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Reconstructing the Layout of a Coastal Georgia Plantation: Applications of LiDAR

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Abstract

We present a case study using publicly available LiDAR and information from historical records to reconstruct the layout of the South End, a cotton plantation in operation from 1849-1861, on Ossabaw Island, Georgia in the southeastern United States. We approach problems such as the lack of maps, extant architecture, or geographically clear areas with an interwoven analysis of primarily two datasets-LIDAR and historical documentation. Layering the datasets was a crucial component in the case study and allowed for the mapping of the entirety of the South End plantation. Broadening the view to the entire plantation as well as merging the data from LiDAR and the historic record provides the opportunity for future research to use that map as a baseline for not only understanding lost geographies of movement of enslaved individuals but also a way to elucidate the agency of those individuals within a plantation landscape.

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Key Words

historical archaeology, plantation, enslaved life, LiDAR, Georgia Coast

Highlights

- Combining publicly available LiDAR with the historical record can assist in identifying and mapping cultural features in areas without maps or geographically clear areas
- Ground truthing of features identified in LiDAR is a necessary component of analysis
- Focusing on archaeological topographies can help archaeologists understand cultural actions, modifications, movements, and use of the wider landscape

1. Introduction

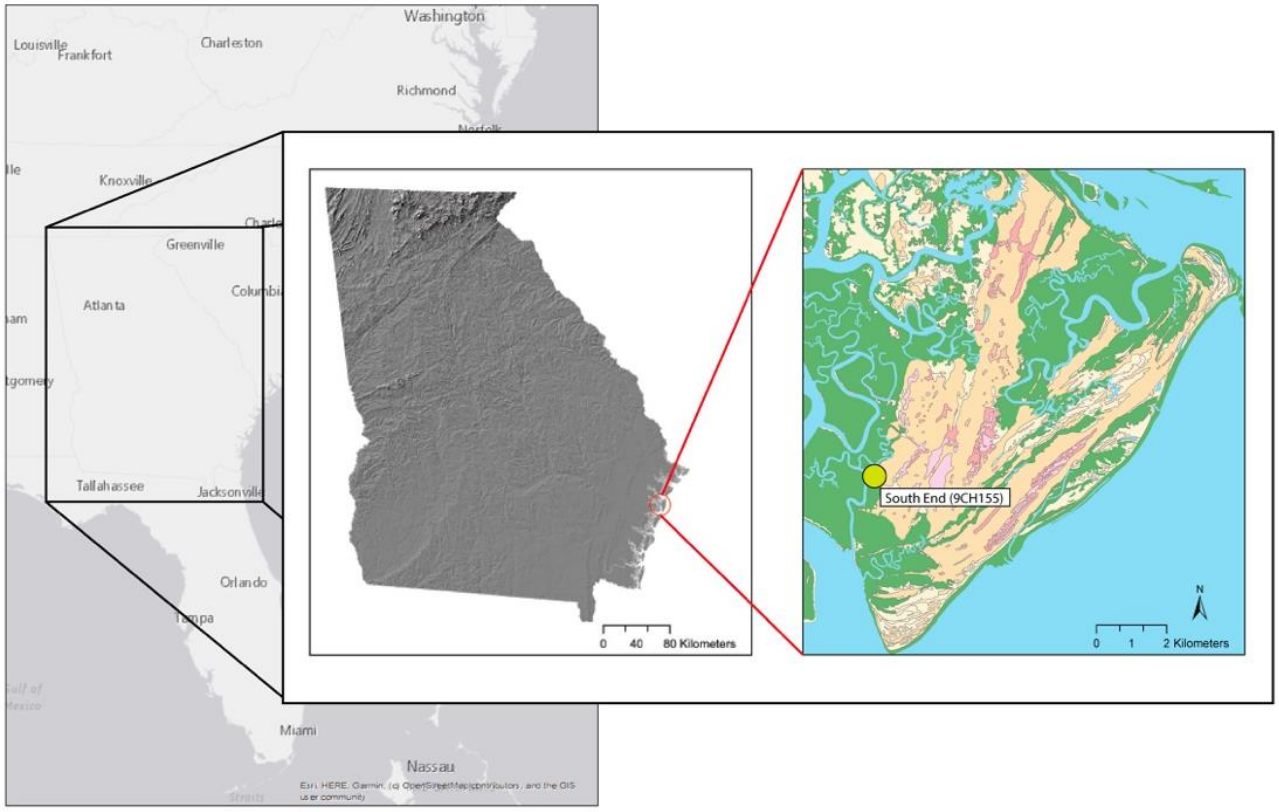
Legacies of landscapes shaped by the hands of enslaved individuals can be seen from urban settings to rural areas across the United States. Yet much research, particularly regarding plantations located in the erosion heavy Atlantic coastal zone, has tended to focus in on the central area of domestic structures and other outbuildings (referred to here as the plantation core) leaving the wider landscape of the plantation unidentified and underexplored. Often, when working on plantations, archaeologists turn to excavation and geophysical survey techniques, such as ground penetrating radar (GPR), to assist in locating, mapping and understanding sites. While these are useful ways to interpret sites, time and money often limit archaeologists to the plantation core. Additionally, there is a heavy reliance on the historic record, such as using maps and other documents, to confirm or locate cultural resources. However, historic records do not always exist or hold inaccuracies, limiting their utility to researchers, or only a limited number of plantation structures survive causing more difficulty. While these certainly are useful methods, the narrow focus might not allow for the wider lens of interpretation needed to understand the impact and relationship of enslaved individuals to their surrounding landscape. These same areas are also now under threat of heavy erosion and site loss. Cultural areas such as those discussed in this paper contain features not easily recognized and are at significant risk of loss. A wide view of an landscape such as this allows for better management and mitigation of site loss.

