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Looking for Remnants of Rice Cultivation at Manchester State Forest Through the Use of LIDAR

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Looking for Remnants of Rice Cultivation at Manchester State Forest Through the Use of
LIDAR

by

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Abstract

Recently, archaeological and historical preservation studies have looked into identifying and preserving the remnants of rice cultivation left on the modern landscape. This work resulted in guidelines for identifying and evaluating these remnants for nomination to the National Register of Historic Places. Further, these guidelines made a clear distinguish between two types of rice cultivation; tidal and inland rice cultivation. Still, this research focused on the identification and evaluation of rice cultivation remnant in areas of where the majority of rice cultivation place in South Carolina: along the Atlantic Coast. This study examines one parcel of land with possible rice remnants located in southwest portion of Sumter County, South Carolina. In order to examine these features, LIDAR data from the Digital Coast portion of the National Oceanic and Atmospheric Administration (NOAA), was utilized in Geographic Information Systems ArcMap 10.2 to create a Digital Elevation Model (DEM) in order to look at the possible remnants of rice cultivation on the parcel of land. In order to identify if the features seen on in the DEM were remnants of rice cultivation, as well as which type of rice cultivation these remnants represent, a second DEM was created from LIDAR data from the same website representing an area of known rice cultivation along the Atlantic Coast.

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Introduction

In recent years, the interest in the history of rice cultivation and industry of South Carolina has grown. This is evident in the public media and tourist efforts in the state, where there are attempts to research and interpret rice cultivation through demonstrations at historic sites. For example, at Middleton Place, the site of a former rice plantation, historic interpreters demonstrate the tools and techniques used in the irrigation controls of the fields while discussing the difficulties faced by the enslaved workforce in keeping these fields functional.

The Charleston World Heritage Coalition (CWHC) sees this renewed interest in rice cultivation in the city of Charleston's recent bid as a UNESCO World Heritage Site. While Charleston is an old city, consisting of preserved eighteenth and nineteenth century buildings, this reason alone is not enough to be added to the list of World Heritage Sites since many other cities around the world can boast the same. Thus, it is the link to the rice cultivation and the resulting wealth from this crop to the architecture and history of Charleston that makes this city unique and potentially eligible for the World Heritage Site listing.¹

¹ Brittany Lavelle Tulla, "Charleston's Bid for World Heritage Status," (Presentation at the 2016 Statewide Historic Preservation Conference, Columbia, South Carolina, April 22, 2016).

Still, the majority of the focus of the history of rice cultivation in South Carolina has been on rice production near the Atlantic Coast, known as the Lowcountry. In the Lowcountry, former rice plantations have established histories of rice production at these sites, even if the creation and mechanics of these rice fields are not yet fully understood. To date, however, there are few discussions on rice cultivation at plantations located in the Upland region of the state, such as Sumter County. While it is unknown when it was first cultivated in the region, rice production was present in Sumter County during the mid-nineteenth century. There are many entries for rice production in Sumter County found in the *United States Agricultural Censuses* from 1850 to 1860. After the Civil War, there was a marked decline of acreage devoted to rice production in the county, but the crop still grew as shown in the *Agriculture Census for Sumter County* produced by the state of South Carolina in 1870. While this census focuses only on the locations of Middleton and Statesburg in Sumter County, it shows that mainly African American farmers still grew rice, possibly as a cash crop.

By the twentieth century, rice cultivation in Sumter County had mostly disappeared from the landscape. Still, there were references to past rice cultivation in the area in works from the early twentieth century. One example is the *1907 Soil Survey for Sumter County*, which describes rice cultivation in the region as something that existed in Sumter County before the Civil War, “along the streams or in depressions,” but was produced on a small scale and consumed locally.²

² Frank Bennett, Jane L. Burgerss, and G.W. Tallby Jr., *The 1907 Soil Survey of Sumter County, South Carolina*, (United States Department of Agriculture, 1907), 302.

This thesis will focus on a parcel of land that might be a site of rice cultivation. This parcel is a part of the Manchester State Forest, located in southwestern Sumter County. Specifically, this parcel is located in an area known as the High Hills of the Santee. This name refers to a high area defined by a span of hills that follows the Wateree River and forms a border between the coastal plain and the Wateree watershed.³

This parcel of land is of interest because it contains a series of ditches seen in aerial photographs of the area. Currently, it is unknown what purpose these ditches served, but it is possible that they are physical remnants of an irrigation system used in rice cultivation, due to their location in the Wateree watershed. This location could provide a direct water source from either the branches or creeks or the Wateree River. Thus, due to this possibility of branches or creeks being used as water resources, the question becomes are these ditches the remnants of inland rice cultivation?

This parcel of land is located in an area that once consisted of several plantations in the late eighteenth century. By the mid-nineteenth century, the Belser family owned land directly east of the project area and perhaps the project area itself. There is some archival evidence that the Belser family grew rice but the exact location is unknown. Thus, due to the location of this parcel of land it is possible that it was a part of the land owned by the Belser family, and used for rice cultivation.

While there are earlier owners of land in the area of the project area that may have also grown rice, the focus of this thesis will be on the mid-nineteenth century and the

³ Bennett, Burgeress, and Tallby Jr., *The 1907 Soil Survey of Sumter County*, 299; Matthew A. Lockhart, "High Hills of the Santee," *The South Carolina Encyclopedia* (Columbia: The University of South Carolina Press, 2006), 443.

Belser ownership of the land. During this time, there were two types of rice cultivation used in the state: inland and tidal rice cultivation. Both types of rice cultivation consisted of modifications to the physical landscape, such as those possibly seen in the project area.

Even though there is evidence that some rice cultivation continued in South Carolina after the Civil War, its production was limited when compared to earlier in the century.⁴ After the Civil War, there was a reduction of the work force needed to create and maintain the rice fields. Thus, it is less likely that there were an effort placed into to physical modification to the landscape after 1860 when compared to the late eighteenth and early nineteenth centuries, when the rice production was higher.⁵ While the rice cultivation may have continued in the same fields after 1860, the focus of this paper is on locating the physical remnants of rice cultivation, prior to the Civil War.

While both inland and tidal rice cultivation involved major alterations to the physical landscape, there are differences between the two types of cultivation. These differences included different types of modifications to the physical landscape. In some cases, these different forms of modification found the physical landscape today are a clue into the form of rice cultivation used at that location.

Recent efforts combine archival research with fieldwork to identify and document the remnants of rice cultivation. In many cases, there are maps in the form of estate plats that show the locations of the rice fields and dams. These maps are often combined with modern aerial photography, Geographic Information Systems (GIS), and Light Detection

⁴ Hayden Ros Smith, *Rich Swamps and Rice Grounds: The Specialization of Inland Rice Culture in the South Carolina Lowcountry, 1670-1861*, (Ph.D. diss., University of Georgia, 2012), 8-9.

⁵ Smith, *Rich Swamps and Rice Grounds*, 8-9.

and Ranging (LIDAR) of an area, not only to determine the location of the rice fields on a modern landscape, but also to determine what features of the rice cultivation are still present, as well as, what can be preserved.

While archaeologists utilize LIDAR data and document features on the physical landscape, many of these studies have use maps or other clues from the archival data to help determine spatial locations. For the parcel found in Manchester State Forest, hereafter labeled as Project Area One, there are no historical maps that show the location of the rice fields. Thus, there are no maps to help identify where more features related to rice cultivation may be located, as well as, determine the extent of these features on the landscape. As a result, this thesis will examine if analysis from LIDAR and GIS are enough to fill in the clues about the landscape in the absence of historic spatial information. To test this question, LIDAR data from the Digital Coast website created by the National Oceanic and Atmospheric Administration (NOAA) was used with GIS to examine and determine the extent of the possible remnants of rice cultivation for the project site.

In order to compare the LIDAR results of the project area, a second project area consisting of a known rice plantation was selected. This second project area is Hampton Island located to the north of the Hampton Plantation State Historical Site and is located in the northern part of Charleston County near the Santee River. Hereafter it will be labeled Project Area Two.

For this second project area, the LIDAR data was downloaded from NOAA's Digital Coast website, the same website used for Project Area One. This allowed for an attempt of a direct comparison of the Digital Elevation Model (DEM) and hillshade

layers produced from the LIDAR data for these two sites. It also shows that the LIDAR data results for Project Area One were not false, and allows for some assurance that the data was accurate. This is important because recently, Christopher Griesback in his master's thesis described some problems with public databases for LIDAR data, including NOAA's Digital Coast.⁶ Thus, a second project area assured for the accuracy of this data, even though it is from the NOAA website.

To explore the question of the existence of rice cultivation and the possible remnants of it on land that now is a part Manchester State Forest, this study is divided into four chapters. Chapter One examines the scholarly literature on rice cultivation that has emerged over the last thirty years within the field of history. This consists of a history of rice along with recent arguments made into where the ideas behind the mechanics of rice cultivation came from the European colonist or the enslaved labor force from Africa. The second half of this chapter looks at the efforts in the preservation of the physical remnants of rice cultivation on the landscape in South Carolina. This includes a discussion on the physical remnants of rice cultivation found today on the landscape and ways to preserve them.

Chapter Two examines Project Area One, starting with an examination of the archival evidence for rice cultivation for the area. Within this examination, is an attempt to determine which type of rice cultivation existed in Project Area One based on the language used in archival evidence. The last part of this chapter discusses one piece of

⁶ Christopher Griesback, "Improving LIDAR Data Processing Techniques for Archaeology Sites Management and Analysis: A Case Study for Canaveral National Seashore Park" (master's Thesis, University of South Florida, 2015), 5.

archival evidence from the eighteenth century, and the importance of the word usage in determining if rice cultivation occurred on a landscape.

Next, Chapter Three consists of a discussion of the methodology used to examine and define the physical remnants on the landscape, with the use of GIS and LIDAR. The first part of this chapter includes a brief discussion of LIDAR and its role in locating cultural features on the physical landscape. This includes a discussion of the data and methods used in both project areas. In addition, this section looks at the modern landscapes of the both project areas in order to determine what role the landscape played in shaping what type of rice cultivation was used at the site. The second part of the chapter discusses the LIDAR results, including the comparison of the LIDAR results between the two project areas.

Finally, the last chapter offers conclusions on the possible remnants of rice cultivation in Project Area One. This chapter also discusses what still needs to be explored in regards to rice cultivation at this site. This includes outlining further work with LIDAR, GIS, as well as, archaeology testing of Project Area One.

Chapter One

A Literature Review

Interest in the history of rice cultivation in South Carolina has reemerged in the historical community over the last thirty years. This scholarship shows the interconnection of rice cultivation with slavery and challenges earlier beliefs about the introduction and subsequent development of rice to South Carolina held by earlier historians and scholars of the twentieth century.⁷ This earlier work maintained that rice was introduced to South Carolina and subsequently developed by European colonists. For example, in one story rice was brought to South Carolina in 1685 by Captain Thurber and Dr. Henry Woodward. It states that while in Charlestown, Thurber met with and gave Dr. Woodward a small quantity of rice, which he grew. Thus, the awareness and interest in the plant grew from there.⁸ In this early view of the induction and development of rice in South Carolina, enslaved Africans played only a minor role as the labor force needed to grow and harvest the crop. In the work the *Black Majority*, however, Peter Wood

⁷ Smith, *Rich Swamps and Rice Grounds*, 8-9.

⁸ Duncan Clinch Hayward, *Seed From Madagascar* (1937) by the University of North Carolina Press. Reprinted (1993) by the University of South Carolina, 4-5.

reexamined the role of the enslaved Africans in rice cultivation. In this work, Peter Wood argues that it was the enslaved Africans who brought the knowledge of rice cultivation to South Carolina.⁹ In the following years, other expanded and built upon Wood's argument.¹⁰ While these authors have shown the impact of African traditions in the rise of rice cultivation, their work will not be the focus of this paper. Instead, this thesis will look at the identification of remnants of rice cultivation through modern spatial technologies of LIDAR and GIS. While these possible remnants of rice cultivation may show evidence of African knowledge and tradition, first an examination of these features are needed

In addition to the questions about who introduced rice technology to South Carolina, there has been recent efforts to better define the differences between two of the methods of rice cultivation found in South Carolina: inland and tidal rice cultivation. Recent efforts to document and preserve the remnants of rice cultivation shows that the differences between the forms of rice cultivation are not always distinguished in scholarly literature about rice cultivation in South Carolina. Often these descriptions depicted methods associated with only tidal cultivation and not inland cultivation.¹¹

Confusion between these two forms of rice cultivation in the scholarly literature may have occurred because both cultivation methods consisted of major modifications to the physical landscape to construct fields and earthen structures to control the irrigation

⁹ Peter Wood, *The Black Majority: Negroes in Colonial South Carolina from 1670 through the Stono Rebellion* (New York: Knopf, 1974), 61.

¹⁰ Refer to Judith Carney *Black Rice: The African Origins of Rice Cultivation in the Americas* (Cambridge, Massachusetts: Harvard University Press, 2001); Daniel C. Littlefield *Rice and Slaves: Ethnicity and the Slave Trade in Colonial South Carolina* (Baton Rouge: Louisiana State University Press, 1981).

¹¹ Smith, *Rich Swamps and Rice Grounds*, 3.

for the rice plants. Further, both forms of rice cultivation occurred near the same time in South Carolina. Although tidal rice cultivation exceeded inland rice cultivation in popularity in the late eighteenth century, inland rice cultivation did not totally disappear from the South Carolina landscape. Instead both forms of cultivation were used in the nineteenth century until the after the Civil War.

