthy is the relative unanimity with which people considered farm woodlots to be important part of agricultural landscapes. Douglass (1878) himself, who, while not noted as a conservationist, was a progressive Republican, and discusses the importance of woodlots and the need to actively plant trees to replace those that were consumed, both for the continued maintenance of the soil and for their economic importance for the future elsewhere in the tome as well. While there were doubtlessly people who either did not see the problems created by deforestation in the nineteenth

17 Contrast this with the rate of clearance along the eastern seaboard, where it had taken centuries for forest cover to be reduced to such levels (Whitney 1994).
century, or care about it, there were a number of people around who clearly saw woodlots as an important part of the landscape.

Given this cultural mandate to “improve” the land, the attitude that excessively wet areas (either seasonal wetlands or outright swamps) were abnormalities on the landscape and the relatively straightforward method needed to remove them (digging ditches), how well can the location of woodlots in the three townships be explained by the decision of farmers to avoid clearing these areas on their properties?

Woodlot location at the farm scale

The first analysis that I would like to discuss is the relationship between woodlots and various soil characteristics. I first ranked the soils on the basis of the presence or absence of five characteristics and counted the number of woodlots that were on soils in each category, shown in Table 2. I also counted the number of woodlots that were present on soils of each Hydrologic Group as well as in relation to septic tank suitability ratings, shown in Table 3. I then counted the number of woodlots that were found on two land capability subclasses where soil wetness was a limiting factor (IIw/2w and IIIw/3w) and one (VIIe/7e) where erosion due to steep slopes was a factor, shown in Table 4. As shown in Figures 7, 8, and 9, the location of woodlots does not reflect a bias towards the locations of the wettest areas of the townships nor of individual farms.
Figure 7. Forested land cover, Baughman Township. Woodlots are usually all found near parcel boundaries and not near streams.
Figure 8. Forested land cover, Green Township. Woodlots are usually all found near parcel boundaries and not near streams.
Figure 9. Forested land cover, Plain Township. Elevation data was used to highlight the relationship with topography.
Indeed, in examining the following tables, two trends become evident. First, woodlots are generally not found on soils that have the greatest problems with wetness. Beyond that, the number of woodlots found in a given category simply reflect the amount of area that the soils in each category cover in each township. If you compare Table 4 with Table 1, 

Table 2. Percentage of Woodlots found on soils in each rank.

<table>
<thead>
<tr>
<th></th>
<th>Total</th>
<th>5</th>
<th>4</th>
<th>3</th>
<th>2</th>
<th>0</th>
</tr>
</thead>
<tbody>
<tr>
<td>Green</td>
<td>Count</td>
<td>134</td>
<td>4</td>
<td>50</td>
<td>76</td>
<td>4</td>
</tr>
<tr>
<td>Green</td>
<td>Percentage</td>
<td>3.0%</td>
<td>37.3%</td>
<td>56.7%</td>
<td>3.0%</td>
<td>0.0%</td>
</tr>
<tr>
<td>Baughman</td>
<td>Count</td>
<td>162</td>
<td>4</td>
<td>131</td>
<td>24</td>
<td>2</td>
</tr>
<tr>
<td>Baughman</td>
<td>Percentage</td>
<td>2.5%</td>
<td>80.9%</td>
<td>14.8%</td>
<td>1.2%</td>
<td>0.6%</td>
</tr>
<tr>
<td>Plain</td>
<td>Count</td>
<td>126</td>
<td>15</td>
<td>102</td>
<td>5</td>
<td>2</td>
</tr>
<tr>
<td>Plain</td>
<td>Percentage</td>
<td>11.9%</td>
<td>81.0%</td>
<td>4.0%</td>
<td>1.6%</td>
<td>1.6%</td>
</tr>
</tbody>
</table>

Table 3. Percentage of Woodlots with soils in each Hydrologic Group and Septic Tank ranking category.

<table>
<thead>
<tr>
<th></th>
<th>Total</th>
<th>Group B</th>
<th>Group C</th>
<th>Group D</th>
<th>Slight</th>
<th>Moderate</th>
<th>Severe</th>
<th>Wet</th>
</tr>
</thead>
<tbody>
<tr>
<td>Green</td>
<td>Count</td>
<td>134</td>
<td>11</td>
<td>109</td>
<td>14</td>
<td>0</td>
<td>5</td>
<td>114</td>
</tr>
<tr>
<td>Green</td>
<td>Percentage</td>
<td>8.2%</td>
<td>81.3%</td>
<td>10.4%</td>
<td>0.0%</td>
<td>3.7%</td>
<td>85.1%</td>
<td>11.2%</td>
</tr>
<tr>
<td>Baughman</td>
<td>Count</td>
<td>162</td>
<td>10</td>
<td>127</td>
<td>25</td>
<td>0</td>
<td>1</td>
<td>141</td>
</tr>
<tr>
<td>Baughman</td>
<td>Percentage</td>
<td>6.2%</td>
<td>78.4%</td>
<td>15.4%</td>
<td>0.0%</td>
<td>0.6%</td>
<td>87.0%</td>
<td>12.3%</td>
</tr>
<tr>
<td>Plain</td>
<td>Count</td>
<td>126</td>
<td>12</td>
<td>106</td>
<td>8</td>
<td>3</td>
<td>7</td>
<td>109</td>
</tr>
<tr>
<td>Plain</td>
<td>Percentage</td>
<td>9.5%</td>
<td>84.1%</td>
<td>6.3%</td>
<td>2.4%</td>
<td>5.6%</td>
<td>86.5%</td>
<td>5.6%</td>
</tr>
</tbody>
</table>

Table 4. Percentage of Woodlots with soils of each LCC subclass, Baughman Township.

