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This dendroarchaeological study determined the age of a historic building on the Summers' Farm in Summerfield, North Carolina. Several historic buildings associated with 19th century tobacco farming remain in the Piedmont region of North Carolina. However, the structural integrity of these buildings is declining, thus the necessity to determine their age prior to installing architectural-era improvements appropriate to the historic period. Here, I dendrochronologically sampled two historic structures during 2018 including the Farm's main house and a tobacco barn, the later which could not be dated. Conversely, northern red oak (*Quercus rubra* L.) cross sections and cores (n = 15) were obtained from the main house, dendrochronologically processed, and standardized with late-wood ring widths. The red oak samples strongly crossdated with each other (interseries correlation = 0.604) and a regional (i.e., ~96 km distant) longleaf pine (*Pinus palustris* Mill.) reference chronology (interseries correlation = 0.548) used to anchor tree-ring dates suggesting an estimated building date of 1883–1888 that matched the site survey date. These results: 1) gives an estimated building date for each building; 2) match the architecture of the structures and their component features with the dendrochronological dating; and 3) provide information regarding if the folklore surrounding the buildings is accurately anchored in history.

DENDROARCHAEOLOGY AND THE DATING OF HISTORIC FARM BUILDINGS ON THE SUMMERS' FARM, SUMMERFIELD, N.C.

by

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APPROVAL PAGE

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CHAPTER I

INTRODUCTION

This thesis uses dendrochronological and dendroarchaeological methods to surmise the dates of the main house and a tobacco barn standing on the Summers' Farm in Summerfield, N.C. By using dendrochronological methods and architectural building styles the main house and tobacco barn have approximate buildings dates attributed to them of the 1880s and 1920s. This study shows the novel use in the southeastern U.S. of using different species of trees from a similar location and climate to date a structure. It shows the influx of Scotch-Irish and German ancestry into the area and how the use of agriculture has maintained the farm for six generations. Results from this study also provides additional information about the farm history, agrees with the architectural building styles of the time period, and corrects the false folklore surrounding the farm, which placed too early of a time frame on building construction. Finally, the results provide evidence so that the farm as a complex can begin the process of applying to the National Register of Historic Places.

CHAPTER II

DENDROARCHAEOLOGY AND THE DATING OF HISTORIC FARM BUILDINGS ON THE SUMMERS' FARM, SUMMERFIELD N.C.

2.1 Abstract

This dendroarchaeological study determined the age of a historic building on the Summers' Farm in Summerfield, North Carolina. Several historic buildings associated with 19th century tobacco farming remain in the Piedmont region of North Carolina. However, the structural integrity of these buildings is declining, thus the necessity to determine their age prior to installing architectural-era improvements appropriate to the historic period. Here, I dendrochronologically sampled two historic structures during 2018 including the Farm's main house and a tobacco barn, the later which could not be dated. Conversely, northern red oak (*Quercus rubra* L.) cross sections and cores (n = 15) were obtained from the main house, dendrochronologically processed, and standardized with late-wood ring widths. The red oak samples strongly crossdated with each other (interseries correlation = 0.604) and a regional (i.e., ~96 km distant) longleaf pine (*Pinus palustris* Mill.) reference chronology (interseries correlation = 0.548) used to anchor tree-ring dates suggesting an estimated building date of 1883–1888 that matched the site survey date. These results: 1) gives an estimated building date for each building; 2) match the architecture of the structures and their component features with the

dendrochronological dating; and 3) provide information regarding if the folklore surrounding the buildings is accurately anchored in history.

2.2 Introduction

In Piedmont North Carolina, the location of standing historic (i.e., pre-1900) wooden structures is often restricted to buildings associated with tobacco farming, yet building ages are unknown and thus typically exaggerated (Wight and Grissino-Mayer 2004; Schneider *et al.*, 2015). Here I use dendroarchaeological methods in effort to determine the age of two historic intact structures, the main house and a tobacco barn, on the Summers' Farm is in Summerfield, North Carolina in Guilford County (Figure 1).

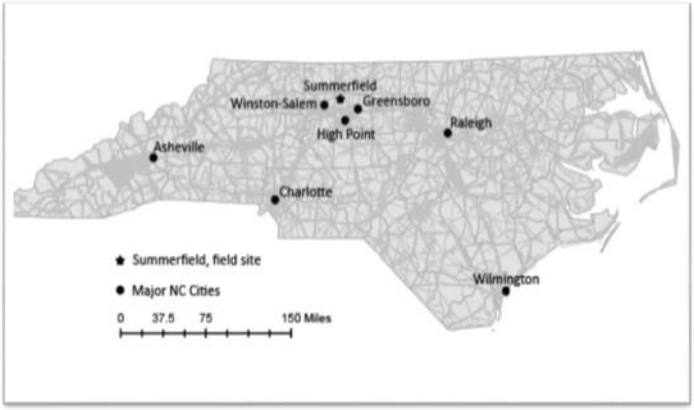

Figure 1. Map Showing the Major Cities in North Carolina, Highlighting Where Summerfield is in Location to Them.