The recent efforts to distinguish inland and tidal rice cultivation types resulted in the document *Rice Fields and Section 106: SHPO Guidance for Federal Agencies and Applicants*, used by the South Carolina State Historic Preservation Office (SHPO). This document serves as a guide for documenting the remnants of rice cultivation still found on the physical landscape. Further, this document serves as a guide for determining if a feature of rice cultivation is eligible for the National Register of Historic Places. At the end of this document is a checklist of requirements for eligibility for each type of cultivation.¹²

Since this thesis will try to establish that the ditch features found on the Manchester State Forest property are remnants of inland rice cultivation, two forms of rice cultivation will be defined following the guidelines set by the South Carolina SHPO. It should be noted, that there was a third form of rice cultivation, known as “providence cultivation,” in use prior to both inland and tidal rice cultivation in South Carolina. This form of rice cultivation relied on the soil moisture to irrigate the rice crop. Thus, this form of rice cultivation was dependent on natural sources of water, such as rainwater and freshets, to keep the soil damp. In addition, it relied on water runoff from higher places of

¹² Jodi Barnes and Rebekah Dobrasko, *Rice Fields and Section 106: Guidelines for Federal Agencies and Applicants* (Columbia, South Carolina: South Carolina State Historic Preservation Office, 2011) 1-2.

elevation.¹³ Due to the reliance on rainwater as the irrigation source, this form never consisted of the complex irrigation systems that required major alternations to the physical landscape. As a result, this form of rice cultivation will not be discussed in this thesis.

One of the main difference between inland and tidal rice cultivation is the water resource used to irrigate the rice fields. Inland rice cultivation relied on water sources from springs, streams, and estuaries. Also known as reservoir culture, this form of rice cultivation relied on bodies of water that could be controlled and reserved for later use.¹⁴

This form of rice cultivation was constructed in fresh water inland swamps.¹⁵ It consisted of physical modifications to the landscape such as the partial draining of the swamp and the excavation of large amounts of soil to create the rice fields and irrigation system. This irrigation system consisted of earthen features known as dams, embankments, ditches, and canals.

These earthen features can be divided into two main groups by formation and function. Both dams and facing embankments were large earthen features constructed from large amounts of soil. Both of these features served as physical barriers to the water. The dams were used to block the flow of water from the reservoirs, while facing embankments served as physical containment walls for reservoirs and the water in the

¹³ Richard Dwight Porcher Jr., and William Robert Judd, *The Market Preparation of Carolina Rice: An Illustrated History of Innovation in the Lowcountry Rice Kingdom*, (Columbia: The University of South Carolina Press, 2014), 28, 32.

¹⁴ Porcher, Jr, and Judd, *The Market Preparation of Carolina Rice*, 28.

¹⁵ Barnes and Dobrasko, *Rice Fields and Section 106*, 1-2.

fields. Ditches and canals were features formed from the removal of soil from the earth and used to transport water. The ditches are smaller in width and mainly found in rice fields used to collect water from the fields. Canals were larger and used to transport water for longer distances.

The design of inland rice fields varied due to the differences in elevation of landscapes, but there are two types of designs in the construction of inland rice fields. In the first design, the water flowed in only one direction. The starting point was from the reservoir and the ending point was the creeks, which collected the water from the fields through a drainage canal.¹⁶

In this design, a set of dams were the first element constructed in order to avoid a flood of fresh water into the swamps. These dams were constructed to stop the natural flow of the water to create a reservoir. Next, two sets of facing embankments or banks were constructed. The first set of facing embankments were constructed on opposite ends of the swamp. The purpose of the first facing embankments was to help contain the reserved water controlled by a dam, while the second facing embankment was used to contain the water in the area between the two embankments.¹⁷

The construction of the second set of facing embankments followed in a lower area of the swamp. Each facing embankment was placed on opposite, high area portions

¹⁶ Porcher, Jr., and Judd, *The Market Preparation of Carolina Rice*, 48.

¹⁷ Barnes and Dobrasko, *Rice Fields and Section 106*, 2-3; Porcher Jr., and Judd, *The Market Preparation of Carolina Rice*, 48.

of this lower area. The area between these two facing embankments became the location of the rice fields.¹⁸

Then, ditches and canals were dug to help transport and drain water to and from fields. There are two type of ditches, known as the outer and inner facing ditches. The outer facing ditches carried the water from the reservoir to the fields and formed an outer frame to fields. The inner facing ditches were smaller and carried water into and out of the fields.¹⁹ Water from the fields drained into a canal that carried it to a creek source.²⁰

In the second design for inland rice cultivation, two canals, known as flanking canals, carried water to and from the rice fields.²¹ This design consisted of a flanking canal that stretched from the reservoir, down the sides of the fields, and ending at river. Below the field, a second dam controlled water flow into a drainage canal. Trunks in the both dams allowed for the control of water flow into the flanking canals. As a result, the water flow was not just restricted to one way.²²

Unlike inland rice cultivation and its reliance on various reserved sources, tidal cultivation relied on the tidal power of water sources, where the rise and fall of the tides

¹⁸ Barnes and Dobrasko, *Rice Fields and Section 106*, 3-4; Porcher Jr., and Judd, *The Market Preparation of Carolina Rice*, 48.

¹⁹ Barnes and Dobrasko, *Rice Fields and Section 106*, 3-4; Porcher Jr., and Judd, *The Market Preparation of Carolina Rice*, 48.

²⁰ Porcher Jr., and Judd, *The Market Preparation of Carolina Rice*, 48.

²¹ Porcher Jr., and Judd, *The Market Preparation of Carolina Rice*, 50.

²² Porcher and Judd, *The Market Preparation of Carolina Rice*, 50.

controlled the rate of flood to the rice fields. As a result, the fields for this type of cultivation were constructed in tidal swamps located next to tidal rivers or streams.²³

As in the case of inland rice cultivation, tidal rice cultivation comprised of major modifications to the physical landscape. These modifications consisted of the creation of earthen features: dams, banks, ditches, and canals. The basic concept for these features are similar to those of inland rice cultivation, where the dams were used to prevent the flood of water into the fields, and the banks or earthen embankments, which formed the walls of the individual fields. The irrigations system consisted of drainage ditches, smaller ditches used to drain the fields, and the canals to carry the water from the fields.

The design and construction these fields also varied in tidal rice cultivation, due to changes in the landscape. Still, the basic design for these fields comprised of a boundary that extended from the high and low areas of the swamp and along the edge of the river.²⁴The first step of the construction of a tidal rice field was the creation of the outer margin of an outer bank. Next, a temporary ditch and embankment were excavated, with trunks placed in the temporary embankment to drain the area.²⁵

Then, the inner margin of the bank was measured and marked off. Using this marked off area as a guide the main ditch was excavated, allowing for the filling of the temporary ditch, and the formation of the permanent outer bank. Subsequently, the whole

²³ Porcher, and Judd, *The Market Preparation of Carolina Rice*, 28.

²⁴ Porcher, Jr., and Judd, *The Market Preparation of Carolina Rice*, 65.

²⁵ Porcher, Jr., and Judd, *The Market Preparation of Carolina Rice*, 66.

area was cleared of vegetation and the large bank area was subdivided into smaller fields.²⁶

Tide trucks were placed in the embankments around each of these subdivided fields to allow for flooding control for each individual field. As a result, the embankments surrounding each of the individual the fields were constructed high enough to hold back the tidal water. Thus, the embankments were higher than those found in inland rice cultivation.²⁷

Lastly, the quarter drains or ditches were dug in these fields. These quarter drains all flowed into the main ditch of the embankment.²⁸ A canal known as an access canal, was constructed from the river to the back corner field, far from the main ditch of the bank. A truck to control the flooding in the field was constructed where the embankment of the field met the end of the access canal.²⁹

Rice and Preservation

As mentioned in the section above, the interest in rice also extends to the questions of how to evaluate, document, and preserve the rice fields left on the landscape within the archaeology and preservation community of South Carolina in recent years. In 2010, efforts to create a general permit to stream line repair and maintain the wetlands of the South Carolina lowlands led to the collaboration between the United States Army

²⁶ Porcher, Jr., and Judd, *The Market Preparation of Carolina Rice*, 67-68.

²⁷ Porcher, Jr., and Judd, *The Market Preparation of Carolina Rice*, 67-68.

²⁸ Porcher, Jr. and Judd, *The Market Preparation of Carolina Rice*, 67-69.

²⁹ Porcher, Jr., and Judd, *The Market Preparation of Carolina Rice*, 69.

Corps of Engineers and the South Carolina State Historic Preservation Agency in looking at historic tidal rice cultivation fields, which were often found on wetlands, hunting and ecological preserves. One outcome of this collaboration was the need to recognize historic rice fields as working cultural landscapes. In many cases, these rice fields met the criteria of the National Register of Historic Places. As a result, it was determined that work proposed by the general permit would need to address adverse effects on these rice fields, and, the historic resources connected to them.³⁰

In 2010, Andrew Agha, Charles F. Phillips, and Joshua Fletcher of Brockington and Associates, Inc. examined inland rice swamps at historical and archaeological sites in Berkeley, Charleston, and Dorchester County. This work resulted in the *Inland Swamp Rice Context c. 1690-1883* in which addressed the important of continual archaeology excavation to understand how these irrigated fields were constructed and the need to document inland cultivation rice fields, in which are harder to find on the landscape in comparison to tidal cultivation fields.³¹ In addition, this context created criteria for identifying inland rice fields for nomination to the National Register of Historic Places.³²

In 2011, the South Carolina SHPO produced *Rice Fields and Section 106: SHPO Guidelines for Federal Agencies and Applicants*, which built upon the *Inland Swamp Rice Context* and the collaboration efforts with the US Army Corps of Engineers to

³⁰ Jodi A. Barnes and Rebekah Dobrasko, "South Carolina's Tidal Rice Fields: Consultation, Collaboration, and Cultural Landscapes," *The International Journal of Cultural Property* 21, 4 (November 2014): 430-433.

³¹ Andrew Agha, Charles Philips, and Joshua Fletcher, *Inland Swamp Rice Context, c1690-1783*, (South Carolina Department of Archives and History, 2011).

³² Agha, Phillips, and Fletcher, *Inland Swamp Rice Context, c 1690-1783*, Section E, 3.

recognize and preserve tidal rice fields. This work provides an overview of the history of rice cultivation in South Carolina, outlines the three types of rice cultivation, and, provides descriptions of the different physical features associated with rice cultivation. Using these descriptions, historic preservations and archaeologists can determine what physical remnants of rice cultivation, if any, are present at their site. This document ends with checklist of criteria for determining if the rice field feature is eligible for the National Register of Historic Places and provides separate criteria for tidal rice cultivation and inland rice cultivation. Thus, this document makes a clear distinction between the two types of rice cultivations remnants that the author of the NRHP nomination needs to know and understand.³³

In conclusion, the understanding of rice cultivation has grown in recent years from work done in both the archaeological and historical communities. The next chapter will focus on the examination of evidence for rice cultivation at Project Area One. This project area is located in a region not viewed as a rice-producing county when discussed within the larger history of rice cultivation in South Carolina. By looking at the specific archival evidence for rice cultivation possibly tied to the land that is now Manchester State Forest, the thesis adds to this scholarship on rice cultivation in South Carolina.

³³ Barnes and Dobrasko, *Rice Fields and Section 106*, 10.

Chapter Two

The History of Project Area One and the Evidence for Rice

There is some archival evidence for rice cultivation on or near the project area, though limited. Further, this archival material consists of no spatial clues into the exact location of the rice fields on the land. As a result, there is no direct tie from the archival evidence to the project area. Still, this evidence indicates rice cultivation in the area in the mid-nineteenth century, during the Belser family ownership. During this time, tidal rice cultivation was the popular and preferred method of rice cultivation, though inland rice cultivation still existed in South Carolina.³⁴

Jacob Belser was a lawyer, planter, and later politician who, before moving to Sumter County owned a house in Charleston known as the Presqu'ile Property.³⁵ His name appears on plats for property in the St. James Goose Creek area. In 1814, his name appears on a survey plat in Sumter County for "300 acres of land on Beech Creek and the Wateree Swamp."³⁶

It is during the Belser's ownership of land that local newspapers and genealogy

³⁴ Joyce E. Chapin, *An Anxious Pursuit: Agriculture Innovation and Modernity on the Lower South 1730-1815* (Chapel Hill: University of North Carolina Press, 1993), 243.

³⁵ *Presqu'ile, Charleston, Charleston County, South Carolina*, Nomination to the National Register of Historic Places, 10 October 1987, Section 8.

³⁶ "Jacob Belser Plat for 300 acres on Beech Creek and Wateree Swamp," *Sumter County Book of Plats*, Volume 43, page 560. South Carolina Department of Archives and History. Microfilm.

sources have attributed to cultivating rice on the property.³⁷ These sources also attribute his lands, around 3,000 acres, to most of the land that makes up the current Poinsett State Park. This land was purchased from Christopher Williman, who received it from the Singleton family.³⁸

The existence of a mill on or near the Belser property is one piece of evidence of rice cultivation during his ownership. By the 1820s, Jacob Belser lived in the area and his name is listed on this property on the Robert Mills *Map of South Carolina* and the S.H. Boykin *Map of Sumter District* both completed in the 1820s. Both maps show the name Belser on land above Shank's Creek along with the names of Dow, Cain, and Richardson, his nearest neighbors to the south of Shank's Creek.³⁹ On both the Mills and Boykins maps, a mill is indicated on Shank's Creek, though there is no indication that it was used for rice on either maps. Though the mill is not directly linked to Belser on these maps, there is a clue that Belser did own a mill on plat from 1829 showing a portion of Belser's land. On this plat, Shank's Creek is labeled as "Jacob Belser's mill stream called Shank's Creek."⁴⁰

³⁷ Gordon Belser, J., Edwin Belser, and Irvine Furman Belser, *The Belser Family of South Carolina* Place of Publication not identified: 1941, 20.

³⁸ Stephen W. Skelton, "Poinsett State Park: National Register Nomination Preliminary Research," (unpublished history paper, June 26, 1989), "Pre-Park History Folder," *Poinsett State Park Files*. South Carolina State Parks Office.

³⁹ Robert Mills, "Sumter County," *The Atlas of South Carolina 1825* (Philadelphia: H.S. Tanner and Assistants, 1826), South Carolina Department of Archives and History; S. H. Boykin, *Map of Sumter District, 1821: Improved for Mills Atlas, 1826*, (Philadelphia: Tanner and Associates, 1826), South Carolina Department of Archives and History: Box S35, Folder N14.; Note that on the Robert Mill's *Map of Sumter County*, the name Belser appears as Belseer.

⁴⁰ "Jacob Belser to William Cain," *Sumter County Record of Mesne Conveyance* Book H, page 99. South Carolina Department of Archives, Microfilm.