<table>
<thead>
<tr>
<th></th>
<th>Total</th>
<th>Class IIw</th>
<th>Class IIIw</th>
<th>Class VII</th>
<th>Other</th>
<th>Multiple</th>
</tr>
</thead>
<tbody>
<tr>
<td>Green</td>
<td>Count</td>
<td>134</td>
<td>25</td>
<td>11</td>
<td>2</td>
<td>88</td>
</tr>
<tr>
<td>Green</td>
<td>Percentage</td>
<td>18.7%</td>
<td>8.2%</td>
<td>1.5%</td>
<td>65.7%</td>
<td>6.0%</td>
</tr>
<tr>
<td>Baughman</td>
<td>Count</td>
<td>162</td>
<td>44</td>
<td>19</td>
<td>2</td>
<td>82</td>
</tr>
<tr>
<td>Baughman</td>
<td>Percentage</td>
<td>27.2%</td>
<td>11.7%</td>
<td>1.2%</td>
<td>50.6%</td>
<td>9.3%</td>
</tr>
<tr>
<td>Plain</td>
<td>Count</td>
<td>126</td>
<td>36</td>
<td>1</td>
<td>5</td>
<td>79</td>
</tr>
<tr>
<td>Plain</td>
<td>Percentage</td>
<td>28.6%</td>
<td>0.8%</td>
<td>4.0%</td>
<td>62.7%</td>
<td>4.0%</td>
</tr>
</tbody>
</table>
the percentages of woodlots found on soils that had wetness problems fall roughly into
the same proportion as the percentage of acreage in the county which falls into each class.
There does seem to be a slight bias towards woodlots being found in these areas, but
problems with soil moisture doesn’t explain the majority of woodlots. Only in Baughman
is even close to half of the woodlots found on soils with moisture or slope problems
according to the Land Capability Classification.

In actuality this analysis probably overstates the impact of the soils with wetness
problems on the presence of woodlots on that farm. It is simply a count of woodlots with
a class IIw or a class IIIw soil in them; in a good many cases, the soil in the wetness
subclass is not the dominant soil type in the woodlot. If we look at Table 2, for instance,
we find that nearly all of the woodlots are found on soils that have at least three of the
positive soil attributes, which again, reflects the fact that most of the surface area of the
county is covered by soils that have these characteristics (64% of the county has soils that
have four of the five characteristics, 7% have all five, and 25% have three out of the five
characteristics) and the differences between townships largely reflect differing variations
in the amount of surface area that falls into those categories in each township. In the case
of Green township for instance, roughly half of the township has soils that have three out
of the five characteristics. In terms of the Hydrologic Groups and Septic tank rating of
soils, we see exactly the same pattern, the numbers of woodlots found on soils in each
category basically reflect how prevalently that category is found in the township.

In this point Table 5 illustrates two significant points. The first of these is that,
while categorizing soils based on Hydrologic Group or a septic tank field suitability
rating do capture the same soils as the Land Capability Classification, they also fail to
adequately discriminate between soils in a manner relevant to agriculture. As can be seen with the “wet” classification, all of the soils pulled out in the Land Capability Classification are found there, but also encompasses most of the soils designated as Prime or Locally important farmland in the County. Similarly, the hydrologic group classes, which are based on ratings of the rate of water transmission when the soil is thoroughly saturated is not necessarily a value of particular relevance to the agricultural value of the soil. Group C soils, which have a slow rate of infiltration, comprise the majority of the soils with 2w restrictions, but also the majority of the soils with Prime Farmland and Locally important farmland designation. The second point would be that, as the Important Farmland designations show, the potential productivity of the soils, that is the potential benefit of improving drainage in these lands, must also be taken into account. In summary then, nineteenth century land use decision-making regarding the placement of woodlots in Wayne County does not seem to be particularly influenced by excessive soil

<table>
<thead>
<tr>
<th>Hydrologic Group</th>
<th>Land Capability (LCC)</th>
<th>Prime Farmland with Drainage</th>
<th>Local Importance</th>
<th>Not Prime Farmland</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group B</td>
<td>2 0 0 9 0 4 3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Group C</td>
<td>11 0 0 12 15 17 16</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Group D</td>
<td>2 7 2 0 3 1 6</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Septic Tank Drain Field Suitability</th>
<th>Prime Farmland</th>
<th>Local Importance</th>
<th>Not Prime Farmland</th>
</tr>
</thead>
<tbody>
<tr>
<td>Slight</td>
<td>0 0 0 2 0 0 1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Moderate</td>
<td>0 0 0 2 0 3 1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Severe</td>
<td>0 0 0 3 0 7 14</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wet</td>
<td>15 7 2 14 18 12 9</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Soil Ranking</th>
<th>Prime Farmland</th>
<th>Local Importance</th>
<th>Not Prime Farmland</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0 0 0 0 0 0 0 0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>1 2 2 0 0 1 5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>7 3 0 4 8 4 8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>7 2 0 13 10 13 9</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>0 0 0 4 0 4 3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>15 7 2 21 18 22 25</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
wetness (as exemplified by the Land Capability classes, the Hydrologic Groups, and septic tank rating) because such limitations alone do not adequately reflect the agricultural potential of the soils.