The North Carolina Historic Preservation Office Site Survey in 1995 of the surrounding area places the main house construction date to the 1880s while the tobacco barn was dated to the early 20th century, possibly the 1920s (Graybeal, 1995). Family folklore

surrounding this building pushes its construction date back further to the revolutionary War (1775–1783). Exact dates of the buildings have not been determined but as an agrarian complex (the historic buildings and land) the farm is eligible for the National Register of Historic Places (Graybeal, 1995) provided that the complex is at least 50-years old, is similar to its historic operation, and shows significance for the local area or state (National Park Service, 2018). As noted in the site survey (Graybeal, 1995) the farm as a complex would be eligible, relating to the landscape history and as an archeological investigation (National Park Service, 2018). The farm can show the biogeography of trees and agriculture and how the expansion of agriculture affected the surrounding forest and water systems. To address this question of building age, this study is designed to address three research questions: 1) what is the age of each of the buildings; 2) the architecture styles of the structures and their component features and artifacts agree with the dendrochronological dating; and 3) is the folklore surrounding the buildings accurately anchored in history?

Accurately assigning dates for these structures would provide evidence about who constructed the buildings and the individuals who occupied them. If the Summers' Farm buildings can be accurately placed in history it could validate the family stories that surround these buildings (Grissino-Mayer *et al.,* 2009b; Henderson *et al.,* 2009; Mann *et al.,* 2009*;* DeWeese *et al*., 2015; Schneider *et al.,* 2015). This would help with the understanding of how the farm was used through time by placing the farm in a historic period where there are certain markers for the time (i.e. architecture and agriculture styles).

Those used to recording vernacular buildings in agricultural landscapes have learned that oral history, like most historic sources, have biases based on faulty memories and personal idiosyncrasies. Folklore tends to attribute erroneous earlier construction dates, which confuse building ages, and occasionally attribute greater age to help preserve buildings (Wight and Grissino-Mayer 2004; Schneider *et al.*, 2015). Knowing if the architectural and archeological features present in the structures are supported by dendrochronological research and *vice versa* provides evidence that architecture was the same in the time that it was built. Alternatively, a dendrochronological analysis could show that the architecture was modern for the era and provide evidence for a transition period in architectural styles.

2.2.1 Dendroarchaeology in the Southeastern U.S.

Dendroarchaeology is the dating of either a tree-ring core or slab obtained from joists (beams) of historic buildings by comparing ring patterns to a local or regional reference tree-ring chronology (DeWeese *et al*., 2015). In the U.S. the first dendroarchaeological research studies were based on structures sampled in the southwestern United States in the early 1900s (Grissino-Mayer 2009a). A.E. Douglass, an astronomer at the University of Arizona (Orser 2017), initiated the field of dendrochronology *ca.*1904 and some of his earliest work involved dating joists in ancient pueblos in the American Southwest (Orser 2017). Dendrochronology research in the southeastern U.S. began much later compared to the American Southwestern studies, as it was not until the 1930s when Florence Hawley verified tree-ring chronologies were possible to obtain in the eastern US by establishing a chronology of eastern red cedar and

cross-dating the trees (Grissino-Mayer 2009a). By 1938, Roy Lassetter, conducted the first successful dendroarchaeological attempt of tree-ring dating in the Southeast sampling log cabins, yet it was not until 1979 when standardized dendrochronological methods for dating wooden structures emerged (Lewis *et al.*, 2009 and Grissino-Mayer *et al.*, 2013).

The historic lack of dendroarchaeological research in the Southeast was principally caused by the incorrect perception that prevailing environmental conditions limited the viability of wood samples (Wight and Grissino-Mayer, 2004) such as: 1) high humidity and a mesic climate promoted faster decay than arid and semiarid regions, and 2) an abundance of fungi, and insects altered the wood structure via decomposition based on wood type and exposure extent (Wight and Grissino-Mayer, 2004; Grissino- Mayer 2009a). Even though these assumptions are true for the Southeast, the practice of coring multiple joists has shown that some species exhibit high decay resistance (i.e. greater resin or density), thus it is possible to obtain a large sample size even if some of the cores are unable to be crossdated. That said, tree-ring chronologies also have been developed from water-submerged (e.g., wooden crib dams) environments, further suggesting that for some decay-resistant southeastern species such as longleaf pine, logs can retain visible ring patterns that can be dated after decades of submersion (van de Gevel *et al.*, 2009; Garland *et al.*, 2012).

A cutting date for sills and joists in a historic structure (Table 1) can be precisely determined if there is either bark remaining on the sills or joists or if there seems to be smooth edge that maintains a natural form where the bark has fallen off over time

(Schneider *et al.,* 2015). Cutting-date determination also is predicated on obtaining enough rings (years) to demonstrate distinguishable interannual growth pattern in ring widths and the presence of a reference tree-ring chronology (i.e., a developed chronology with similar growth patterns) to 'anchor' a timeframe for the beam cutting dates (Therrell and Stahle, 2012).