During the planning of Poinsett State Park, research into the mill ruin dated it to late eighteenth century. Different landowner names' are associated with this mill.⁴¹ While this mill might have existed before the Belser ownership, there is evidence that he was making efforts to repair a mill. In the final inventory of Jacob Belser's property, prepared after his death, there are entries related to the payment for work on a mill. Specifically, this entry states a payment to M. Plummon for work on the rice mill.

While both forms of rice cultivation relied on mills to process the rice, tidal rice cultivation resulted in new attempts at creating better mills. This form of rice cultivation allowed for greater production of rice without the worry of loss of crop due to salt water and flooding connected to inland rice production. As a result, rice milling became even more important, resulting in new attempts to create better mills for more efficient rice processing.⁴²

In this inventory, there are two other mentions of rice. These occur in the statement of business for the 1833: one for payment for teaching rice methods and one for bushels of rice. Thus, this could be an indicator of tidal rice cultivation, due to the focus on the repairs to the rice mill and the teaching of rice methods.

A second piece of evidence for rice cultivation is from a newspaper advertisement for the sale of 3500 acres of land and property by Belser. While there is no mention of a dam, or other physical modifications to the land that is associated with rice cultivation found within this description, it does indicate that a stream flows through the land. Within

⁴¹ Skelton, "Poinsett State Park: National Register Nomination Preliminary Research," 9

⁴² Joyce E. Chaplin, *An Anxious Pursuit*, 254.

this brief mention of this stream, a reference is made to this land being used for rice cultivation: “Through the land flows a perpetual stream, sufficient for machinery of any kind, also to inundate the swamp should it be converted into a rice plantation, which make it not inferior to tide swamp”.⁴³ In this description, the stream is seen as having the potential to serve as an irrigation force for the rice fields and to power machinery such as those used in rice mills. This advertisement also implies that the land could be used for rice cultivation: “the whole might be easily reclaimed to a planter of force, 500 bags of cotton or 1000 barrels of rice might be annually”.⁴⁴ Thus, the land has the potential for growing rice through adequate attempts to *reclaim* the land.

While this description shows the potential for growing rice through improvements to the land, it can also indicate past attempts to grow rice at this site. In the description the land needs to be *reclaimed* which can indicate an attempt to reclaim the land from nature, thus improving, land such as swampland that was otherwise seen as useless to nineteenth century farmers. This use of the word *reclaim* in this description can also mean that the rice fields are overgrown with weeds through neglected and work needs to be done to reclaim it back from nature.

Both the listing of the figures of potential yields of crops and stream on the land seem to further indicate both the potential for the land and that rice was once grown on the land. The figures for the crops could be just estimates intended to attract the potential buyer, but these figures could also be based on results from past yields. The stated potential of the stream to power machinery and to flood rice fields can also be just an

⁴³ “Land and Negros for Sale,” *City Gazette*, 17 October 1820.

⁴⁴ “Land and Negros for Sale,” *City Gazette*, 17 October 1820.

attempt to show the value of the property to the potential buyer, but it also can be based off the fact that already the stream has powered machinery and irrigated the rice fields.

While this advertisement might indicate past attempts at rice cultivation, as well as, the continual potential of rice cultivation on the land, there are two main problems in trying to tie this newspaper article to rice production in Project Area One. First, it is unknown if this is Jacob Belser's land or land he is selling on the behalf of someone else. In this article, two other properties are listed and Jacob Belser's name appears at the bottom it. Perhaps, this was an attempt by Jacob Belser's family to sell the land after his death, but there is no land sale record attributed to Jacob Belser or his family for 3500 acres of land. In 1829, however, Jacob Belser bought land from three of his neighbors totaling around 3650 acres. He also sells land including 828.25 acres to J. S. Richardson and 59 acres to William Cain.⁴⁵ After his death, his family sell land but not 3650 acres of land. In addition, they also buy land at this time.

Second, due to lack of specific spatial description, it is not known if this ad specifically refers to land of Project Area One. Still, the land described in the advertisement states that the property is located near the town of Manchester, in the High Hills of the Santee, consisting of 800 acres of the land that is a part of the Wateree watershed, and has a stream that flows through the land. The project area is located to the southwest of the town of Manchester, is in located in Wateree watershed, and Shank's

⁴⁵ Note that there might be a clue into rice cultivation with this large purchase in land by the Jacob Belser, especially with the land from John S. Richardson. This land consists of swampland at the edge of river. This land piece of land was a part of the land granted to Ann Bodily in the late 1700s. While there is no mention of rice in this land transaction or accompanying plat, it does show that Jacob Belser was interested in gaining more land near the swamp and near the edge of a river, possibly indicating tidal rice cultivation.

Creek drains into the Wateree watershed to just to the south of the project area. Thus, it is possible that the land advertisement was for land included in the project area, but the Belser family had trouble selling the total numbers of acres listed in the advertisement.

The last piece of evidence for rice cultivation during the Belser family ownership is for Martha Belser's listing in the 1850s agriculture census. This listing some have attributed to the Belser family, and by default their land, with being successful at rice production due the amount listed under rice. Others have stated this entry as being 182,000 pounds and thus the highest of this area.⁴⁶

This rice entry for Martha Belser, however, is problematic due to the lack of spatial data. In this census, no addresses were listed for each entry. By the 1860 Agriculture Census the closest post office is listed at the top of the page, but this is not the case for the 1850 census. Thus, while it can be assumed that this is the same land owned by the Belser family, the actual location for Martha Belser at this time is unknown. In his will, Jacob Belser leaves his property to his wife and on an 1850 map of South Carolina entitled *A Map of South Carolina*, a L. Belser is shown living near Shank's Creek, so there is a possibility that Martha Belser was still living on the Belser property.⁴⁷

By the 1860s, according to Belser family genealogy, Martha Belser moves to Alabama to live with her younger son and it seems that at least some of the property was sold to the Richardson family, though the exact amount is still being researched. As

⁴⁶ "Rice Reference Folder" Poinsett State Park Files.

⁴⁷ *A Map of South Carolina, 1850* South Carolina Department of Archives and History, Reference Room.

mentioned above, after Jacob Belser's death in 1833, his family continued to buy and sell land. In 1837 his wife Martha Belser purchases 33.7 acres of land from J. S. Richardson. Around the same time, Martha along with her sons sells 22.4 acres to J. S. Richardson.⁴⁸ By the 1870s J.S. Richardson had sold the property to Manning and on the H.M. McLaurin *Map of South Carolina* from the 1878 shows the Manning name in this general area including appearing in the Wateree Floodplain area of the property.⁴⁹

While the three pieces of evidence for rice cultivation associated with the Belser family makes a case for the possibility of rice cultivation at Project Area One, there is still the question of what type of rice cultivation was used: inland or tidal rice cultivation. At the time of the Belser ownership, tidal rice cultivation was the preferred choice of rice cultivation in the state. There are limited indicators for tidal cultivation found in the description of the land and stream from the 1850s land sale advertisement.

The Eighteenth Century

Project Area One was a part of the large area known as Craven County in the late eighteenth century. Many survey plats and land memorials from this time that mentions both Craven County and the bodies of water such as Shank's Creek, Beech Creek or the Wateree River, which flow though or are near the present day Manchester State Forest and Poinsett State Park.⁵⁰ John Dargan is one of the earlier owners in the area with a

⁴⁸ Note that land purchased by Jacob Belser from J. S. Richardson was for 15 to 20 acres. In calculating the total acres of land for the Belser family, I used 15 acres when calculating this property holding. From these calculations, by the late 1830's the Belser's land holdings was around 2000 acres.

⁴⁹ H.M. McLaurin, *Map of Sumter County 1878, South Carolina: Compiled from Railroad and Private Roads*. South Carolina Department of Archives and History, Box 13, Folder 17.

⁵⁰ Over time, much of this property was bought and consolidated into larger land holdings. Some of the names of the early purchases of land in this area are those listed in the accepted chain of title of John

purchase of land through a memorial in 1760 for land originally purchased for John Steel in 1752. This land memorial is for 300 acres on Beech Creek, a creek that is near Manchester State Park. In 1762, John Dargan purchased 200 acres of more land to the south of Beech Creek in an area located along Shank's Creek, a creek that is located to the south of Manchester State Park in what is now Poinsett State Park.⁵¹ In this description of this second memorial, the area is referred to as the "marsh of Shank' Creek known as Williams Old Field near the high hills area of the Santee."⁵²

There is a piece of evidence for rice cultivation during the Dargan ownership, which might indicate inland rice cultivation in the late eighteenth century, in the general area near the project area.⁵³ This piece of evidence is a newspaper advertisement from 1767, which lists land owned by John Dargan that is to be sold due to his death. One of the tracks of the land owned by John Dargan is described as of consisting of 200 acres of land, located within Craven County on Shank's Creek. Of the 200 acres, 150 acres is

Dargan to Matthew Singleton to Christopher Williman to Jacob Belser to J. S. Richardson to Manning. Note that there were owners of the land after Manning but the focus of this paper will only look at the owners from the eighteenth to late eighteenth century; "Pre-Park History Folder," *Poinsett State Park Files*. South Carolina State Parks Office.

⁵¹ Refer to "Memorial for John Dargan, 300 acres on Beech Creek in Craven County" *Colonial Memorials* Volume 7, page 312. South Carolina Department of Archives and History, Microfilm.

⁵² "Memorial for John Dargan, 200 acers near the High Hills of Santee in Craven County" *Colonial Memorials* Volume 6, page 16, South Carolina Department of Archives and History, Microfilm; It is also believed that John Dargan's brother Timothy Dargan, owned land near Williams Old Field and Shank's Creek. A land plat from 1761 names Timothy Dargan as the owner of 200 acres of "land near Shank's Creek known as Williams Old Field...", but also shows John Dargan's name next to the certification of the land in 1762. Refer to "Plat for Timothy Dargan, 200 acres in Craven County" *Colonial Plat Book* Volume 7, page 276. South Carolina Department of Archives and History, Microfilm.

⁵³ The possibility that this land described in John Dargan is land that later Jacob Belser owned. Thus, the point of this evidence is to show that inland rice was grown near project area one. John Dargan acquired a few pieces of land in the general area of the project area so it is hard to connect rice cultivation to a specific plat.

identified as swampland described as “rich dry swamp with a creek running through it, by which the land may easily be slowed; ten acres of the swamp is under dams.”⁵⁴

While there is no statement about rice cultivation in this land advertisement, the mention of the word *dams* indicates physical alterations made to the land and water sources during Dargan’s ownership, possibly for irrigation for crops, such as rice. From the twentieth century there are two references made specifically to dams on Dargan’s land by two historians in South Carolina. In her chapter on early settlement in Sumter County, Anne King Gregorie states that John Dargan made improvements on his land such as the construction of a gristmill and dams in his swamp, possibly for the cultivation of rice, plus two sets of indigo vats.⁵⁵ Unfortunately, there was no reference to the source of this information, though it is possible that she was referring to this newspaper advertisement.

In the 1940’s, Robert Meriwether, a historian and professor at the University of South Carolina, attributed the language used in this newspaper advertisement to that of rice cultivation, even though the word *rice* did not appear in the description. Simply he states that from this description, the land “was well equipped for the culture of rice, for it was described as good swamp overflowed, ten acres under dams.”⁵⁶ Unfortunately, he

⁵⁴ “To be Sold at Plantation where the Late Captain John Dargan Lived,” *The South Carolina Gazette and Country Journal*, 3 March 1767, online via Accessible Archives <www.accessible.com> (5 May 2016).

⁵⁵ Anne King Gregorie, *The History of Sumter County*, (Sumter, South Carolina: Library Board of Sumter County, 1974), 13.

⁵⁶ Robert Meriwether, *The Expansion of South Carolina, 1729-1765*, (Kingsport, Tennessee: Southern Publishers, Inc., 1940), 109.

does not elaborate on this fact. Instead, he moves on to talk about another early European settler of this area, Richard Richardson.

Recently, it has been argued that the language used in rice cultivation is important to understand because it often reflects the time it was used.⁵⁷ Thus, Meriwether was right that the term *dams* is connected to rice cultivation, for they were an important mechanism that served to prevent an overflow of water. Through it continued to be an important part of rice cultivation, the term *dam* was often reflects colonial era rice cultivation terminology, specifically inland rice cultivation.⁵⁸ Therefore, there is the possibility that Dargan was cultivating inland rice.

At the time of John Dargan's ownership of this property in the mid-eighteenth century, inland rice cultivation was the popular method of rice production used in South Carolina. During the mid-eighteenth century, however, another rice cultivation method, tidal rice cultivation did exist in South Carolina, though this form of rice cultivation would emerge in popularity in the years following the American Revolution. While this method did not gain popularity until the end of the eighteenth century, it was a known method at the time of Dargan's ownership of the property. Due to the overlap of these two rice production methods, the physical components of tidal rice cultivation needs to be also considered when looking at this land advertisement.

⁵⁷ Agha, Phillips, and Fletcher, *Inland Swamp Rice Context, c 1690-1783*, Section E, 8.; Barnes and Dobrasko, *Rice Fields and Section 106*, 2-3.

⁵⁸ Agha, Phillips, and Fletcher, *Inland Swamp Rice Context, c 1690-1783*, 3.

From Meriwether's work it is known that the wording in the description of the "ten acres of swamp under dams" from the newspaper article for the sale of Dargan's land, indicates that there were 10 acres of land in a swamp with a series of dams. In looking at other words used in this land advertisement, the swamp is also described as being "rich dry swamp with a creek running through it by which the land may be easily flowed" which might refer to the swamp being drained, mostly likely because of the dams. Lastly, the creek that can be used to "easily flowed" might refer to a creek that can flood the land.⁵⁹

In considering both forms of rice cultivation, however, it is not easy to determine from the description which method was utilized on Dargan's land. Both inland and tidal rice cultivation used physical barriers or dams to keep water from overflowing the area. Further, both forms of rice cultivation relied on water sources that could flood an area of land.