I also performed several other analyses of the location of woodlots relative to other features of the landscape. As can be seen in Table 5, they were found to be nearly universally adjacent to parcel boundaries and adjacent to streams roughly 15% of the time. Woodlots were found to have at least one side adjacent to a road between 38 and 47% of the time. The geographical relationships are illustrated in Figures 7, 8, and 9. Finding the strong relationship between parcel boundaries and the location of woodlots, as well as the low frequency of their occurrence next to streams seem to fit well with a model of initial occupancy where settlers cleared their properties outwards from their initial farmsteads. Indeed, the critical factor in understanding the location of the woodlot on the farm could be well the location of the core farmstead.

<table>
<thead>
<tr>
<th>Table 6. Percentage of woodlots adjacent to landscape features.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Roads</td>
</tr>
<tr>
<td>Baughman</td>
</tr>
<tr>
<td>Green</td>
</tr>
<tr>
<td>Plain</td>
</tr>
<tr>
<td>Average</td>
</tr>
</tbody>
</table>

In Baughman Township (Figure 7) the relationship of both houses and woodlots to property boundaries can be seen. Houses can be seen to cluster towards the ends of properties closest to roads, which stands in contrast with the popularly-held image of a Midwestern farmhouse sitting in the center of a 360 acre farm. Two interesting features to note are Graber woods in the northwestern portion of the township, which was one of
the remnant old growth forest used by Braun in her research on the eastern deciduous forest. It is now owned by the state. Also important to note is the blank area in the southwestern corner. This is the city of Orrville, Ohio, which straddles the line between Green and Baughman Townships. Aside from the city of Orrville, woodlots seem fairly evenly distributed throughout the Township.

In Green Township (Figure 8) we again see the strong relationship between the boundaries of properties and woodlots. More woodlots occur along roads than in Baughman Township. Woodlots here seem to be concentrated mostly to the northwest of the city of Orrville in the southeastern portion of the Township. In Plain Township (Figure 11) there again appears to be a clustering of woodlots in the eastern portion of the township. In particular it is interesting to note how the woodlots are not found in the Class IIw and Class IIIw soils along the Kiser Ditch in the western portion of the Township.

As shown in the maps as well as Table 5, the location of woodlots is closely related to parcel boundaries. The presence of roads does not seem to be a factor. Considering the fact that roads are strongly associated with property boundaries, the presence of roads doesn’t seem to factor much into the choice of locations for woodlots. The low occurrence of woodlots near streams probably reflects a number of factors that made proximity to streams a desirable attribute for settlers in the nineteenth century. Most obviously, streams gave settlers easy access to potable water without having to dig a well, so it would be logical to situate one’s cabin close to a stream. Another, was the settler’s preference for “second bottom” areas along small streams, which were both easier to clear (because they were mostly brush and not mature stands of trees) and
considered superior land for growing corn as well as pasture for cattle (Douglass 1878, 75). Finally, streams were the preferential location for mills and the villages that grew up around. Lehman (1969, 213) notes that the village of Jericho, in the Swiss Mennonite settlement of Sonnenberg, grew up around the grist mill and woolen factory that John Greble, built next to the Kidron Creek, which he dammed and used to power the mill. Of course, the settlement pattern in was not entirely due to proximity to streams. The location of houses in relation to roads in the three townships exhibits a pattern strikingly similar to what Kiefer (1972) found in his study of agricultural settlement near Bremen, Indiana. In Wayne County as well, roads were obviously influential on the decision of where to core farmstead (main dwelling and major outbuildings) were located.

Relative to the settlement pattern, the final element that needs to be is the idea that woodlots would have been located in areas that were relatively “remote” or most time-consuming or difficult to access from the places where everyday farm activities would have taken place. To test this I constructed a variety of cost-weighted distance grids that weighted remoteness from both houses and roads using the data from Baughman Township. I found that these “remote” areas of the farm did not match up well with the actual location. What I found was that while there were no woodlots within 1,000 feet of the core farmstead, and 60% of the woodlots fell at a distance of over 2,000 feet. If we break the grid into four classes: (1) less than 1,000 feet, (2) between 1,000 and 2,000 feet, (3) between 2,000 and 3,000 feet, and (4) everything over 3,000 feet from the farmstead core and then count the number of woodlots that had their center in each class, then there were no woodlots in the first group, 40% of the woodlots had their center in the second group, 35% fell into the third group, 25% of the woodlots fell into the fourth.
I decided that a more appropriate approach to the question was one of examining the *Ortsgrunderissform* of the farm as a spatial unit. Using the parcels from Green and Plain Townships, I classed each one where a house and woodlot were discernable on the parcel as to whether or not it exhibited the standard layout of having the woodlot on the opposite side of the parcel from the house. Approximately 60% of the selected parcels followed the “standard” form of the woodlot being on the opposite side of the property from the core farmstead.

In Green township eighty-seven parcels had a house and a woodlot and fifty-three parcels were identified as falling in to the standard category (Figure 11). In Plain Township eighty-three parcels had both a woodlot and an identifiable house on the 1897 map (Figure 12). Fifty-one of these parcels were identified as following the standard layout. This standard form of farm layout, with the woodlot on the opposite side of the farm, would fit well with the spatial model of forest clearance that I put forward earlier.

Despite the numerous first-hand descriptions of the process by which pioneers decided where to build and how they went about building log cabins to replace their temporary shelters and start clearing the trees on their land, no one seems to have ever remarked upon where the settler’s began to clear the forest. In actuality, there was probably not one specific “way” in which settlers cleared the land, but it does seem fairly straightforward that they would clear outwards in a progression from their cabins and outbuildings, probably one field at a time. There are, of course, a significant number of “non-standard” farm layouts containing woodlots. A number of decisions could affect the placement of houses on a landscape, and it would indeed be remarkable if the locations of houses on individual properties had not changed from the period of initial settlement to
the latter part of the nineteenth century. Yet we still see the persistence of a spatial arrangement that would seem to reflect the original placement of houses and the subsequent defining of the farm woodlot during the clearing of the lot.