Table 1. A Concise Representation of Cutting Date Assumption by Outer Structure. The Left Side Gives Abbreviations for Field Notation.

B	The bark is present and thus the outer ring is intact
OS	There is no bark present but a smooth continuous ring is shown
V	Presence of sapwood but the log was cut down and the date would be within a few years
vv	Impossible to determine the outer ring and no sapwood and heartwood is likely missing

2.2.2 Historic Log Buildings

Most of the historic log homes of the southeastern U.S. are built from oak (*Quercus spp.*), pine (*Pinus spp.*), chestnut (*Castanea spp.*), and tulip poplar (*Lirodendron tulipifera* L.) as these are readily available species (Batista and William, 1997; Small and Wentworth, 1998; Schneider *et. al.* 2015). In some instances, juniper (i.e., 'cedar'), which produces few long, straight trunks required for construction, has been used because of exceptional resistance to decay and bugs (Lewis *et al.,* 2009; Schneider *et al.,* 2015, Rochner *et al*., 2017). Cedar has been used because of its softwood characteristics, which makes it easier and faster to work with and the presence of numerous cedar glades makes it a widely available material (Lewis *et al.,* 2009; Schneider *et al.,* 2015). Cedar is known to have numerous missing rings, yet

dendrochronological studies have successfully dated this species by comparing the ring patterns of the buildings to regional reference chronologies (Lewis *et al.*, 2009; DeWeese *et al.*, 2015). A less frequently used building material is cypress (*Cupressus sp*.), which has been sampled from historic structures in St. Augustine, Florida (Garland *et al.*, 2012; Therrell and Stahle, 2012).

There is no ideal species for dendrochronological sampling ease in the southeastern U.S. Of the most common species used for construction, oak species often can be difficult to sample because of high wood-density characteristics, which complicates obtaining a core. Pines are a common type of building material because of their widespread distribution, the ease of working with a softwood during construction, and production of straight trunks. Yet, obtaining samples from pine joists is difficult as large amounts of resin (the quality that resists insects and fungal decay) exists in the species, which can clog an increment borer (Grissino-Mayer *et al*., 2010). Tulip poplar has dendroarchaeological limitations because of its diffuse-porous ring structure and its greenish/yellowish xylem makes ring-structure detection difficult (Rochner *et al*., 2017). However, if rings can be distinguished, the tulip poplar can be dated. In sum, while dendroarchaeological success is defined by determining exact construction dates, dating precision may be affected by the quality and type of wood used for building construction.

Other factors beyond the species used for building must also be considered. Some historic buildings have squared joists, indicating that the bark has been stripped from the timbers and an absolute cutting date cannot be determined. In this instance, building dates can be determined within a few (+- 5) years of accuracy (Grissino-Mayer *et al.*,

2010). Buildings can also undergo renovations where the joists can be taken down and reassembled by re-notching or decayed joists replaced with newer wood (Stachowiak *et al.*, 2014). A protection for the structure is if owners place clapboard siding on the house for insulation and to guard against the elements (Slayton *et al.*, 2009). Owners can plank-over the joists that are inside the house to insure a smooth wall and for less air flow to come inside if the chinking has cracked.

A way to approximate building age is to examine the type of nails used during construction. Wood pegs support the building's historic status, because nails today are either metal or iron so that they are easy to drive into the wood. Wooden pegs require the wood to be pre-drilled and the nail must be specifically cut for a log. Machine-cut nails range from 1830–1890 while wire cut nails which were less expensive, appear in the late 1880s (Mann *et al.*, 2009; Orser, 2017). Further, the examination of nails reveals whether the building underwent modifications through the presence of newer nail types in the wood compared to old nails that were hand forged. Hand-made nails are easily recognized by hammered heads and flattened points that are usually not identical to each other (Orser 2017). Also, the building's architecture reveals its construction date because building styles change (Mann *et al.*, 2009).

There is also a problem with structures being rebuilt in the same site because sometimes builders will reuse joists from a previous home building, thus leading to some joists dating much earlier than the rest of the structure. To compensate, a random assortment of joists is chosen but appearance is noted for inconsistencies on them, such as adze marks. This approach comes with the issue of folklore because there might be a

building that was referred to by historians but the building that is standing is a newer version (Bortolot *et al*., 2001; Schneider *et al.,* 2015). This is one of the main reasons that buildings have an incorrect construction date assigned to them and why dendroarchaeology is an important approach to help correct the dating errors.

2.3 History of the Study Site

The Summers' Farm, known locally as Fairy Tale Farm, is in Summerfield, N.C (36.236998, -79.850072, elevation of 277.063m.). Summers' Farm is 526,091 m^2 and has 11 historic buildings of various construction dates standing and 6–8 buildings that have been torn down (J. Summers, personal communication, March 18, 2018). The historic buildings in sufficiently good condition (i.e., structurally safe) to be in use are the main house (36.236666, -79.849912) (Figure 2), and tobacco barn (36.237001, -79.848663) (Figure 3).