Still the usage of the word *creek* in the land track description may refer to inland rice cultivation rather than tidal rice cultivation. As mentioned in chapter one, inland rice cultivation relied on reserved fresh water sources, including creeks for irrigation to the rice plant. Tidal rice cultivation usually relied on tidal rivers or streams. While tidal creeks did exist, the word *tidal* was not in the description. In addition, there seems to be a clear distinction between rivers and creeks in this land advertisement. In two other land track descriptions, swamps are described as "rich river swamp."

⁵⁹ Meriwether, *The Expansion of South Carolina, 1729-1765*, 109; "To be Sold at Plantation where the Late Captain John Dargan Lived," *The South Carolina Gazette and Country Journal*, 3 March 1767.

Another possibility raised by this newspaper advertisement for Dargan's land is for indigo cultivation in Project Area One. In a description for a different land track in Craven County, there is a "rich dry swamp for indigo or hemp."⁶⁰ During the eighteenth century, indigo was a popular crop in South Carolina and remained so until the American Revolution. In addition, rice and indigo often grew on the same plantation.

Unlike in studies for rice cultivation in South Carolina, the amount of water needed in growth of the indigo plant in the eighteenth century is unknown. From descriptions of indigo cultivation in Florida, the growth of the indigo plant did not depend on a flooded field to grow. Instead, these plants were planted in tilled fields and relied on the sun along with rainwater for growth.⁶¹

After harvested, the indigo plant would set in vats of water in order to draw out and process the dye from the plant. Water was essential for this step and required enough water to submerge the plants. In descriptions of indigo cultivation at the Governor James Grant's Villa Plantation in Florida, a large amount of fresh water was collected for the vats. Due to this large volume of water, the vats at this plantation were located near the water source. Initially the water source for the vats was from surface pools but later it included water from rain and runoff that accumulated in the drainage canals. Cisterns were used to carry the water from the drainage canals to the vats.⁶²

⁶⁰ "To be Sold at Plantation where the Late Captain John Dargan Lived," *The South Carolina Gazette and Country Journal*, 3 March 1767, online via Accessible Archives <www.accessible.com> (5 May 2016).

⁶¹ "Indigo Cultivation: Life at Governor James Grant's Villa Planation," *Florida History Online*, <https://www.unf.edu/floridahistoryonline/Plantations/plantations/Indigo_Cultivation_and_Processing.htm> (27 October 2016).

⁶² "Indigo Cultivation: Life at Governor James Grant's Villa Planation," *Florida History Online*.

Although water was required in the processing of indigo, the exact amount needed is unknown. Based on the size of the vats found in description a rough estimation of volume of water can be made. The size of the vats varied, but usually were constructed in a group of two or more vats. At the Villa Plantation in Florida, the tallest vat of a group measured at eighteen square feet by two feet, while the second vat measured fifteen square feet by two feet.⁶³ At Otranto Plantation in South Carolina, the remnants of the three indigo vats each measure at fourteen square feet and comprise of brick and stucco.⁶⁴

The extent of changes to the physical landscape, if any, for the collection of water for the vats is unknown. To date there has been no comprehensive study on the changes to the physical landscape caused by the indigo cultivation.⁶⁵ Due to modern development, the three indigo vats from Otranto Plantation moved from their original location.⁶⁶ Thus, there can be no direct comparison of the remnants of water system for vats at Otranto Plantation to the landscape features found in Project Area One. Further, these three vats from Otranto Plantation are the only known standing indigo structure in South Carolina.⁶⁷ Thus, how the remnants from indigo cultivation compare to the

⁶³ “Indigo Cultivation: Life at Governor James Grant’s Villa Planation,” *Florida History Online*.

⁶⁴ *Otranto Plantation Indigo Vats, Goose Creek, Berkeley County, South Carolina*, Nomination to the National Register of Historic Places, 8 November, 1988, 2.

⁶⁵ Hayden R. Smith, email message to Sarah Moore, June 22, 2016.

⁶⁶ *Otranto Plantation Indigo Vats, Goose Creek, Berkeley County, South Carolina*, Nomination to the National Register of Historic Places, 2- 4.

⁶⁷ *Otranto Plantation Indigo Vats, Goose Creek, Berkeley County, South Carolina*, Nomination to the National Register of Historic Places, 3.

remnants of inland and tidal rice cultivation on the physical landscape is also undetermined.

The chance of indigo cultivation on Dargan's land, however, does not rule out the presence or attempts of rice cultivation on the same land. There is some evidence that both indigo and rice grew on the same plantations, since indigo could grow on land of higher elevations than rice. Although, the land descriptions in the land advertisement defines the indigo being located in the swamps, the growth season for each plant was different enough to avoid a shortage of labor attending the cultivation of either plant.⁶⁸ As a result, it is possible that both crops grew in the same area.

Rock Spring, located in the Lowcountry of South Carolina, might be an example of a plantation where both rice and indigo were grown. This plantation is a part of larger estate owned by James Stobo, a known indigo and rice planter in South Carolina in the early-to mid-eighteenth century. At Rock Springs, indigo might have once grown on a knoll located above a lowland swamp. Located not far away from this area, are features relating to inland rice cultivation: facing ditches, dams, and embankment.⁶⁹

While no remnants of the rice fields were discovered, these fields are believed to be located in the swamp located below the knoll. One area of this swamp in particular contains the remnants of a plantation causeway and facing ditches, making it a possible candidate for the rice fields. Due to the close proximity of the remnants of rice cultivation to the possible location of indigo cultivation, there is a possibility of a tie between the

⁶⁸ Chaplin, *An Anxious Pursuit*, 193

⁶⁹ Agha, Phillips, and Fletcher, *Inland Swamp Rice Context, c. 1690-1783*, Section E, Pages 24-25.

drainage for rice and indigo cultivation. Specifically, “between the draining of high ground for indigo growing, and how those drains could have fed inland fields with much needed fresh water.”⁷⁰

In conclusion, there is some evidence for rice cultivation in Project Area One. It is possible that inland rice fields existed before the time of Belser’s ownership. Under the Belser ownership, these rice fields were updated following the tidal rice cultivation example. It is also possible that Belser created the rice fields, using the influence of tidal rice cultivation to create the irrigation systems and update the mill. Without more archival evidence it is unknown if either possibility will be reflected on the landscape.

As a result, what is still needed, is a define image of the landscape to look for possible remnants of rice cultivation. In addition, a direct tie from the archival evidence to a specific location in this project area is also needed. Thus, in order to tie the archival evidence to land, more spatial data is needed perhaps through modern spatial technologies, such as LIDAR.

⁷⁰ Agha, Phillips, and Fletcher, *Inland Swamp Rice Context, c. 1690-1783*, Section E, Page 25.

Chapter Three

Methods and Results

Recently, on a piece of land in Manchester State Forest a series of ditches were observed. Due to the way these ditches seem to interconnect, these ditches might be the remnants of rice cultivation. As seen in chapter two, there is some archival evidence for rice cultivation in this part of Sumter County, though no direct spatial connection can be made to Project Area One. With modern technologies such as Light Detection and Ranging or LIDAR and Geographic Information Systems (GIS), it is hope that the question of if these ditches are remnants of rice cultivation can be answered.

LIDAR

LIDAR is a type of remote sensing method that uses light in the form of a laser to measure distances to the earth.⁷¹ There are two main types of LIDAR: Terrestrial and Airborne Laser Scanning. The main difference between the two is that Terrestrial Laser Scanning (TLS) is collected on the surface usually from a total station, while Airborne Laser Scanning (ALS) is collected through a device on an airplane or drone. For this chapter, however, the focus will be on LIDAR data collected from Airborne Laser Scanning.

⁷¹ “What is LIDAR,” *National Oceanic and Atmospheric Administration*. <<http://oceanservice.noaa.gov/facts/lidar.html>> (28 June 2016).

This technology consists of light pulses of infrared light launched towards the ground and reflected back to the source. Data points are compiled from this return pulse and depending on the data, it can be used in GIS for further analysis. This return pulse, however, may not have reached the actual ground surface. Instead, it may have been reflected by the vegetation first. Thus, data that represents vegetation needs to be separated from data that represents the ground surface, in a process known as data point classification. This step is important when considering that LIDAR data has the potential to locate and define different structures and features on the physical landscape, often using Digital Elevation Models, which are based on ground surface classification LIDAR in GIS.⁷²

First, however, the raw data collected is classified. Data point classification uses algorithms to divide and group LIDAR points. LIDAR data points that do not fit into these desired groups established by the algorithm are removed. Thus, the user must understand the parameters of the project, in that the algorithm used must address the desired results, by stating which points are wanted and which ones that are not.⁷³

Recent work in archaeology has utilized the usage of LIDAR to help identify cultural features hidden on the landscape. To date, there are many archaeological based studies worldwide utilizing LIDAR into their examination of landscapes. One of the first studies using LIDAR to look at cultural remnants on the landscape was a study conducted

⁷² Christopher Griesbach, "Improving LIDAR Data Processing Techniques for Archaeology Sites Management and Analysis: A Case Study from Canaveral National Seashore Park" (master's thesis, University of South Florida, 2015), 13-14.

⁷³ Griesbach, "Improving LIDAR Data Processing Techniques for Archaeology Sites Management and Analysis," 13-14.

by P. Crow, S. Benham, and G.S. Amable. In this study, LIDAR helped to locate cultural resources during an archaeological reconnaissance survey in the thick forests of England. This study explored the effects of vegetation in producing false LIDAR results, since the different vegetation could block the LIDAR signals from the ground surface itself. Still, the conclusion of this study showed that, even without calculations made to filter out certain vegetation cover from the data, LIDAR was able to make out certain archaeological features on the landscape, especially when compared to other forms of data and maps.⁷⁴

In the United States, archaeological studies have also utilized LIDAR for locating archaeological or cultural remnants on the physical landscape, especially during an archaeology reconnaissance survey where time is a factor. A study by Katharine M. Johnson and William B. Ouimet used LIDAR to help locate the remnants from the nineteenth century New England agriculture landscape. The LIDAR data was compared with survey fieldwork including the mapping and measuring of the physical landscape features to assess the results from the LIDAR data in looking at three project sites. The result of this study indicated the potential for LIDAR in archaeology surveys especially when combined with historical documents and maps.⁷⁵

⁷⁴ P. Crow, S. Benham, and G.S. Amable, "Woodland Vegetation and Its Implications for Archaeology Survey using LIDAR" *Forestry* 80, no.3 (2007): 251,<
<http://forestry.oxfordjournals.org/content/80/3/214.full.pdf>> (accessed 1 July 2016).

⁷⁵ K. M. Johnson and W. B. Ouimet, "Rediscovering the Lost Archaeological Landscape of Southern New England using Airborne Light Detection and Ranging (LIDAR)," *Journal of Archaeology Science* 43 (March 2014): <<http://www.sciencedirect.com/science/article/pii/S03054403130043442>> (accessed 10 July 2016).

In the last few years, many archaeology master's theses that have utilized LIDAR in looking at different sites and landscapes in the United States. In 2010, Rebecca C. O'Sullivan used LIDAR to study the past landscape, including structures at Bulow Plantation in Florida. Due to limited historical documentation that described the structures, the LIDAR based DEM combined with data from the pedestrian survey and Global Positioning Systems (GPS) revealed several features related to the plantation landscape.⁷⁶

In 2015, Christopher Griesbach used LIDAR to look at the efforts of documenting and preserving the prehistoric sites at Canaveral National Seashore Park in New Smyrna, Florida. The focus of Griesbach's work was to show the limitations and problems caused by the LIDAR data processing procedures and the effects that they can have on preserving these sites. This thesis is of interest to this work because Griesbach used the LIDAR data from the Digital Coast database from the NOAA website, which is the same database used for this study.

Within the last few years, archaeological research has also utilized LIDAR to look at sites of former rice plantations in South Carolina and Georgia. At two sites of former inland rice plantations of Jasper County, South Carolina, LIDAR data was used to examine the landscape and aid in the archaeological work being conducted there by the Anthropology students from Georgia Southern University.⁷⁷ This includes a thesis written

⁷⁶ Rebecca C. O'Sullivan, "Out of the Land of Forgetfulness: Archaeological Investigations at Bulow Plantation Flagler County, Florida" (master's thesis, University of South Florida, 2011), 97.

⁷⁷ Refer to the *Heart of Home: Archaeology at Mount Repose. The archaeology of an 18th century kitchen plantation*, a tumbler blog post about current archaeology excavations at this site. Two posts dated May 19 and May 27 2015 briefly mention the use of LIDAR. To date, only Weitman's thesis is the only scholarly publication found that uses LIDAR on the site.

by Sarah L. Weitman where terrestrial LIDAR was contrasted with other methods to test the potential use of LIDAR to document a cemetery on the property.⁷⁸ The scope of these studies, however, have not included the search for the remnants of rice cultivation at these sites.

In contrast, a project looking at the possibility of rice fields on what is now the Wormsloe Institute for Environmental History, used LIDAR data. Similar to the current question examined in this thesis, the lands of the Wormsloe Institute is believed to have once consisted of inland rice fields. On the Isle of Hope in Georgia, a form of ground-based LIDAR known as Terrestrial Laser Scanning (TLS) was used along with other geospatial technologies and historical research to look for rice fields on lands that now make up the Wormsloe Institute for Environmental History. Before the TLS work conducted by Alessandro Pasqua of the University of Georgia in 2013, the archival evidence for inland rice cultivation consisted of small mentions of rice from agricultural censuses, inventories, and letters. There are also physical clues from the modern landscape such as the presence of drainage ditches, dikes, and poorly drained areas, needed for inland rice cultivation. In combination with other methods, such as field surveys and soil studies, a LIDAR elevation map was completed in November 15, 2013 illustrating three possible areas on the property where rice cultivation may have occurred.

⁷⁹ The current website for the Center of Geospatial Research at the University of Georgia

⁷⁸ Sarah L. Weitman, "Using Archaeology Methods in Cemetery Surveys with Emphasis on the Application of LiDAR" (master's thesis, Georgia Southern University, 2012), 15-16.

⁷⁹ Alessandro Pasqua, *Use of Terrestrial Laser Scanning (TLS) and Unmanned Aerial Vehicles(UVA) to Investigate Rice Cultivation on the Isle of Hope, Georgia* (End of Year Report). January 2014 Report prepared for the Wormsloe Institute, pages 1-2; 5, <http://crew.uga.edu/reports/Jan2014/>.

lists this project with an interactive GIS map showing where the irrigation ditches are located based on the LIDAR data.