Figure 10. Properties with woodlots and houses, Green Township, 1897. Parcels with the “standard” layout had houses and woodlots were on opposite sides of the property. Parcels not filled either did not have woodlots or an identified house building on the map.
Figure 11. Properties with woodlots and houses, Plain Township, 1897. Parcels with the “standard” layout had houses and woodlots were on opposite sides of the property. Parcels not filled either did not have woodlots or an identified house building on the map.
Woodlots and Agricultural Economics

Beyond the interrelationships between decision-making about the location of woodlots and the physical landscape, economic development also quite likely had a role in where woodlots were found at the scale of the Township. To better address the question of agricultural characteristics and their influence on the location and size of woodlots during this time period I turned to the manuscript schedules of the 1880 Agricultural Census for Green and Plain Townships. I also examined the schedules for Baughman, unfortunately the microfilm was no longer legible beyond the second page. The first step of my analysis was to examine the relationships between farming patterns and the reported size of woodlots in 1880. The second was to attempt to link the 1880 data to the 1897 map to see if there were any correlations between observed standardized farm layout and farming activities as reported in the 1880 Census.

In particular I was interested in the relationship between the size of the farm and the number of wooded acres as well as the relationship between the size of the farm and farmer motivations. I decided to examine the relationship between productivity and size because there was a strong relationship between the size of the farm and the total wooded acreage via a bivariate regression analysis (Table 6; Figure 12). I then did a bivariate regression on productivity measured in Dollars earned per Acre (DPA) versus the total acreage for the farm for Green and Plain Townships. The results and ANOVA for them are found in Tables 7 and 8. As shown in Figure 13, I found a negative trend in the 1880 data for Green township ($R^2 = .1873$), but a much weaker one for Plain ($R^2 = .0860$), as shown in Figure 14. I then examined the outliers to see what differences there were on
their farms from the DPA versus acreage analysis and also examined one of the outliers from the total acreage versus wooded acreage regression.

**Table 7.** Wooded Acreage versus Total Acreage, Green and Plain Townships

<table>
<thead>
<tr>
<th>Regression Statistics</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Multiple R</td>
<td>0.771034</td>
</tr>
<tr>
<td>R Square</td>
<td>0.594493</td>
</tr>
<tr>
<td>Adjusted R Square</td>
<td>0.593617</td>
</tr>
<tr>
<td>Standard Error</td>
<td>12.55626</td>
</tr>
<tr>
<td>Observations</td>
<td>465</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ANOVA</th>
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</tr>
</thead>
<tbody>
<tr>
<td>df</td>
<td>SS</td>
</tr>
<tr>
<td>Regression</td>
<td>1</td>
</tr>
<tr>
<td>Residual</td>
<td>463</td>
</tr>
<tr>
<td>Total</td>
<td>464</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Coefficients</th>
<th>Standard Error</th>
<th>t Stat</th>
<th>P-value</th>
<th>Lower 95%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>-4.80809</td>
<td>1.053531</td>
<td>4.56379</td>
<td>6.44E-06</td>
</tr>
<tr>
<td>33</td>
<td>0.224198</td>
<td>0.008605</td>
<td>26.05343</td>
<td>8.57E-93</td>
</tr>
</tbody>
</table>

As can be seen in Figures 13, there is a considerable amount of spread in the data even though the results were significant for Green Township. Obviously the amount that a farmer earned per acre cannot be explained entirely by reference to his total acreage, in that regard there are a number of variables that this regression model does not attempt to address. Such a negative correlation, however, is not necessarily counter-intuitive. Smaller farms would have to be more productive in order to be competitive with farmers who had more land and could therefore afford to be less efficient. In general there is a trend towards larger farms being less productive on a per-acre basis, and wooded acreage has an even stronger negative correlation with the earnings per acre. We also see that there is a positive relationship between the size of the property and the presence of
woodlots. This would suggest to me that large farm owners have other motivations besides increased productivity to own large amounts of land. One could possibly be land speculation, the other could be that they are attempting to consolidate enough land to set up their sons as farmers (Cosgel 1993).

**Woodlot acreage versus total acreage**

![Woodlot acreage versus total acreage](image)

**Figure 12.** Woodlot acreage versus total acreage, Plain and Green townships.

There was a strong positive correlation between wooded acreage and total acreage for Green and Plain combined (with an $R^2$ of 0.5952). This is, of course, data from only one year; consequently, should probably not be over-interpreted. It does, however, fit well with the previous work of agricultural historians who have stressed the speculative nature of agriculture (Cochrane 1979, Jones 1983) and the diversified nature of Ohio
agriculture that grew up in response to it. Diversification, however, was as much a practice of the local farmer as it was a regional pattern.