William H. Clayton (1837–1914) was the original owner of the farm (1850s) with a massive farmstead of over 2.4 km^2 (J. Summers, personal communication, March 18,2018). As his eight children grew up and married he would sell sections off to them and the majority of the farms are still in use by his descendants (J. Summers, personal communication, March 18, 2018). His daughter, Edna Clayton (1873–1928), married John R. Painter (1876–1963) and bought the land that is now the Summers' Farm. Afterwards, Jasper Earl Williams (1913–1998) and wife Desmonia Clayton (i.e. Edna Clayton's niece) bought the farm from the Painter's. From the historic site survey (Graybeal, 1995) the builder of the house was John R. Painter but from Summers-family

knowledge this date does not make sense because John Painter would have been approximately age 10 at the time of construction.

Figure 2. The Main House (Left) from the East Side with Kitchen (Right). (Photography Courtesy of the North Carolina State Historic Preservation Office, Circa 1995).

Figure 3. The Tobacco Barn. The Front Foundation was Redone (Date Unknown), but the Remainder of the Foundation is Original Stacked Stone. (Photograph by Author).

Throughout the occupation of the farm it was extensively used in the production of tobacco but was transitioned to a horse farm beginning in the 1985. Currently (i.e., 2019) the farm is principally pasture and open fields used to grow fescue/orchard grass hay. Remnant from early tobacco-era farming practices that did not implant conservation practices, is a gulley (at its widest extent of 12 m across, 9 m deep, and running 609 m) that has stabilized (i.e., no additional expansion) today. The Summers' Farm is known for being an innovative farm operation because it is the first farm in Guilford County to have a bulk barn for curing tobacco instead of a tobacco barn, and owner Jill Summers recalls in the 1960s farmers from the County visiting to view bulk barn (J. Summers, personal communication, March 18, 2018). In the 1990s Guilford County did surveys of all the farms in the county to see if they met Soil and Water Conservation Act requirements (J. Summers, personal communication, March 18, 2018). The office found that the Summers' Farm was the only farm in the county that met all the requirements because they were installed by Jasper Williams (i.e., stabilization of the gulley, planting of kudzu, and establishment of terraces) (J. Summers, personal communication, March 18, 2018). Also, the history of the farm helps to understand the growth of new forest that reestablished to protect the land that was severely damaged by gullying and helps historians understand the true landscape of what an old farm operation looked like.

2.3.1 Building Styles

The building styles at Summers' Farm are similar to northern European building styles that are present in England, Ireland, Scandinavia, and northern Germany (Swaim, 1978; Jordan, 1985). Scotch-Irish and German ancestry is strong in the Piedmont area of

North Carolina and family stories and lineage are from these groups of people (Swaim, 1978; J. Summers, personal communication, March 18, 2018).

The tobacco barn has full and half-dovetail notching. The joists are squared timbers and were likely hand notched by an adze and/or ax because of scarring on the joists instead of a smooth surface. The tobacco barn stands alone without any siding except for a shed that sits at a sharp angle on the back to help protect those that maintained the fires and for protection from the sun as farmers hand tied the tobacco leaves to stakes to prepare them to be hung in the barn. However, in 2018 the old shed was torn down and a new wraparound shed was added for farm equipment storage because the original shed had deteriorated.

The main house is marked by diamond V-notching, which is a style of notching not commonly practiced in the Southeast (Swaim, 1978; Jordan, 1985). This style of notching was mainly German that the Scottish then adopted (Swaim, 1978) but because of how labor intensive it is to take so much wood off every side it was not commonly seen. The joists used in the construction of the main house are also hand-hewn logs. The house is covered in clapboard siding except for the front entrance which is covered with a porch overhang, resembling a canter-lever barn. The back of the house has a full-length porch and the joists are planked with boards. The back porch is the most deteriorated part of the structure, but this has exposed several of the main support sills running under the house. The sills were used to raise the house up above the ground and originally set on large smooth stones but there is evidence that some areas were replaced by modern bricks.

The plan of the main house is an English and Scotch-Irish hall-and-parlor structure as evidenced by a chimney along the roof ridge, as well as having the front and back door perpendicular to the roof ridge and aligned with each other (Jordan, 1985; Graybeal, 1995). The hall-and-parlor style is distinguished by a single, square living space on the main floor with a small boxed stairway that leads to the sleeping area upstairs 'parlor' (Swaim, 1978). The Scotch-Irish also had a shed room attached to the house with a small porch and then a large full-length front porch (Swaim, 1978). However, in this house the shed has always been called the front of the house because of the road that runs in front of it. This shed would have been helpful for a farmer; as he drove down the road he could stop and grab what he needed out of the shed. The full-length back porch, which at some point was screened, overlooks the farm. From German ancestry the use of a semi-subterranean cellar is evident by the northeast side of the house has an exposed cellar (Swaim, 1978). This is the principal reason why the inside of the floor is slowly collapsing as the sills rot. The southwest side of the house has a stone chimney on the side wall with an opposite facing window. Originally there was a kitchen that was detached from the house like the dog-trot houses in Northern Europe, though it lacked their characteristic connecting alley (Jordan, 1985). However, the kitchen was dilapidated and suffered extensive damage from a tornado, after which it was torn down and replaced with a new building.