Project Area One

Manchester State Forest is located in the southwestern portion of Sumter County and extends into Clarendon County, with a total of nearly 28,675 acres.⁸⁰ For the purpose of this paper, the focus will only be on one portion of Manchester State Forest land, and will be referred to as Project Area One. This project area is located entirely in Sumter County, bounded by Poinsett State Park to the southeast and the Wateree watershed to the west.

Before the establishment of the Manchester State Forest and Poinsett State Park in the twentieth century, this area was a part of an active plantation, with possible ownership beginning in the mid- eighteenth century and lasting until the late nineteenth century. During this time, there were a range of owners of the land, each of whom reestablished the boundary of their land through purchases of more land and sales of other portions.

As mentioned earlier in the chapter, possible irrigation ditches found in Project Area One, land just outside the boundary of Poinsett State Park might be physical remnants of rice cultivation. This area is a lowland wetland area, of the Wateree watershed. There is, however, no archival evidence found that directly indicates rice cultivation to this piece of land. (Refer to Figure 3.1).

⁸⁰ “Manchester State Forest,” *South Carolina Forestry Commission*, accessed September 5, 2016, <<https://www.state.sc.us/forest/refman.htm>>

Aerial photographs have played an important role in the recent efforts to study, as well as to preserve, rice cultivation on the modern landscape. In some cases, a collection of squares along major river systems in the aerial images indicated the remnants of rice features.⁸¹ In other cases, the thick growth of trees obscured these features.

During a 2004 survey of the Francis Marion National Forest by Brockington and Associates, it was observed that aerial images could still be used to locate hidden remnants of rice fields. When comparing the historic plats of the area that showed the rice fields, researchers with Brockington and Associates were able to recognize a series of organized lines in the aerial images. The recognition of these organized lines, also known as “window pane pattering,” is important because it narrows down the possible location of the remnants of rice cultivation in an area overgrown with trees. In order to better define what was left of the rice fields, researchers used GIS to overlay the historic plat of the rice field over the aerial images.⁸²

Although there are no plats that indicate where the rice fields for Project Area One were located, Al Hester of South Carolina State Parks examined recent aerial images of Manchester State Forest near the Wateree watershed and Poinsett State Park. In the Wateree watershed area, there were a series of faint connecting lines similar to those mentioned in the Francis Marion National Forest study. Due to this area of the Wateree

⁸¹ Jodi A. Barnes and Rebekah Dobrasko, “South Carolina’s Tidal Rice Fields: Consultation, Collaboration, and Cultural Landscapes” *International Journal of Cultural Property* (2014), 425

⁸² Andrew Agha and Charles E. Philips, “Landscape of Cultivation: Inland Rice Fields as Landscapes and Archaeology Sites” *African Diaspora Archaeology Network Newsletter*, September 2009, 13; Andrew Agha and others, *Inland Swamp Rice Context, c. 1690-1783*, Section E Page 14.

watershed being heavily covered with trees, it was hard to determine if these lines were in fact the remnants of rice cultivation. (Refer to Figure 3.2.).

In addition, these connecting lines or gridded squares observed in the aerial photographs might reflect the recent work by the forest officials to manage the land. To maintain certain tree species, such as longleaf pine, certain trees are removed. Also, due to the damage caused by Hurricane Hugo in 1989 several acres have been replanted.⁸³ Further, the land in the Wateree watershed is often flooded through a system of culverts to help manage the duck population.⁸⁴ Thus, the squares observed in the aerial photographs might be the work related to one or both actions by forest officials. As a result, a more defined image of the ground surface was needed.

To help better define the lines seen in the aerial photographs, LIDAR data was used. For this study, the LIDAR data was from an existing LIDAR data collected from an aerial survey in 2010 by the South Carolina Department of Natural Resources for floodplain mapping.⁸⁵ The LIDAR data was downloaded from the Digital Coast Database of the National Ocean and Atmospheric Administration (NOAA) website. For this study, the LIDAR data was selected for Project Area One to the west of the boundary of Poinsett State Park in Wateree watershed. It should be noted that this LIDAR data was

⁸³ “Manchester State Forest.” *South Carolina Forestry Commission*
<https://www.state.sc.us/forest/refman.htm>.

⁸⁴ James R. Douglas III, South Carolina Forestry Commission, Manchester State Forest, e-mail message to Sarah Moore, October 27, 2016.

⁸⁵ “2010 SC DNR LIDAR: Sumter County” Digital Coast Database of the National Oceanic and Atmospheric Administration website. <https://coast.noaa.gov/dataviewer/#/lidar/search/>.

already processed and classified by the Digital Coast team. Thus, the work in this thesis only describes the spatial analysis using the data after it was downloaded.

As mentioned LIDAR data can be used to create the 3D models of the earth in GIS such as digital elevation models and digital surface models. A Digital Elevation Model or DEM is used to create a surface that examines just the bare surface of the earth, while the digital surface model on the other hand includes natural and man-made features on the earth.⁸⁶ Often a hillshade is created from these models because it creates “a grayscale 3D representation of the surface, with the sun's relative position taken into account for shading the image.”⁸⁷ It was hoped that through the creation of both models would result in a better definition of the features seen in aerials, but only a DEM was successfully created.

After the LIDAR data was downloaded into ESRI's ArcMap 10.2, a new LIDAR data set was created consisting of only the ground points from the LIDAR cloud point. From this new ground point layer, DEM and hillshade layers were created to look for evidence of rice fields and was overlaid over an aerial image of the area. Through the DEM and hillshade layers, the line features first seen in the aerial photograph were better defined. (Refer to Figures 3.3 and 3.4).

There was no doubt that these features were rectangles further divided into smaller rectangles on a grid in the Wateree watershed, possibly the “window pane

⁸⁶ “DEM, DSM and DTM Differences-GIS Elevation Models” GIS Geography, <http://gisgeography.com/dem-dsm-dtm-differences/>

⁸⁷ “Hillshade Function” ArcGIS for Desktop. <http://desktop.arcgis.com/en/arcmap/10.3/manage-data/raster-and-images/hillshade-function.htm>

patterning” look of the remnants of rice fields seen in the aerial photography. Due to these feature’s “window pane pattering” appearance, however, does not rule out the possibility of these features being the result of modern construction. Close to and possibly within Project Area One, there is a system of modern cisterns used to flood this area in Manchester State Forest. Thus, the subdivide rectangle feature, might be a part of the modern flooding system used by the South Carolina Forestry Service. (Refer to Figures 3.4 and 3.5).

Still, the presence of modern irrigation system does not fully rule out the likelihood of the existence of rice cultivation in the area. Further, the modern irrigation system does not rule the possibility of some of the remnants of rice fields remaining on the landscape. This, however, depends the size of the modern irrigation system.

In addition to the rectangle feature, another feature first seen in the aerial images was also further defined in the DEM and hillshade layers. This feature is Y-shaped with two ends pointing towards the area of the gridded rectangle. These two ends connect at a point forming one line that extends west into the Wateree watershed. Presently, this Y-shaped feature is a road, but due to its shape it might be a former canal that was filled in. (Refer to Figure 3.5).

In addition, this road feature might also indicate human interference with the natural flow of the water sources in the area. In a *Soil Map of Sumter County* from 1907, a Y-shaped water feature is present. In the map, this Y- feature appears to be a body of water that drains into the Wateree Ricer. The two ends of the Y-shape is connected to Campbell Creek to the north, and to Shank’s Creek to the South. Along Shank’s Creek there are two water ponds, one of which is the grist millpond located in Poinsett State

Park. In the area above the Y-shaped feature is a line of water with three more ponded areas with possibly more ponded areas to the north.⁸⁸ These three pond-like areas are mostly likely man made, possibly damned or impounded areas, perhaps the remnants of reservoirs for inland rice cultivation. (Refer to Figure 3.7).

As mentioned above, if the Y-shaped road feature is an earthen remnant of rice cultivation, it is mostly likely a type of canal. Due to its shape, this feature might be a reserve canal that connected the water from the reservoir to the ditches that lead to the fields. This feature is similar in shape to the reserve canal shown in the illustration drawn by Richard D. Porcher, Jr., of an inland-swamp rice field on the Western Branch of the Cooper River in Berkley County in South Carolina.⁸⁹ In this illustration, a similar Y-shaped feature is identified as a reserve canal with two ends connected to a water reserve. The two ends of the reserve canal combine to form one line before it entered a third reserve and the upper bank area of the fields. (Refer to Figure 3.6)

The Y-shaped feature in Project Area One, however, is opposite of this illustration. Instead of connecting with two reserves and merging into one line before reaching the upper bank area, the two ends of the Y-shaped feature in the project area extends into the gridded rectangle area. As mention above, the two ends of this Y-shaped feature merge into on line to the west of the gridded rectangle area, and extend into the Wateree watershed.⁹⁰

⁸⁸ Refer to Figure A.4 in the Appendix.

⁸⁹ Porcher, Jr., and Judd, *The Market Preparation of Carolina Rice*, 49.

⁹⁰ Refer to Figure A.3 in the Appendix.

This Y-shape feature might also be a drainage canal or a flanking canal that carries water from the fields into a body of water that is closer to what is now the Poinsett State Park Boundary. Thus, the two ends of the drainage canal split before reaching the gridded square feature in order to drain both sides of the field. These canals would then carry the drained water to a larger body of water to drain into, such as Shank's Creek or Campbell's Creek.

Soils

From recent research and archaeology fieldwork on former rice plantations in the Lowcountry, it is known that rice grew well in certain types of soils such as the Megget Loam.⁹¹ Usually these soils retained water and have high water- holding capacity, thus ideal for planting a crop that relied on a high volume of water in order to grow. In addition, this archaeology work also indicated that although different inland rice plantations were found in different watershed locations, all of the locations contained the same soil characteristics needed for rice cultivation.⁹² Thus, while Project Area One is located in the southwest portion of Sumter County, it is possible that the soils found in the Wateree watershed might contain characteristics similar to those soils found at former inland rice fields in the Lowcountry.

In examining the soil for Project Area One, a consideration must be made to different landform regions or zones that comprise South Carolina. There are five main zones in South Carolina: Blue Ridge, Piedmont, Sandhills, Coastal Plain and the Coastal

⁹¹ Smith, *Rich Swamps and Rice Grounds*, 48.

⁹² Smith, *Rich Swamps and Rice Grounds*, 48.

Zone, though some further subdivide the Coastal Plain Region into Inner and Outer Coastal Plains.⁹³ Each of these landform regions comprise of different topography and soil characteristics, but for the focus of this thesis only the Sandhill and Inner Coastal Plain will be further discussed.

The Sandhill region comprises of narrow area of the state and is located between the Piedmont and the Coastal Plain. This region also runs alongside or at times overlaps with the Fall Line. This region mainly comprises of a rolling hill landscape, in which defines the mid portion of the state known as the Midlands.⁹⁴ As the name of this region refers, the soil texture of this region is mostly sandy. As a result, the soil allows for good water drainage, thus not ideal for growing rice.

The Inner Coastal Plain Region is a portion of the Coastal Zone located close to the Sandhill region. As a result, the topography for this area resembles that of the Sandhill and Piedmont regions and it can comprise of a higher areas of elevation than the topography of the Outer Coastal Plain. While this soil is good for most crops, the soil of this area has good surface and internal drainage, thus it is not ideal for growing rice.⁹⁵

Project Area One is located in either the Sandhill or Inner Coastal Plain region. Since both regions consist of soils that drain well, ideally the soils found in the Project Area One would also drain well, thus it is not suitable for rice cultivation. The river flood plains of the Coastal Plain Region, however, consist of soils that are good for agriculture.

⁹³ Charles F. Kovacik and John J. Winberry, *South Carolina: The Making of a Landscape*, (Columbia, South Carolina: University of South Carolina Press; 1989), 13.

⁹⁴ Kovacik and Winberry, *South Carolina: The Making of a Landscape*, 18.

⁹⁵ Kovacik and Winberry, *South Carolina: The Making of a Landscape*, 18.

These soils range from loamy to clay in texture, with high nutrient and organic matter, similar to those seen in studies at former rice plantations in the Lowcountry.⁹⁶ After the area has been drained, the soil can be used to grow crops successfully since the soil consist of slow water permeability and evidence of rice cultivation has been found in such soils.⁹⁷ Therefore, since Project Area One is located in the watershed of the Wateree River, it could contain these soil characteristics.

There is a second reason for favorable soils for growing rice in Project Area One. Some have suggested that there is a small region that runs northwest of Columbia to the Wateree River. This region, known as the Red Hills, is tiny in range and width, only two to four miles at its widest point. This region is said to be found between the Sand Hills and the Coastal Plain thus could account for pocket of area with the favorable soils for rice cultivation.⁹⁸

The physical landscape of Project Area One also needs to be considered when looking into the possibility of rice cultivation. As mentioned, all of Project Area One is located within the Wateree watershed. The area is just too the east of Project Area One, however, it comprises of a higher elevation and a hilly landscape. The difference in elevation between these areas helps form the boundary between Poinsett State Park and

⁹⁶ Smith, *Inland Swamps and Rice Grounds*, 48.

⁹⁷ Kovacic and Winberry, *South Carolina: The Making of a Landscape*, 41-42.

⁹⁸ Lynwood Smith, "Physiography of South Carolina "(master's thesis, University of South Carolina, 1933), 26.

Manchester State Park lands. It would also have help determine the location of the rice fields, embankments, and related irrigation systems of Project Area One.

The overall size and shape of inland rice fields were determined by topography.⁹⁹ The topography would also define the physical border for the impounded water and the rice fields.¹⁰⁰ Thus, a drop in elevation between Poinsett State Park and Project Area One forms a natural barrier for fields and water sources.