Table 8. DPA and Acreage, Green Township

<table>
<thead>
<tr>
<th>Regression Statistics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Multiple R</td>
</tr>
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<td>R Square</td>
</tr>
<tr>
<td>Adjusted R Square</td>
</tr>
<tr>
<td>Standard Error</td>
</tr>
<tr>
<td>Observations</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ANOVA</th>
</tr>
</thead>
<tbody>
<tr>
<td>df</td>
</tr>
<tr>
<td>Regression</td>
</tr>
<tr>
<td>Residual</td>
</tr>
<tr>
<td>Total</td>
</tr>
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</table>

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<thead>
<tr>
<th>Coefficients</th>
<th>Standard Error</th>
<th>t Stat</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
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<td>32.54771905</td>
</tr>
<tr>
<td>X Variable 1</td>
<td>-0.0275997</td>
<td>0.003765767</td>
<td>7.329105492</td>
</tr>
</tbody>
</table>

Figure 13. Scatter plot of DPA versus total acreage, Green Township.
Two further examinations were made using the 1880 data, first of the outliers from the Green and Plain analysis (tables 8 and 9) and finally, an examination of the person represented by the farm of 680 acres in Plain Township. The farmers who were outliers in the regression seem to have a variety of differences for why they did not fit the mold. Finley Shrock, is a bit of an anomaly, perhaps he had just bought his farm or wasn’t available to respond to the Census taker. The ones on the upper end, who had large farms and large incomes, cannot be easily explained. Particularly anomalous is Robert Latimer who had an income of $3,148.00 and was renting his 148 acres. In Green the outliers did not stand out in terms of the census variable that I was examining.

Variation could come from a number of sources; income sources that I wasn’t examining (e.g., raising horses) or farm-related businesses, apple orchards or even just a particularly bad or good year for crops.

| Table 9. DPA and Acreage, Plain Township |

<table>
<thead>
<tr>
<th>Regression Statistics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Multiple R</td>
</tr>
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<td>R Square</td>
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<tr>
<td>Adjusted R Square</td>
</tr>
<tr>
<td>Standard Error</td>
</tr>
<tr>
<td>Observations</td>
</tr>
</tbody>
</table>

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<thead>
<tr>
<th>ANOVA</th>
</tr>
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<tbody>
<tr>
<td>df</td>
</tr>
<tr>
<td>Regression</td>
</tr>
<tr>
<td>Residual</td>
</tr>
<tr>
<td>Total</td>
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</tbody>
</table>

<table>
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<tr>
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<th>Standard Error</th>
<th>t Stat</th>
<th>P-value</th>
<th>Lower 95%</th>
</tr>
</thead>
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<td>0.477682134</td>
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<td>X Variable 1</td>
<td>-0.01658999</td>
<td>0.00361345</td>
<td>4.59117854</td>
<td>7.34701E-06</td>
</tr>
</tbody>
</table>
A more interesting case study is the Sidle family. On the scatter plot graph of Plain township, John Sidle’s 680 acres of land place him far outside the range of most farms in the township. Following the Sidle name to the 1897 Atlas was an instructive example of motivations for landowners to own larger land portions than was economically feasible for them to farm. As can be seen in Figure 15, John Sidle’s 680 acres was partially sold off, but also split into three farms for three sons. This illustrates the bequest motive for accruing large amounts of land, as well as using land as an investment that could be readily converted to cash if need be.
### Table 10. Regression outliers, Plain Township

<table>
<thead>
<tr>
<th>Name</th>
<th>Last</th>
<th>First</th>
<th>Tenure</th>
<th>Cattle</th>
<th>Other</th>
<th>Sheep</th>
<th>Swine</th>
<th>Total</th>
<th>DPA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shrock</td>
<td>Finley</td>
<td>Owner</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>$0.00</td>
<td>$0.00</td>
</tr>
<tr>
<td>Thomas</td>
<td>Daniel</td>
<td>Owner</td>
<td>0</td>
<td>0</td>
<td>10</td>
<td>1</td>
<td>$150.00</td>
<td>$1.03</td>
<td></td>
</tr>
<tr>
<td>Latimer</td>
<td>Robert</td>
<td>Renter</td>
<td>8</td>
<td>14</td>
<td>122</td>
<td>30</td>
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<td>$21.27</td>
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</tr>
<tr>
<td>Welly</td>
<td>John G</td>
<td>Owner</td>
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<td>6</td>
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</tr>
<tr>
<td>Myrrs</td>
<td>William</td>
<td>Owner</td>
<td>4</td>
<td>6</td>
<td>49</td>
<td>24</td>
<td>$1,881.00</td>
<td>$23.51</td>
<td></td>
</tr>
<tr>
<td>Michel</td>
<td>Henry</td>
<td>Owner</td>
<td>4</td>
<td>3</td>
<td>0</td>
<td>22</td>
<td>$900.00</td>
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</tr>
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<td>Spar</td>
<td>David</td>
<td>Owner</td>
<td>2</td>
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<table>
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<tr>
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<th>Corn</th>
<th>Oats</th>
<th>Wheat</th>
<th>Wooded %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shrock</td>
<td>Finley</td>
<td>40</td>
<td>40</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0%</td>
</tr>
<tr>
<td>Thomas</td>
<td>Daniel</td>
<td>145</td>
<td>99</td>
<td>10</td>
<td>5</td>
<td>25</td>
<td>45%</td>
</tr>
<tr>
<td>Latimer</td>
<td>Robert</td>
<td>148</td>
<td>100</td>
<td>29</td>
<td>28</td>
<td>36</td>
<td>42%</td>
</tr>
<tr>
<td>Welly</td>
<td>John G</td>
<td>20</td>
<td>16</td>
<td>5</td>
<td>0</td>
<td>8</td>
<td>4%</td>
</tr>
<tr>
<td>Myrrs</td>
<td>William</td>
<td>80</td>
<td>41</td>
<td>16</td>
<td>17</td>
<td>36</td>
<td>20%</td>
</tr>
<tr>
<td>Michel</td>
<td>Henry</td>
<td>35</td>
<td>28</td>
<td>15</td>
<td>6</td>
<td>15</td>
<td>5%</td>
</tr>
<tr>
<td>Spar</td>
<td>David</td>
<td>24</td>
<td>23</td>
<td>4</td>
<td>0</td>
<td>3</td>
<td>0%</td>
</tr>
</tbody>
</table>