Through contact with the NC Department of Natural and Cultural Resources I was able to obtain site surveys of the farm conducted in 1995 (Graybeal, 1995). There are photographs from this survey of the standing structures and an estimated guess that the

main house was built sometime in the 1880s in a pre-Rustic Revival style of hall-and-parlor (Figure 4) (Graybeal, 1995). The tobacco barn according to the NC Department of Natural and Cultural Resources site survey was built in the 1920s (Graybeal, 1995). The document also reveals that the farm is a candidate for National Registry of Historic Places as an agriculture complex (Graybeal, 1995), meaning that the acres of land with the standing structures as a whole are eligible for the registry, not just the house itself.

Figure 4. The Northeast Side of the House Where Timber Slabs and Cores were Pulled. (Photograph by Author).

2.3.2 Folklore

One of the folklore stories surrounding the Summers' Farm is that the main house was standing during the Battle of Guilford Courthouse in 1781 with soldiers residing in the house during the war (J. Summers, personal communication, 2016). This assumption is credible because Summerfield Elementary, which is approximately 8 km southwest of the Farm was a campsite for soldiers (J. Summers, personal communication, 2016). Other stories include Jasper Williams always referring to the fact he could not keep tenant farmers in the house for longer than a month because the tenants complained of music and voices traveling through the house and people walking around the outside of the house when there was no one around. Jasper Williams credited this to living near gullies and the sound travelling "through the hollers" (gullies) from a church several miles away. However, the story of soldiers staying in this house during the Civil War (1861–1865) seems to be a plausible date because of history's tendency to age structures beyond their years. Even though the cabin appears to be older than the rest of the barns, dating it to the Revolutionary War is unlikely when one considers how it was constructed and some of the building materials used.

2.4 Methods

The two buildings were sampled in December 2018. A 25.4 cm length dry-wood borer (i.e. a hollow drill bit) attached to a power drill and an increment borer were used to obtain 10 cores from the tobacco barn and 10 cores (limited sampling due to a collapsing floor), with 4 slabs from the sills from the main house. An increment borer is useful with

oak and poplar cores because it does not destroy the initial 2–3 cm of the wood before it is able to take grip of the wood like a dry-wood borer does.

Cores were pulled from the front porch wall and inside back wall in the house, while slabs were pulled from the sills on the northeast side of the house with a DeWalt™ reciprocating saw. On the main house the sills were all squared instead of the joists of diamond V-notching. The squared sills appear to have smooth edges suggesting that several rings were not removed in the process, thus showing a greater number of annual rings (Therrell and Stahle, 2012). The tobacco barn was built using multiple types of tree species, though principally pine (unknown species), while the main house was constructed of red oak. All the species were likely growing on the property as live samples of these trees can be found on the farm. Cores pulled from the tobacco barn were sampled on joists four and higher, because the lower samples pulled out deteriorated ring structures.

There is little agreement on how many cores to obtain to accurately date a sample other than a preference for larger sample sizes (Grissino-Mayer *et al.*, 2010; Garland *et al.*, 2012; Deweese *et al*., 2015). However, by using the program ARSTAN (Cook 1984), one can determine the number of cores needed to achieve an expressed population signal (EPS) greater than 0.85 (Wigley *et al*., 1984), which identifies the minimum number of samples necessary for a statically significant sample size.

The cores that were sampled from the historic buildings were mounted to a core mount and sanded using progressively finer grit from 120–800*u*m. The finished cores were scanned, and ring-widths including earlywood, latewood, and totalwood were

measured using WinDendro™ (Regent Instruments Inc., 2012). Latewood samples from the red oak displayed the most interannual variability and thus were crossdated using a latewood montane longleaf pine reference chronology from the Uwharrie Mountains (35.41, -80.06) ranging from CE 1740–2018 developed at the UNCG Carolina Tree-Ring Science Lab (CTRSL) and hereafter called the "montane" chronology. Measured cores (i.e., "floating" cores) from the historic structures were added to the montane chronology and run in the program COFECHA (Holmes 1986), which "anchors" the cores to a specific beginning date based on similar interannual ring-width variation. The result of anchoring a core is the precise assignment of an outermost date to each sampled timber (Lewis *et al.,* 2009).