Project Area 2

As previously mentioned, a second project area was selected in order to understand and compare the features indicated in the DEM and hillshade layers created from the LIDAR data for Project Area One. Project Area Two is located in northern Charleston County to the north of Hampton Plantation, the site of a former rice plantation. Two bodies of water border this project area: Santee River to the north and Wambaw Creek to the South, in which serves as the northern boundary for the Hampton Plantation Site.¹⁰¹ (Refer to Figures 3.8 and 3.10)

While Project Area Two is now located outside boundary of the Hampton Plantation Historic Site, it was once a part of the Hampton property, and therefore is connected to the history of rice cultivation at Hampton Plantation. The archival evidence for Hampton Planation suggests a long history of rice cultivation with the possibility of

⁹⁹ Smith, *Rich Swamps and Rice Grounds*, 50.

¹⁰⁰ Smith, *Rich Swamps and Rice Grounds*, 51.

¹⁰¹ *Hampton Plantation Additional Documents, McClellanville, Charleston County, South Carolina*, Nomination to the National Register of Historic Places, 16 May 2016, Section 7, page 14.

rice cultivation from 1765 and continuing into the early twentieth century.¹⁰² At sites near Wambaw Creek, rice once grew. In addition, there is both archival and physical evidence that both types of rice cultivation once grew at Hampton Plantation.¹⁰³

In two United States Geographic Survey (USGS) Maps for Hampton Plantation the location of rice cultivation are shown on land bordering the Santee River, including Hampton Island.¹⁰⁴ In order to examine a part of land along the Santee River and Wambaw Creek where rice was grown at Hampton Plantation, Hampton Island was selected to be the focus of the LIDAR examination and comparison to Project Area One. Recently, the remnants of rice cultivation found on Hampton Plantation in area known as Mainfield, was evaluated for a listing to the National Register as a contributing resource for constructed water features. Through this evaluation it was determined that the remnants meet all nine criteria for tidal cultivation of South Carolina State Historic Preservation and was listed as a contributing resource in the nomination to the National Register of Historic Places for additional sites at Hampton Plantation.¹⁰⁵ Thus, there is a possibility that LIDAR data would show the remnants of rice cultivation on Hampton Island and that these remnants will indicate tidal rice cultivation.

¹⁰² *Hampton Plantation Additional Documents, McClellanville, Charleston County, South Carolina, Nomination to the National Register of Historic Places, 16 May 2016, Section 8, page 35.*

¹⁰³ *Hampton Plantation Additional Documents, McClellanville, Charleston County, South Carolina, Nomination to the National Register of Historic Places, 16 May 2016, Section 7, page 16.*

¹⁰⁴ Refer to Figure A.13 in the Appendix. Note that Hampton Creek is Wambaw Creek.

¹⁰⁵ *Hampton Plantation Additional Documents, McClellanville, Charleston County, South Carolina, Nomination to the National Register of Historic Places, 16 May 2016, Section 7, page 16.*

As in the case for Project Area One, the LIDAR data points for Project Area Two were from the Digital Coast of the NOAA website. After the initial LIDAR points were added to ArcMap, the LIDAR point layer consisting of only ground points was created. Then from this ground point LIDAR layer, DEM and hillshade layers were created. (Refer to Figures 3.9. and 3.11.).

The DEM and hillshade layers for Project Area Two show the island subdivided into rectangle like areas. Most of the line features shown appear in the USGS map and are most likely the remnants of irrigation features that once brought water from the Santee River to drain into Wambaw Creek. These lines cross each other to form the rectangles shapes.¹⁰⁶

In addition, in the left corner of the DEM and hillshade layer there is a possible remnant of a rice field. This feature is also shaped like a rectangle that is subdivided into smaller rectangles, similar to what is seen in the diagram entitled the *Construction of tidal rice fields*.¹⁰⁷ While this area does not appear on the USGS maps, it is possible that this feature is a remnant of a rice field, that is not well preserved and only through LIDAR points is better defined. (Refer to Figures 3.12 and 3.13).

While the LIDAR results of both Project Areas show rectangles, the overall size of the features are different. In Project Area One the main features is a grid like rectangle surrounded by the Y-feature, while in Project Area Two, there is no a grid-like rectangle.

¹⁰⁶ Refer to Figure A.14 in the Appendix.

¹⁰⁷ Refer to the *Diagram of the Construction of Tidal Fields* used in Porcher, Jr., and Judd, *The Market Preparation of Carolina Rice*, 66.

Instead, line features cross to make rectangles across the island, but no further division appears in these rectangles, with the exception of the east corner of the island. (Refer to Figure 3.13.).

The question remains if both project areas contain physical evidence for inland rice cultivation. More GIS analysis is needed before any defiant answer can be given. In looking at what features were present in both sets of DEM and hillshade layers, it appears that tidal rice cultivation was occurring at Project Area Two. This agrees with the rice cultivation research for Hampton Plantation, in which there was a switch from inland to tidal cultivation in some areas of the property.¹⁰⁸

Plats

Although the LIDAR data produced a more defined line grid feature similar to those seen and described by Agha and others in Project Area One, a link between the archival evidence and the LIDAR result is still needed. Specifically, there needs to be a direct spatial link to one of the landowners' to Project Area One. As discussed in chapter two, while there is evidence that John Dargan cultivated rice on marsh that included Shank's Creek. Dargan, however, was not the only person at this time to purchase land in Craven County along this creek. For instance, both Jacob Wirth and Mathew Singleton purchased land in Craven's county on Shank's Creek in around the same time as John Dargan.¹⁰⁹ Thus, looking at a range of the historic plats of the different owners, especially

¹⁰⁸ *Hampton Plantation Additional Documentation, McClellanville, Charleston County, South Carolina.* Nomination to the National Register of Historic Places, Section 8, 35.

¹⁰⁹ Refer to "Memorial for John Dargan" Colonial Memorial South Carolina Department of Archives and History; "Memorial for Mathew Singleton" Colonial Memorials South Carolina Department of Archives and History; "Memorial for Jacob Wirth" Colonial Memorials South Carolina Department of Archives and History.

those that referenced a body of water such as Shank's Creek, offered the best way to establish this link.

As mentioned in chapter two, both colonial and later period survey plats exist for this study area. In comparison to the South Carolina Lowcountry survey estate plats, the survey plats for the southwest Sumter County are very basic in only outlining the property lines, illustrating bodies of water, and indicating the names of the owners of land that border the property. There were also numerous deed plats representing different pieces of land that became Manchester State Forest. Still, due to the basic information on these plats, it is hard to match up plats directly to the physical landscape.

In order to make a direct comparison to the LIDAR feature and the plats, an overlay of the plat layer in GIS is needed. Scanned images of these plats created by the South Carolina Department of Archives and History were used to try to create an owner-plat layer in GIS. Problems quickly emerged however, in attempts made to georeference the scanned plat images to the existing layers in GIS. These problems consisted of a combination of the lack of detail in the plat, as well as, the size and scale of the plats.¹¹⁰ For example, in trying to georeference the plat for Thomas Singleton for 1000 acres, most of the link points between the scanned plat and the current GIS layer was for Shank's Creek and Campbell's Creek, since the two bodies of water are the only landscape feature indicated on the plat. The resulting error was due to the link points being located too close together in order to properly georeference the plat. (Refer to Figure 3.14.).

¹¹⁰ While the South Carolina Department of Archives and History already scanned many of these survey plats, many of the colonial plats are from bound books showing three to four plats on one page. While the other plats featured on the page could be cropped out once scanned, the concern for scale remained,

Attempts to georeference these plats by decimal degrees also failed. Cadastral surveys conducted in the Southern Colonies in the late eighteenth century used a method comprised of chains, rods, and a compass.¹¹¹ Thus, while many of the plats have number bearings on them these numbers are compass bearings not decimal degrees. Unlike modern cadastral surveys, there is no real world connection to these plats. Still, in some cases, comparisons of the physical landscape features in historic plats to U.S. Geological Survey Maps (USGS) and aerial photographs has led to locating remnants of the past landscape. In examining the differences between estate plans in the colonies, David Buisseret describes how comparing the estate map created by John Goodared for Henry Middleton of his plantation known as Ferry Tract. This plan indicated the location of the rice fields. Using a USGS map from 1918, Goodared was able to Figure out how much of this landscape remained in 1918 only to disappear in the 1980s.

Thus, in cases like the plats for this study area where there is little detail of the physical landscape on the plat, it is hard to determine what specific area the plat actually represents, let alone what physical pieces of the landscape have remained. This becomes even more problematic when there are several plats representing small plots of land, which need to be resembled, like jigsaw pieces in order to recreate a past landscape. Even by just focusing on plats that represent the Wateree watershed such as those that show lands along the Santee River, the same problem remains of only pieces and parts of the land represented, as well, as no details of the physical landscape to help determine specifically who owned the land in addition to the specific location on the land.

¹¹¹ David Buisseret “The Estate Map in the New World” *Rural Images*. (Chicago: University of Chicago Press, 1996), 100; email correspondence with Derek Wheeler.

Through suggestions made by Derek Wheeler of Thomas Jefferson's Monticello, an attempt was made to redraw these plats into CAD.. The plat for Thomas Singleton for 1000 acres was used as test for this method, since this plat contains a portion of both Campbell Creeks and Shank's Creek, thus making the location of this plat easier to locate on the modern landscape. This plat was redrawn in the Microstation program by Derek Wheeler and send to me to be georeferenced in ArcMap.

Though there were still problems with aligning this plat on the modern landscape, it did work. There was, however, no CAD program that I could gain access to on the University of South Carolina campus. While there are CAD programs available for online download, due to lack of training of CAD programs and time considerations, no other plats were georeferenced.



Project Area One. The parcel is indicated by the black arrow. Poissett State Park is the pink parcel to the right.



Figure 3.1. An Overview of Project Area One.



Figure 3.2. An Aerial Image of Project Area One. This figure shows the Wateree watershed in the middle with Poinsett State Park to the right. Shank's Creek is the bottom right corner. Aerial image provided by the South Carolina Department of State Parks.

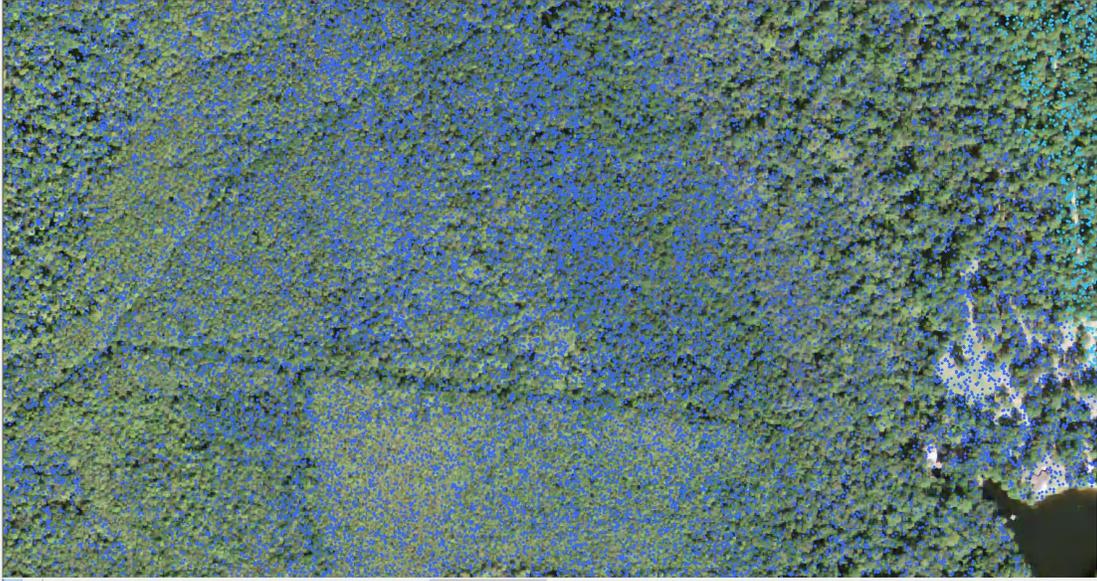
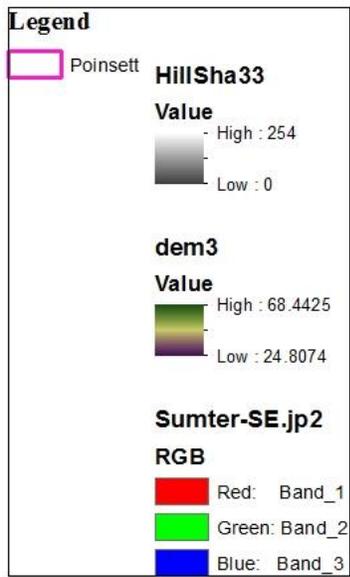
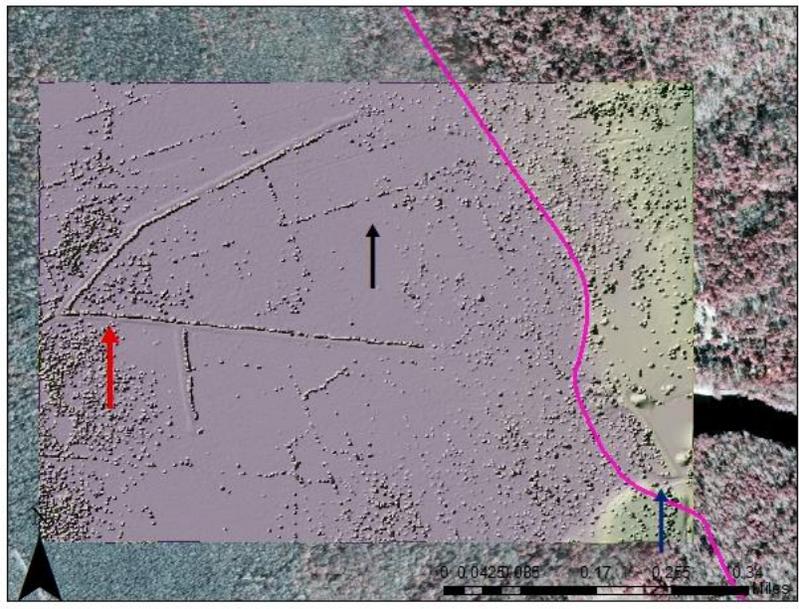


Figure 3.3. The Study Area with LIDAR Points. LIDAR Ground Points over the Aerial Image of Project Area One.



Figure 3.4. Digital Elevation Model Layer for Project Area One. The above image shows the DEM layer and the hillshade layer created from the LIDAR ground points for the study area. The grid lines often forming rectangles are located in the middle with lines extending to the north and east.