### Table 11. Regression outliers, Green Township

<table>
<thead>
<tr>
<th>Name</th>
<th>Last</th>
<th>First</th>
<th>Tenure</th>
<th>Cattle</th>
<th>Other</th>
<th>Sheep</th>
<th>Swine</th>
<th>Income</th>
<th>Revenue</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jahff</td>
<td>Andrew</td>
<td>Owner</td>
<td>2</td>
<td>0</td>
<td>7</td>
<td>6</td>
<td>$175.00</td>
<td>$1.61</td>
<td></td>
</tr>
<tr>
<td>Sichterwalter</td>
<td>Myron</td>
<td>Renter</td>
<td>3</td>
<td>2</td>
<td>14</td>
<td>6</td>
<td>$358.00</td>
<td>$4.31</td>
<td></td>
</tr>
<tr>
<td>Steel</td>
<td>Levi</td>
<td>Owner</td>
<td>7</td>
<td>4</td>
<td>0</td>
<td>30</td>
<td>$2,930.00</td>
<td>$14.87</td>
<td></td>
</tr>
<tr>
<td>Walter</td>
<td>Cyrus</td>
<td>Owner</td>
<td>6</td>
<td>2</td>
<td>0</td>
<td>10</td>
<td>$2,750.00</td>
<td>$15.45</td>
<td></td>
</tr>
<tr>
<td>Song</td>
<td>Adam</td>
<td>Owner</td>
<td>6</td>
<td>8</td>
<td>0</td>
<td>13</td>
<td>$2,800.00</td>
<td>$18.06</td>
<td></td>
</tr>
<tr>
<td>Pinterton</td>
<td>Susa</td>
<td>Owner</td>
<td>5</td>
<td>11</td>
<td>8</td>
<td>21</td>
<td>$1,200.00</td>
<td>$20.00</td>
<td></td>
</tr>
<tr>
<td>Smucker</td>
<td>Amos</td>
<td>Owner</td>
<td>3</td>
<td>3</td>
<td>16</td>
<td>12</td>
<td>$420.00</td>
<td>$20.00</td>
<td></td>
</tr>
<tr>
<td>Myers</td>
<td>Henry</td>
<td>Owner</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>$240.00</td>
<td>$20.00</td>
<td></td>
</tr>
<tr>
<td>Kling</td>
<td>William</td>
<td>Renter</td>
<td>2</td>
<td>1</td>
<td>8</td>
<td>2</td>
<td>$350.00</td>
<td>$23.33</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Name</th>
<th>Acreage</th>
<th>Total</th>
<th>Tilled</th>
<th>Corn</th>
<th>Oats</th>
<th>Wheat</th>
<th>Wooded %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jahff</td>
<td>Andrew</td>
<td>109</td>
<td>8</td>
<td>0</td>
<td>1</td>
<td>3</td>
<td>100%</td>
</tr>
<tr>
<td>Sichterwalter</td>
<td>Myron</td>
<td>83</td>
<td>74</td>
<td>16</td>
<td>7</td>
<td>0</td>
<td>6%</td>
</tr>
<tr>
<td>Steel</td>
<td>Levi</td>
<td>197</td>
<td>155</td>
<td>20</td>
<td>12</td>
<td>50</td>
<td>40%</td>
</tr>
<tr>
<td>Walter</td>
<td>Cyrus</td>
<td>178</td>
<td>152</td>
<td>20</td>
<td>20</td>
<td>45</td>
<td>15%</td>
</tr>
<tr>
<td>Song</td>
<td>Adam</td>
<td>155</td>
<td>140</td>
<td>18</td>
<td>20</td>
<td>40</td>
<td>14%</td>
</tr>
<tr>
<td>Pinterton</td>
<td>Susa</td>
<td>60</td>
<td>45</td>
<td>0</td>
<td>12</td>
<td>20</td>
<td>12%</td>
</tr>
<tr>
<td>Smucker</td>
<td>Amos</td>
<td>21</td>
<td>20</td>
<td>0</td>
<td>4</td>
<td>8</td>
<td>0%</td>
</tr>
<tr>
<td>Myers</td>
<td>Henry</td>
<td>12</td>
<td>10</td>
<td>2</td>
<td>0</td>
<td>2</td>
<td>0%</td>
</tr>
<tr>
<td>Kling</td>
<td>W. H.</td>
<td>15</td>
<td>14</td>
<td>5</td>
<td>0</td>
<td>2</td>
<td>0%</td>
</tr>
</tbody>
</table>
Figure 15. The Sidle family farm(s) in 1897. John Sidle’s 860 acres was apportioned between three sons and some acreage was sold off as well.

Beyond the relationship between size and the presence of woodlots, I also wanted to see if there were differences between the regular and irregular farm-woodlot forms. To do this I first classed farms by size and by total value. Then I joined the data from the 1880 Census to the farms previously identified above. For Green Township, the identified owners of forty-seven of the eighty-seven parcels that had been previously identified as either standard or non-standard were successfully matched to 1880 Census data. For Plain...
Township, landowners for thirty-eight parcels were successfully cross-walked to the eighty-three parcels “standard” and “non-standard” farms in 1897. The Chi-Square tests using the classes that I created from the 1880 census data were not significant. Table 11 shows the original classification breakdown for Green Township.