2.5 Results

Red oak (*Quercus rubra*) was used as the building material for the main house. It is easily recognizable because of large cell sections and reddish wood, and during the coring process the red oak emits a distinctive pungent sour smell. The use of red oak for building construction is unusual because the commonly found white oak is one of the longest living species of oak and thus used as the main hardwood in central Piedmont forests and is not pungent (Bortolot *et al.,* 2001). The architectural styles of the house does match post-Civil War architecture of the time period. The use of cut nails (1800–1880) is evident in the plank boards that cover the joists and outnumber the few wire nails that would be used through modern times. Since this is a working farm the use of a forge would be evident for maintain farm equipment and shoes for horses. From this one can see that door hinges were hung from handmade nails. The folklore surrounding the

house is not placed correctly in history. The house is not of the Revolutionary War or Civil War era and soldiers would not have stayed in it.

The chronology made from red oak for the main house has a series date from 1770–1878 with an interseries correlation of 0.604 and a mean sensitivity of 0.274. There were no problem segments listed in COFECHA, thus indicating no possible dating errors. The montane chronology used to date the oaks had an interseries correlation of 0.548 and a mean sensitivity of 0.489. The longest main house segment MHS_04B expanded 85 years and its corresponding core of MHS_04E were used to match the rest of the cores to the time period (Table 2). The diameter of the sills average 28 cm while the joists averaged 23 cm. A total of eleven cores were pulled but only two were able to cross-date due to breakage and short segments (Figure 5). Some of the cores pulled either had breakage or were too short to cross-date. Of the slabs all four were able to match with the montane chronology. MHS_04B (Figure 6) has the longest segment since MHS_02 had to be truncated at 61 years because of several decades of suppressed ring growth that could not be dated. Slab 4 was split into two sections (MHS_04 and MHS_05) because of it being broken and the two pieces looked different from each other. From the assumption that 5–10 years of missing rings because of no bark present on the base sills this would put the construction date of the house between 1883–1888.

By visual comparison there are cores that appear to be from the same tree. Because of the age of the tree and that several of the joists appear to be limbs it is likely from an old growth red oak tree. The diamond V-notched timbers of the house measure 22.9 cm by 15.2 cm, while the squared base timbers measure 22.9 cm by 23 cm. With

old dates attributing to the limbs means that the tree had to be an old growth oak. The tobacco barn could not be successfully cross-dated due to wide growth rings likely from second-growth young forest and different species used throughout the structure. Due to this the date of the 1920s from the historic site survey (Graybeal, 1995) is where the tobacco barn's building date will stay.

Table 2. Interseries Correlation of Samples, *n* = 15. Only MH_01A and MH_01B are Cores, While the Remainder of Samples are from Slabs.

Core	Begin Year	End Year	Years	Correlation
MH_01A	1835	1866	32	0.548
MH_01B	1836	1864	29	0.443
MHS_01A	1857	1877	21	0.782
MHS_01B	1858	1878	21	0.686
MHS_01C	1857	1873	17	0.834
MHS_01D	1858	1874	17	0.826
MHS_02A	1818	1878	61	0.409
MHS_02C	1837	1867	31	0.548
MHS_02D	1832	1858	27	0.564
MHS_02F	1772	1802	31	0.524
MHS_03A	1835	1872	38	0.604
MHS_04B	1771	1855	85	0.604
MHS_04E	1770	1845	76	0.577
MHS_05A	1789	1828	40	0.691
MHS_05B	1789	1827	39	0.835

Figure 5. Cores (MH_01A_01B) Pulled from the Front Porch Dating to 1866 (Top) and 1864 (Bottom).

Figure 6. Slab MHS_04, This was the Slab used to First Match up Against the Montane Longleaf Pine and Correlate with the Other Red Oak Cores 1771–1858.

2.6 Discussion

The montane chronology was used to ensure accurate crossdating for the oak chronology. Even though the chronologies are different species the interseries correlation between them is high (0.548). The longleaf pine chronology used was developed from 50 samples (Mitchell *et. al*., 2019), resulting in high-correlating trees that can thus be used to match to the oak trees. The montane chronology is approximately 96 km distant and located under similar climate conditions. The montane chronology ranges from 1740–2018 with an EPS of >0.85 beginning at 1790 (Mitchell *et. al.*, 2019).

An interesting finding is that oak (angiosperm) and pine (gymnosperm) were able to correlate highly (i.e., interseries correlation > 0.5) to each other. The high correlation could be because of how close the trees were growing so that they were affected by similar climatic conditions and elevation. Latewood was used to date the rings because it contains more interannual variability than earlywood and total wood and thus better correlates with the montane chronology. Several chronologies were tried but were either too far away (over 160 km), only used totalwood, or climate conditions were substantially different between the two sites. These results show that there is validity between using different-species chronologies for crossdating if they are located close to each other and under similar climatic conditions and to my knowledge this has never been done before in dendroarchaeology in the southeast. The montane chronology was developed to show the extent of climate sensitivity of montane and piedmont longleaf pine to summer precipitation using latewood growth (Mitchell *et. al.*, 2019). These results suggest that oaks and pines share similar sensitivity to drought years (Figure 7) and that more local chronologies of different species may be a better option for crossdating (e.g. Wight and Grissino-Mayer, 2004) than the same-species chronologies from further away. Several dendroarchaeological studies only used reference chronologies of the same species (i.e. DeWeese *et. al.*, 2012; Schneider *et. al*., 2015), while both van de Gevel *et al*. 2009, and Therrell and Stahle, 2012 built reference chronologies from the same species from live trees near (within 200 km) the historic structures.