Overview of the project area, with a DEM and hillshade created from LIDAR points using the method suggested by Matthew Luke. Poinsett State Park is indicated by the pink boundary. The specific parcel with possible remnants of rice cultivation is indicated by a black arrow. The y-feature is indicated by the red arrow and Shank's Creek is indicated by the blue arrow.

Figure 3.5. Features of Project Area One.

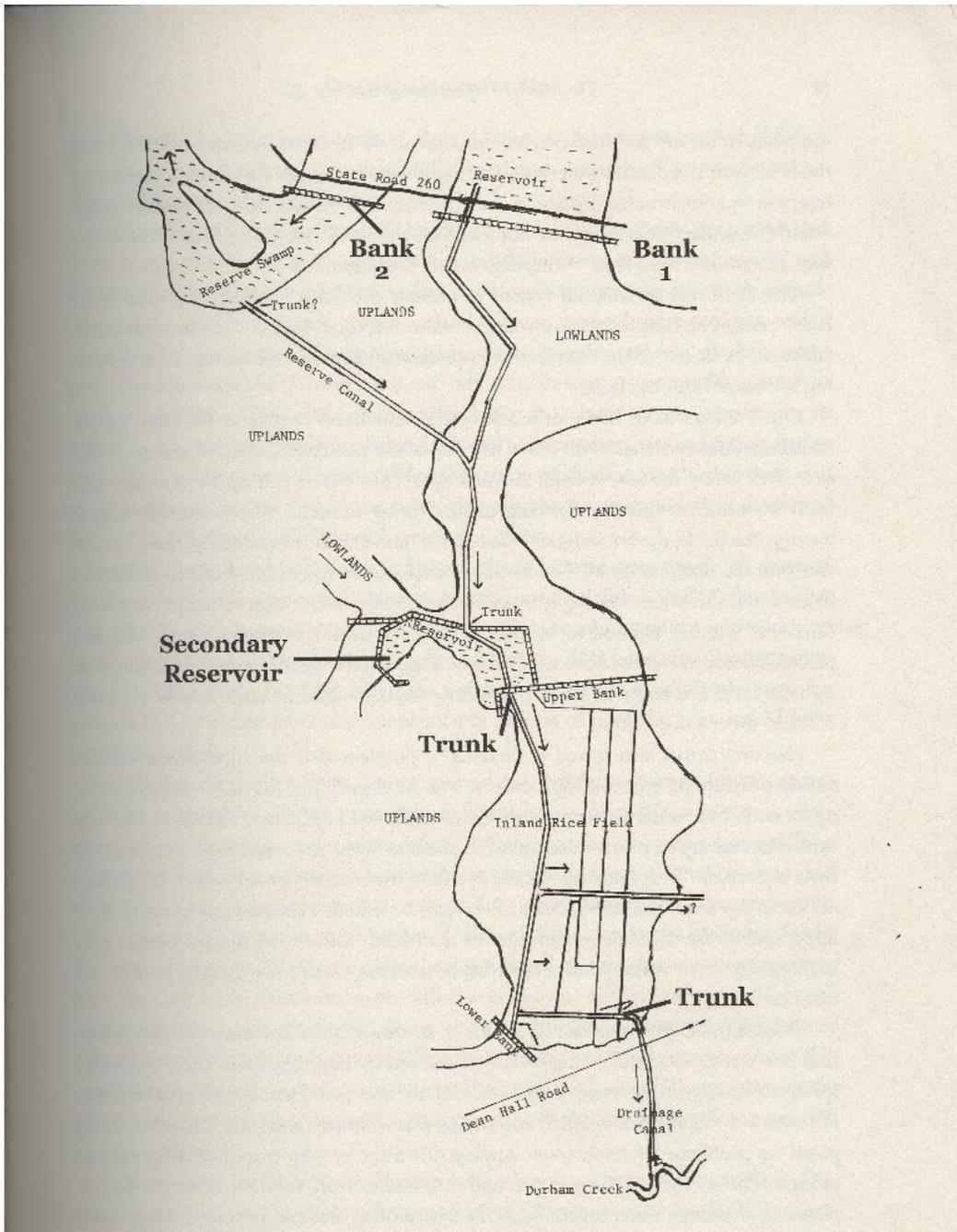


Figure 3.6. An Inland-Swamp Rice Field. The above image is entitled An Inland-Swamp Rice Field on the Western Branch of the Cooper River, Berkeley County, South Carolina. This image is from *The Market Preparation of Carolina Rice: An Illustrated History of Innovations in the Lowcountry Rice Kingdom* by Richard Dwight Porcher Jr., and William Robert Judd.

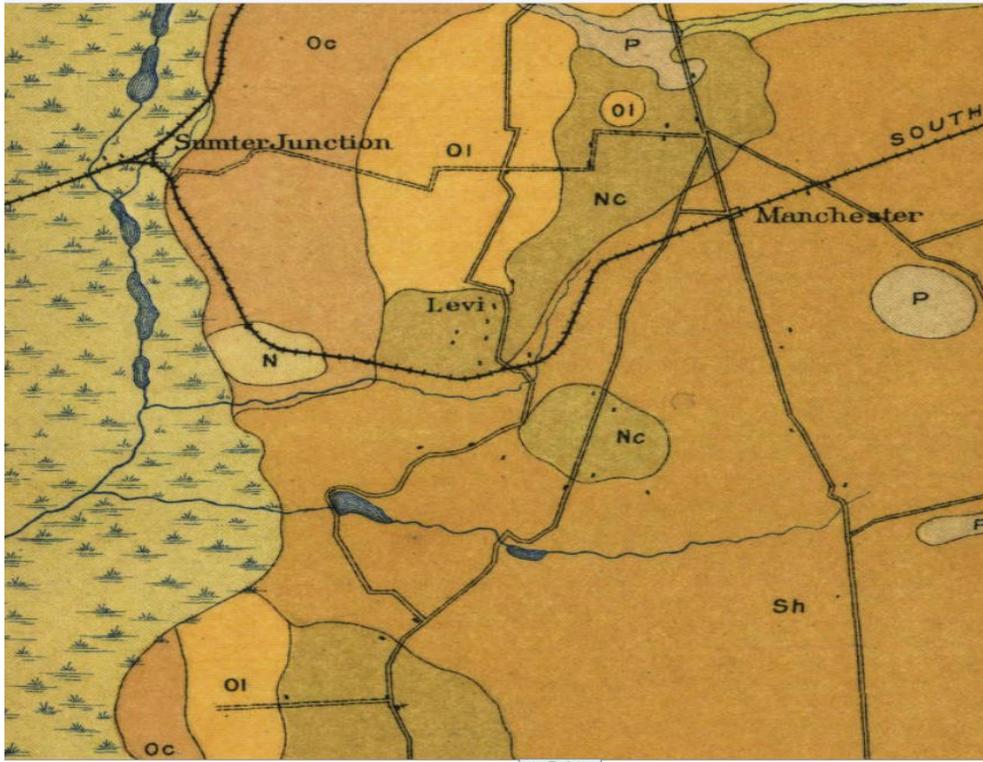


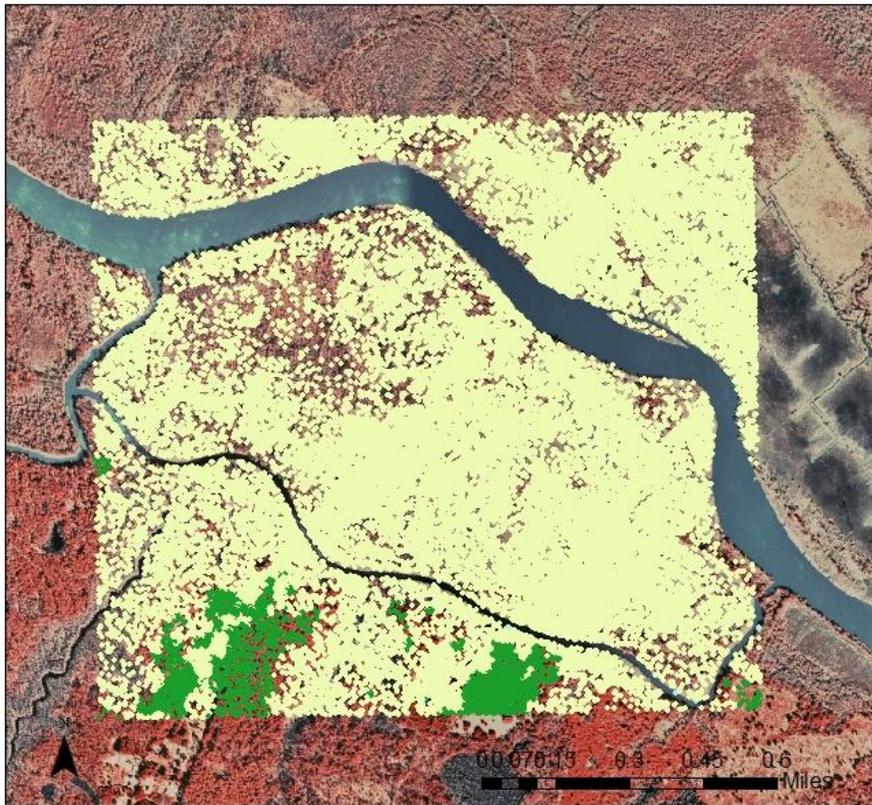
Figure 3.7. Possible Y-shaped Feature in a Soil Map. In this Soil Map of Sumter County from 1907 the Y-shaped feature is shown. Image from the Thomas Copper Library Digital Collections



| Legend | | |
|---|---|---|
| SC_Georgetown_262044_1974_250000_geo.tif | sante99nw.sid | sante99ne.sid |
| RGB | RGB | RGB |
|  Red: Band_1 |  Red: Band_1 |  Red: Band_1 |
|  Green: Band_2 |  Green: Band_2 |  Green: Band_2 |
|  Blue: Band_3 |  Blue: Band_3 |  Blue: Band_3 |

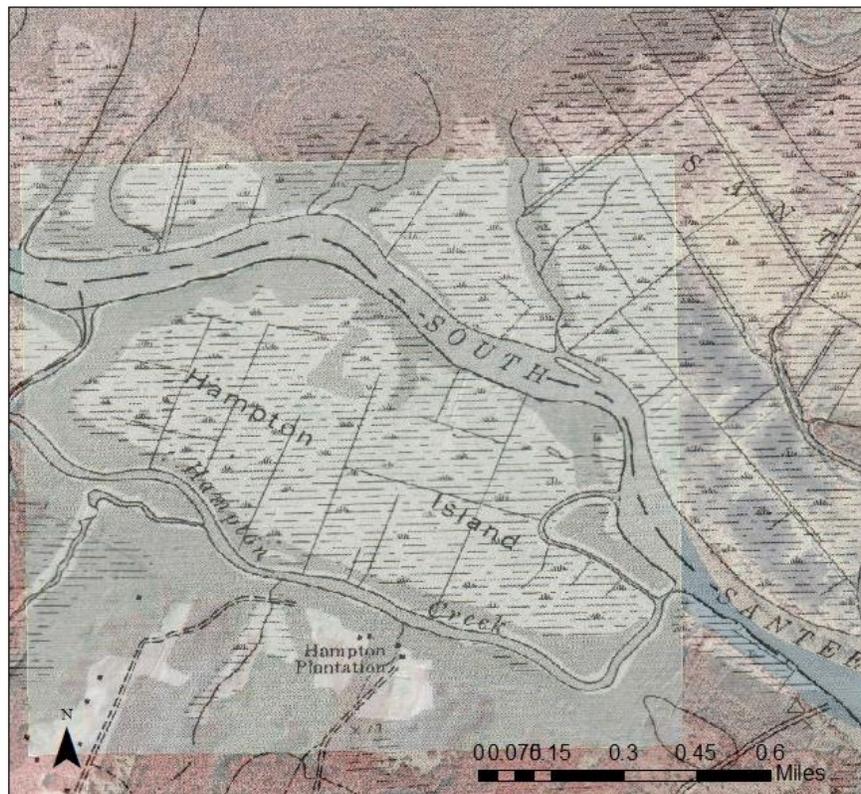
The selected area of Hampton Island with LIDAR points with a USGS map from the 1974. The Santee River s to the North and Hampton Creek is to the south.

Figure 3.8. An Over View of Project Area Two. This includes a USGS Map.



The selected area of Hampton Island with LIDAR points. The Santee River is to the North and Hampton Creek is to the south.

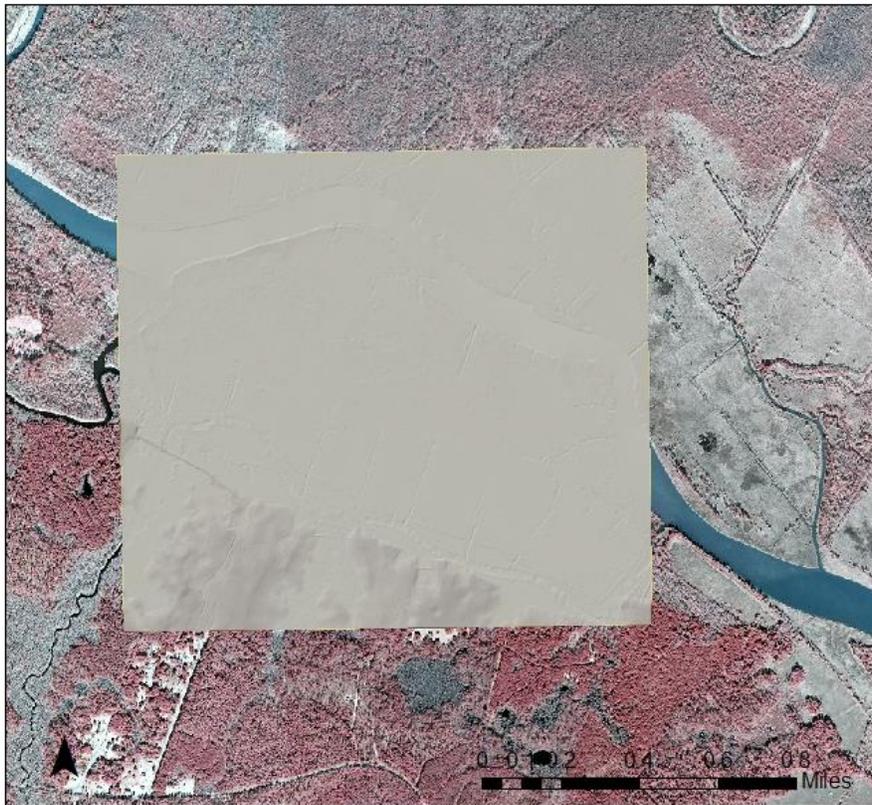
Figure 3.9. LIDAR Point Cover over Project Area Two.



| Legend | |
|---|---|
| MDS00001.jpg | sante99ne.sid |
| RGB | RGB |
|  Red: Band_1 |  Red: Band_1 |
|  Green: Band_2 |  Green: Band_2 |
|  Blue: Band_3 |  Blue: Band_3 |

The selected area of Hampton Island with the U.S. Geological Survey, Santee Map1943, overlaid over a modern aerial image of the area. The Santee Rivers to the North and Hampton Creek is to the south.