**Table 12. Chi-Square classes for Green Township**

<table>
<thead>
<tr>
<th>Total Acres</th>
<th>Class 1</th>
<th>Class 2</th>
<th>Class 3</th>
<th>Class 4</th>
<th>Class 5</th>
<th>Class 6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Irregular</td>
<td>1</td>
<td>6</td>
<td>7</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Regular</td>
<td>0</td>
<td>6</td>
<td>17</td>
<td>6</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Total</td>
<td>47</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

I then decided to use a different approach and used a one-tailed t-Test for difference of means to look for differences in the two populations. The results didn’t really show many significant differences between standard and non-standard layouts (tables 9 & 10). There were significant economic differences between the irregular layout farms and the regular layout farms in Green Township, both in terms of acreage and number of animals. In Plain Township on the other hand, the only significant difference between regular and irregular layout farms was in the number of sheep, with the irregular farms having significantly more sheep on average.

**Table 13. One-tailed t-Tests, Green Township**

<table>
<thead>
<tr>
<th>Green</th>
<th>t Stat</th>
<th>one-tail</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Acreage*</td>
<td>2.226761739</td>
<td>1.734063062</td>
</tr>
<tr>
<td>Cult. Acreage*</td>
<td>2.514393073</td>
<td>1.717144187</td>
</tr>
<tr>
<td>Swine</td>
<td>1.484570991</td>
<td>1.705616341</td>
</tr>
<tr>
<td>Sheep*</td>
<td>2.744721362</td>
<td>1.76130925</td>
</tr>
<tr>
<td>Cattle (Milch &amp; Other)*</td>
<td>2.57075093</td>
<td>1.739606432</td>
</tr>
<tr>
<td>Wooded Acre</td>
<td>1.478449259</td>
<td>1.753051038</td>
</tr>
<tr>
<td>Dollars Per Acre*</td>
<td>-2.017730721</td>
<td>1.687094482</td>
</tr>
</tbody>
</table>

**Table 14. One-tailed t-Tests, Plain Township**

<table>
<thead>
<tr>
<th>Plain</th>
<th>t Stat</th>
<th>one-tail</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Acreage</td>
<td>0.907064829</td>
<td>1.701130259</td>
</tr>
<tr>
<td>Cult. Acreage</td>
<td>0.306207858</td>
<td>1.695518677</td>
</tr>
<tr>
<td>Swine</td>
<td>0.700679933</td>
<td>1.695518677</td>
</tr>
<tr>
<td>Sheep*</td>
<td>2.032451657</td>
<td>1.729131327</td>
</tr>
<tr>
<td>Cattle (Milch &amp; Other)</td>
<td>-0.016193091</td>
<td>1.697260359</td>
</tr>
<tr>
<td>Wooded Acre</td>
<td>1.28367778</td>
<td>1.717144187</td>
</tr>
<tr>
<td>Dollars Per Acre</td>
<td>0.098178916</td>
<td>1.695518677</td>
</tr>
</tbody>
</table>
Comparison between 1897 and 1947

Finally, I wanted to examine the differences between the 1897 map and the 1947 air photos I obtained from the Natural Resources Conservation Service office in Wooster, Ohio. As can be seen in Figure 16, there are differences between the landscape in 1897 and 1947. There are two possible ways of interpreting these differences; (a) as actual change in the landscape or as (b) errors in the original map. Without being able to investigate property records in each particular instance it is impossible to know definitively which a more accurate assessment is in any specific case.

Three such cases are illustrated in Figure 16. The first is the property of G. Breaman, who owned 160 acres according to the 1897 map. In the 1947 air photo, his woodlot is nearly twice the size depicted on the map, and a slightly different shape. The location of the woodlot, however, is fairly accurate given the digitizing constraints. The second example is the property of C. Shelly. Here again, despite the limitations of digitizing, the woodlots surrounding his farm are depicted in the 1897 map in places corresponding to where they do in the 1947 air photo. Curiously, the woodlot on his farm, a narrow rectangular strip connecting the other woodlots with the road at the end of his property, is not depicted. Examining the air photo, it is hard to judge whether this is a new growth or an old forest that has been extensively grazed. In fifty years time it would be possible for a new forest to grow up. His house and barn however are pretty much in the correct location. The third example is perhaps the divergent one. In this case what was marked on the 1897 is not found on the 1947 air photos. While the removal of a woodlot within the fifty years elapsed is completely possible it is harder to believe that a farmstead would disappear in this landscape. Generally, abandoned farmsteads are
converted to storage purposes or simply left to rot, and even if the buildings disappear, the house lot is generally not turned into a field. Generally speaking, abandoning housing stock is not the habit in this area. This area did not experience a serious decline in agriculture and there was little reason for farmers in the period between 1897 and 1947 to consolidate farms, or to abandon farming in favor of working off the farm.

**Figure 16.** Changes in the landscape, 1897–1947. There were some noticeable differences between the 1897 map and the 1947 map as illustrated above.