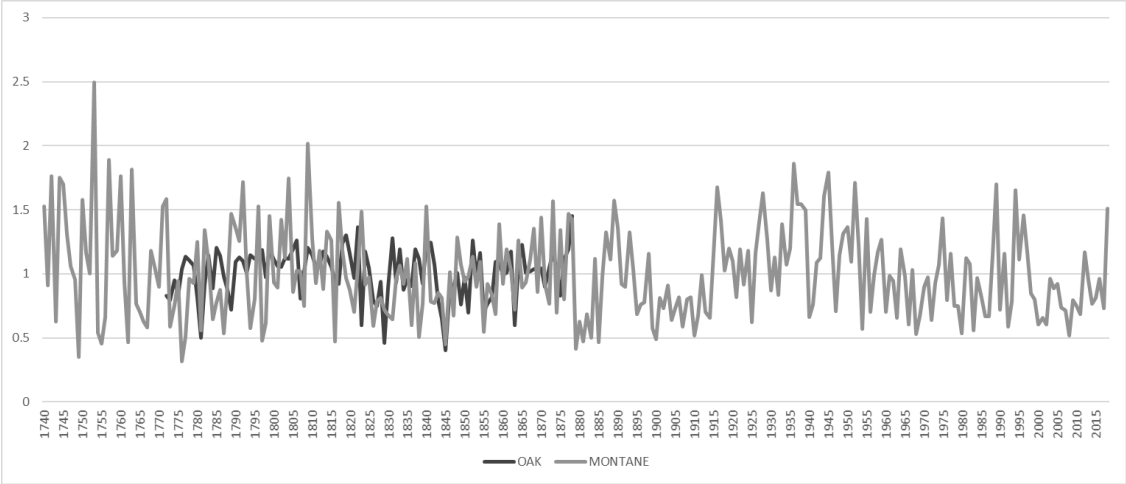

Figure 7. Standardization of Oak vs. Montane from 1772–1878. The Montane Chronology EPS is 1790.

The years for the standardization are 1772–1878 for oak because of 1770–1771 did not have enough data (i.e. only one core) to standardize and was askew. The years 1865, 1855, 1845, 1822, and 1780 are great marker years (i.e. suppressed growth) for oak and correspond to the same years in the montane chronology. By seeing a similar pattern within the oak and montane chronology it shows that different species can be matched up by using drought marker years that are seen only in latewood.

The exterior dates of the cores end in the 1870s, but there is no exact date because of the way the house was built. With the diamond V-notching style several (10–15) outside rings are removed from the logs. However, there are 5–10 years likely missing from the sills because the presence of smoother edges (i.e. close to the bark) unlike cut edges on the diamond V-notched joists, placing the construction date at approximately 1883–1888. This estimate time frame would match with historic documents (Graybeal, 1995) and would seem credible because settlers would want to waste the least amount of

timber possible. However, with a few of the sills having ending dates in the 1850s could give rise to why the folklore surrounding the house is pushed back further in time. These dates give some credibility to possibly a house that was sitting in the same location earlier in the Civil War. The cellar underneath the house was lined with stone giving credence that the house may sit on an older foundation than a more modern brick cellar. Also, when examining the northeast sill, the notching style is different than the rest. Instead of a smooth base it has an intendent notch like it would be sitting on the rock face originally but then was replaced so that it sat on top of the other sills.

The use of red oak is unusual for structures to be lived in by humans because of the sour smell of the wood but was possible that the inside of the house had plank boards over top of the joists but most of the boards are missing today likely to be used in other projects. Old-growth forests were common in piedmont North Carolina prior to the European settlement and as the settlers moved further inland the old-growth forest acreage shrunk in size due to deforestation for agriculture expansion (Batista and William, 1997). Settlers came into the eastern NC Piedmont between 1750 and 1800 and would have slowly moved west (Swaim, 1978). During this period settlers did not want to waste resources, and by cutting down a tree they would salvage everything possible including tree limbs that were sufficiently straight to be used in the building of houses.

The appearance of knots in the joists on the front porch leads to the assumption that the house is likely built from old growth forests. The appearance of knots is seen in tree limbs and not on the trunk of a tree. From coring 10 white oak trees on the property to estimate how old the trees are, they are approaching 200 years. I cored these

specifically because of their girth and size is the largest seen on the property. They are good representations of what an old growth oak tree would look like. Even though people have been living in the area the construction of the structure shows that there were some old-growth oaks remaining. The live standing white oak trees have limbs that are ranging in diameter from 33–43 cm in diameter. This would correlate to the main house where the diameter of the sills are 28 cm and thus would be missing about 5–10 years of growth.