Figure 3.10. Hampton Island with an USGS Map Overlay.



DEM and hillshade layers overlaid are on the Hampton Plantation Historic Site. Hampton Creek is to the south of the DEM and hillshade layers, with the Santee River to the north.

Figure 3.11. DEM Layer Over Project Area Two.

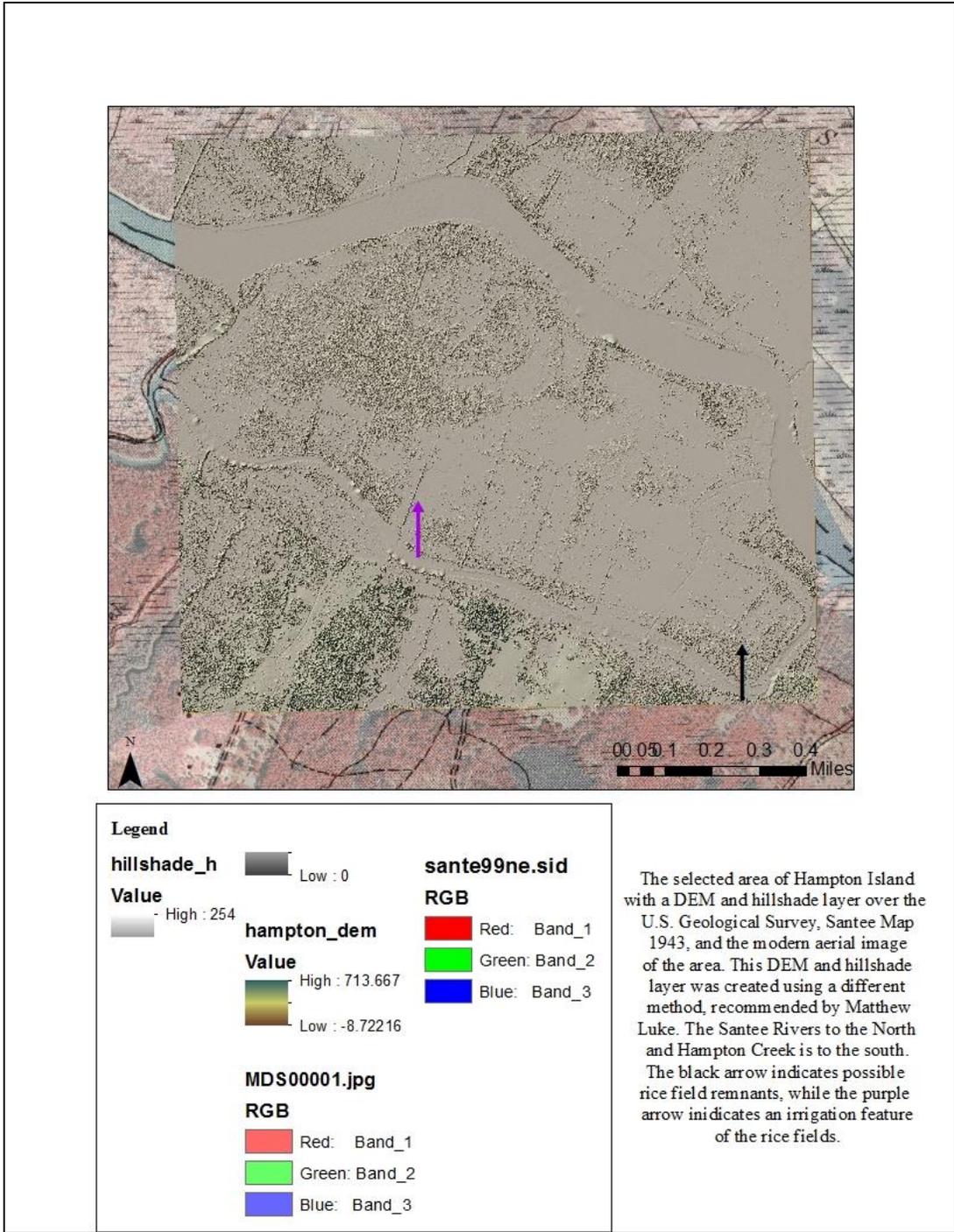


Figure 3.12. Close-up of DEM and Hillshade Layers for Project Area Two

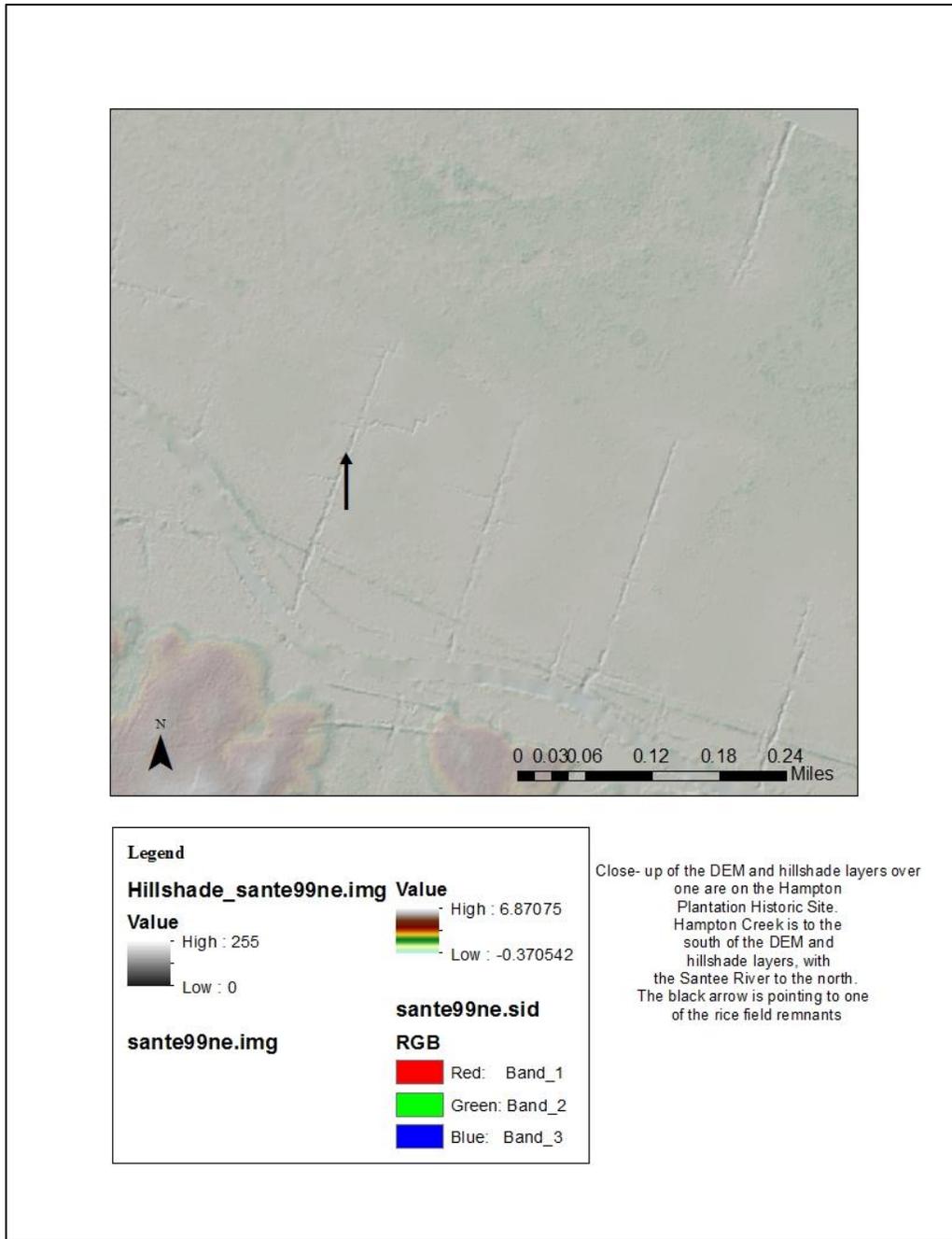


Figure 3.13. Close-up of an Irrigation Feature in Project Area Two.

Conclusion

Rice did grow in Sumter County during the nineteenth century. This is reflected in the archival material and from the agriculture censuses of the time. Through a LIDAR analysis of Project Area One, the hope was to locate and document the physical remnants of rice cultivation, which would serve as a starting point for rice cultivation research in the Sumter County. This, however, was not the case. While a LIDAR image was created for Project Area One, when compared to Project Area Two, it raised more questions due to the clarity of the DEM image for Project Area One. As a result, it is not known if the ditches in question were actually remnants of inland rice cultivation or the consequence of modern efforts to flood the site for hunting season.

Nevertheless, a number of questions can be explored through future historical research and continual utilization of modern spatial technology in regards to the overall rice cultivation in Sumter County. One possible question is how long rice was grown in Sumter County. In the case of Project Area One, there is strong evidence for rice cultivation in the nineteenth century, with one archival reference to possible rice cultivation in the eighteenth century. In contrast, in Project Area Two located in the northern portion of Charleston County, rice cultivation started much earlier in the mid-eighteenth century. Thus, further research into this question might inform us on the

efforts in rice cultivation from all over the county. In addition, more research might also give us the reason behind these efforts, such as early European settlers in Sumter County attempt to grow rice in efforts to copy the success of the crop along the coast.

A second question of potential research is if both types of rice cultivation once grew in Sumter County. While the remnants of rice cultivation in Project Area One seems to reflect inland rice cultivation rather than tidal, this might not be true of the rest county. Further research could explore if other efforts at rice cultivation were also focused on inland rice cultivation rather than the more popular tidal rice cultivation typical of the nineteenth century.

A third area of future research is the continual efforts to recreate a map of landowners for Project Area One, through plats. Further archival research might yield more clues as to who owned which parcel. Through more work in ArcMap, there can be a direct comparison of current boundaries with past boundaries and owners within one map.

In addition, future attempts to produce a landowner layer in GIS, may provide clues into how water sources changed over time. In *a Soil Map of Sumter County from 1907* indicates impounded areas of water above the Project Area One, indicating human interference with the water sources of the area. Thus, future comparisons to the water source can be made through a new layer based on owner plats. Consequently, these comparisons could also indicate more evidence of rice cultivation in Project Area One.

Further work on the LIDAR images might reveal more remnants of rice cultivation on the parcel at Manchester State Forest. As indicated through the recent work

by archaeologists, Global Positioning Systems (GPS) and fieldwork is needed for a better understanding of how the landscape changed over time. Further work might also reveal how the landscape of the area effected the decisions on where to construct the irrigation systems and rice fields. Then a comparison can be made to sites of rice cultivation along the coast, to see if the natural landscape of Sumter County was influencing decisions on the placement and construction of rice fields and irrigation systems.

With an understanding of how the landscape changed, might revel clues into the influence of the enslaved workforce on rice cultivation in the area. Historians such as Peter Wood, Judith Carney, and others have argued on the influence of African tradition in the emergence of rice cultivation along the Atlantic Coast in South Carolina.

Archaeology investigations by Andrew Agha and Charles Phillips, on former rice plantations has shown how the altered landscape can also give us clues into the African influence on rice cultivation.¹¹² Through archaeology testing of the parcel at Manchester State Forest, might reveal the similar clues into the enslaved Africans that once worked in the area.

In addition, further work with LIDAR and GIS might show how Project Area One connects to the rest of the plantation. At Hampton Plantation Historical Site, there are three main types of circulation systems, including Wambaw Creek, in which connected work on Hampton Island to the main part of the Hampton Plantation, as well as connected the enslaved community of Hampton Plantation to other enslaved communities

¹¹² Agha and Philips, "Landscapes of Cultivation: Inland Rice Fields as Landscapes and Archaeology Sites" *African Diaspora Archaeology Network Newsletter*, September 2009, 2-3; Agha, Phillips, and Fletcher, *Inland Swamp Rice Context, c. 1690-1783*, Section E, page 3.

at other plantations of the area.¹¹³ If the ditches found in Project Area One are the remnants of rice cultivation, how did it connect to the millpond located near the present day Poinsett State Park office? Did Shank's Creek serve as the only circulation system or was there another path or road that it is no longer visible on the modern landscape?

Finally, further analysis with LIDAR on sites like Project Area One where there is no map or plat showing the location of the rice fields, might lead to a larger project that examines many sites where there is little spatial evidence or archival evidence. This is important when considering instances where a site is under threat by modern development or land use practices. According to the *Rice Fields and Section 106: SHPO Guidance for Federal Agencies and Applicants*, such sites go through mitigation in order to assess the extent of the damage that will occur to the site.¹¹⁴ Currently, the LIDAR mapping of a site is one mitigation measure, but this work must include a historic context. Through a larger LIDAR study of suspected rice fields with little or no archival resources, might reveal how to evaluate a site without the traditional archival materials.

¹¹³ *Hampton Plantation Additional Documents, McClellanville, Charleston County, South Carolina*, Nomination to the National Register of Historic Places, Section 7, page 14.

¹¹⁴ Barnes and Dobrasko, *Rice Fields and Section 106*, 7.

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