While we can see that there is some ambiguity in the relationship between this map and what we can observe in the 1947 air photos, the map is an extraordinary resource for understanding the historical landscape of Late-Nineteenth Century Wayne
County, Ohio. Obviously there were changes in the landscape in the fifty years between when the map was created and the air photos were taken. For instance, Whitney and Sommerlot (1985) did show that there was an increase in the amount of forested land in the county from the late nineteenth century through the late forties, which would fit in well with the picture painted by the first two examples. While there may be elements of this county atlas that were in some aspects an idealization of what landowners thought should be there or intended to put there, this is a hazard that can be found in any type of historical representation, whether textual or graphic. While it obviously wasn’t intended for the purpose to which I (and Whitney and Sommerlot) have used it, it is an unparalleled view into the historical landscape of an agricultural county in the nineteenth century Midwestern United States.
Conclusions

In conclusion then, I would argue two main points. First, the locations of woodlots at the scale of the farmstead are most strongly controlled by property boundaries and the location of the core farmstead, but were not influenced by roads, and are negatively associated with streams and soils that problems with excessive wetness. I would argue that this is a legacy of the initial occupation of these farmsteads and the process of clearing the farm. Second, at the township scale there is a significant correlation between the amount of wooded acreage and the size of the farm. I would argue that this represents the ability of farmers with more capital to diversify their operation to decrease risk-exposure. While nineteenth century farmers would not have explained it in those terms, farmers certainly were aware of the uncertainties of the market, the weather, and in Ohio seem to have met that by making the farmstead as robust an economic entity as possible.

The location of farm woodlots was ultimately the product of decisions made by landowners, and these decisions were influenced by a number of factors. While woodlots could be a considerable asset for a farmer, they were probably not an absolutely vital part of every farmstead. In Wayne County, heating and cooking fuel could also come from coal or from wood purchased from neighbors. Certainly if a farmer had timber cut, the remaining limbs and branches would be more than adequate to keep several households supplied. At the scale of the individual farm, the location of woodlots seems best explained by reference to the decision-making that went into the layout of the farm.

In Wayne County, woodlots were located nearly universally adjacent to parcel boundaries, however, in the process of assessing remoteness of woodlots in Baughman
Township, I found that the best fit with the data was constructing a cost-weighted surface of distance from the core farmstead, using slope as the cost surface. In Green and Plain townships, roughly 60% of the woodlots examined were on the opposite side of the farm from the core farmstead. This suggests to me that their location was ultimately a product of how the initial occupant of the farmstead went about clearing the land. Certainly this pattern fits in well with the process of clearing the land described by the local historians.

Although the relationship between the size of the farm and farm productivity need to be further explored, the suggestion that farmers were not driven purely by maximizing short-term profitability isn’t really a surprise. As most agricultural historians have pointed out, agriculture was a high risk venture and the best strategy was to have enough diversity that the farmer could meet cash flow needs even if the main crop failed. In such a context woodlots would be valuable from a number of perspectives. For one, extra land was a good investment, for another, woodlots could produce timber that could be sold to raise extra cash when money ran low and they could serve as extra pasture for cattle.

Returning to the continental scale for a moment, these conclusions are in stark contrast to Foster’s (1992) study, which concluded that woodlots in the nineteenth century were largely confined to locations that a steep slope, were too wet and were relatively distant from cultural features such as roads and houses. It is worth noting that there are two important differences between Petersham and Wayne County. Most obviously, the physical environment is a major difference between the two areas. Central Massachusetts is relatively hilly, while Wayne County generally has slopes less than 6%. This higher amount of relief would have made drainage projects more difficult than in Wayne County.
Limitations

GIS is a tool with significant potential for understanding a variety of historical questions. It has several obvious advantages over traditional methods for putting place into historical research. Geographic Information Science theory has several limitations for historical research, particularly addressing temporal rather than geographical change, but most significantly addressing spatial change through time. Additionally, GIS software can lend a certain false level of certainty to historical data that is inherently imprecise and fuzzy.

There were certain limitations regarding the map data. It is hard to match landowners to an agricultural census taken seventeen years earlier and the incomplete nature of the manuscript schedules themselves forced me to rework this study in some ways. Perhaps the biggest difficulty, however, was connecting farm operators from the 1880 census to landowners on the 1897 map. Obviously there were significant changes between 1880 and 1897, both in terms of the landownership turning over to the next generation and in terms of economic differences. The data in 1880 represents one point in time and not a generalized picture of the township in the nineteenth century. One of the significant handicaps of Census data for the nineteenth century is that each census records data in a slightly different fashion.

There were some areas where methods proved disappointing. For one, in analyzing distance, there are several limitations. One is that the distance surface measures the distance for each grid cell from the nearest farmstead house. This does not, however, always reflect the true distance from a farmhouse to the woodlot on the same parcel. More significantly, the distance from a farmhouse to the woodlot is ultimately a function
of the size of the farm and the orientation of the woodlot as well as the inherent ambiguity of measuring from a point to a polygon as a point to point distance.

As one way of getting beyond that I experimented with approaching the problem by examining the topological relationship between the farmstead, the shape of the parcel and the woodlot. This relationship has the advantage of being scale-independent and I feel it was more meaningful in terms of this research, but it also has certain disadvantages. Perhaps most significantly it doesn’t quantify the physical relationship, and is not necessarily completely objective.

**Future Directions**

There are several avenues for future research here. One would be to more fully investigate regional patterns in the data, especially at the county level. There are also certain methodological refinements that could be made. Obviously a more sophisticated statistical analysis using a larger data set would be one place to start. I think it would also be interesting to look at two areas more in physical contrast, as this research was limited mostly by what was available.

I am personally more interested in the possibilities presented by this data set for further historical research in Wayne County. One possibility that I find intriguing is building a web-accessible historical GIS for Wayne County that would integrate this map with the wealth of historical data available for Wayne County. Putting together the Caldwell atlases with the early air photos of the county and census data from the population and agricultural schedules would really be a tremendous asset, both to the local community and for researchers interested in rural nineteenth century America.
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