The lack of suitable wood to core is evident in the tobacco barn and might either be a characteristic of tobacco barns or just a problem with this tobacco barn. Even though wood decays, the results of years of tobacco curing leaves its mark on the wood. The back of the barn is where fires would be lit, and the beams are blackened from smoke fires. Despite the appearance of a solid and undamaged exterior, as the borer goes in the first part of the wood disintegrates and turns to powder. After the borer goes in further, the wood becomes solid and a good core can be pulled, but the starting half is destroyed, resulting in ambiguous cutting dates. Tobacco curing is an extensive process that requires time and open flames. The process requires smoke to circulate into the tobacco barn filled with hanging tobacco leaves to cure them. The smoke usually rests in the bottom of the tobacco barn and the lower timbers that are cored are usually rotten or the rings have been damaged. For tobacco barns the further up the side of the building the easier it is to core and get salvageable cores. The tobacco barn dating was unsuccessful in that the trees used for construction likely were a second growth young forest from the appearance of big growth rings. This caused only a few rings (i.e., 10–20 rings) to be

present in the structure at the time of coring even though the bore went all the way through to pith. Also, a tobacco barn can be constructed of different types of wood and thus trying to find a common wood to analyze and build a floating chronology for to cross-date becomes difficult and would require a large amount of sampling. This barn was primarily made of pine but also had chestnut and tulip popular. A tobacco barn was also built for hard work and with open flame had the potential to burn down, so great care in wood sourcing would not be an issue. The North Carolina State Historic Preservation Office (Graybeal, 1995) places the tobacco barn structure around 1920s and from architecture styles and usage, it would be a decent deduction to keep the structure in this building time period.

The use of adze and axe marks on both buildings shows that everything had to be hand built. With these marks there is no way that farmers were buying timbers from a saw mill because the cuts from a saw mill would be smoother. These marks show that likely all the wood was sourced locally and because you would not want to move the timbers great distances it was sourced directly off the farm.

With knowing the construction date of the main house, owners of the farm can start the process of applying for the National Historic Registry, which was noted in the 1995 survey that as a complex it would be eligible (Graybeal, 1995). Also, the construction date of the house does not support that the builder identified on the 1995 site survey (Graybeal, 1995) is unlikely to have been the actual builder for the house. John R. Painter built Jasper Williams house but would have only been a child (age 10) at the construction of the main house. It is possible that the house was built by William H.

Clayton as a larger house to raise a family who most of the kids were at marrying age or having children at this time. However, with no written documents and oral history that is not accurate the true builder is unknown. The house embodies a good representation of what a post-Civil War house would have looked like. Also, it shows the carefulness and extra steps that were taken by using old oaks and rare notching styles to make sure that the house would last for multiple generations. The folklore making the building date of the house older than it is might come from an original house in the area that could have been nearby or the exact spot where the main house is located.

2.7 Conclusion

The objective of this study was to determine a cutting date for the main house and tobacco barn on the Summers' Farm and to evaluate if the folklore and architecture matched the time period. However, the folklore surrounding the house was older than the actual house. The architecture of the house does match up with the 1880s and thus is a good representation of what post bellum life on a farm would have been like. Dendrochronological work provides the most reliable method of determining when a structure was constructed and gives credible dates for history. It is important to the story of the community and the families that are connected to the farm as it provides evidence to how their ancestors lived and worked the farm. The main house is one of the oldest standing wooden structures in Summerfield and as an agriculture complex the owners can begin the application process to place the agriculture complex on the National Register of Historic Places. Future research can include the application of more samples to build a chronology for this time period and area. Also, there are still nine standing structures

where dendroarchaeology can be applied to determine building dates. Then an actual study site for test plots could be done of either the surrounding main house or other buildings of importance to look at material culture and how the landscape has changed over the generations of the farm. A possible agriculture reconstruction could be done by examining agriculture data and comparing it to precipitation amounts inferred from ring-width variations of the oak chronology. This study helps the Summers' family understand where its farm history originated. It also helps correct the folklore so that there is an actual representation of the farm in future minds. It plays a small part in preserving the grand history of the Southeast's farming heritage.

CHAPTER III

CONCLUSION

The objective of this study was to determine a cutting date for the main house on the Summers' Farm and to evaluate if the folklore and architecture matched the time period. However, the folklore surrounding the house was older than the actual house. The architecture of the house does match up with the 1880s and thus is a good representation of what post bellum life on a farm would have been like. Dendrochronological work provides the most reliable method of determining when a structure was constructed and gives credible dates for history. It is important to the story of the community and the families that are connected to the farm as it provides evidence to how their ancestors lived and worked the farm. The main house is one of the oldest standing structures in Summerfield and as an agriculture complex the owners can begin the application process to place the agriculture complex on the National Register of Historic Places.

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APPENDIX A

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Ramona M. Bartos, Administrator

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November 7, 2018

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