One way to broaden the view is by incorporating other means of visualizing cultural landscapes. Light Detecting and Ranging (LiDAR), particularly if there is publicly available data, should be incorporated with the historical record alongside excavation to reach a more complete understanding of the geographies that existed within plantation boundaries. Only with this

holistic approach can we capture and commemorate the landscapes of those who endured and resisted enslavement.

This case study, based on work by Roberts Thompson (2020), focuses on reconstructing the previously unmapped plantation layout of the South End plantation, a cotton plantation in operation from 1849-1861, on Ossabaw Island, off of the coast of Georgia, in the southeastern United States. Specifically, we articulate how publicly available LiDAR alongside information from the historical record allows for reconstruction of the plantation era landscape of the South End (Figure 1). In simple terms, aerial LiDAR is a particular topographic survey technique accomplished by an airborne reconnaissance over an area with a laser emitter-receiver scanning unit, and an inertial measurement unit (IMU) used with a GPS (global positioning system). The data sent to and from the ground can be used to create topographic representations of the ground surfaces (Chase et al. 2017; Harmon et al. 2006; Johnson and Ouimet 2014, 2016, 2018; Pluckhahn and Thompson 2012).

Figure 1. Map showing location of the South End plantation on Ossabaw Island, Georgia.



The incorporation of LiDAR data in archaeology is becoming increasingly common due to its accessibility. Many countries including the United States now have freely accessible LiDAR data. As an archaeological resource, LiDAR is well-established (e.g., Bennett et al. 2012; Bewley et al. 2005; Challis et al. 2008; Chase et al. 2017; Coluzzi et al. 2010; Devereux et al. 2005; Evans et al. 2013; Hudak et al. 2009; Johnson and Ouimet 2014, 2016, 2018; Masini et al. 2018; Mlekuž 2013; Pluckhahn and Thompson 2012; Nuninger et al. 2020; Opitz et al. 2015; Rosenswig et al. 2013; Rosenswig et al. 2015; Schindling and Gibbes 2014; Vilbig et al. 2020; Werbrouck et al. 2011; Werbrouck et al. 2009). LiDAR is particularly useful for archaeologists whose major focus is the interpretation of landscapes and many publications on LiDAR in archaeology focus on deeper time frames. Conversely, there are currently only a few examples of applications of LiDAR to historic sites (Bristow and Therien 2019; Calfas et al. 2010; Chase et al. 2017; Harmon et al. 2006; Johnson and Ouimet 2014; Moore 2016; Opitz et al. 2015; Montpelier 2022). Explicitly, the application of LiDAR to plantation period sites is not substantively utilized by historical archaeologists with regards to reconstructing the layout of all components within a plantation which might include the plantation core, fields, roads, among other cultural features.

Drawing on the methodologies of Harmon et al. (2006), Johnson and Ouimet (2014, 2016), Opitz et al. (2015) and Chase et al. (2017), the primary goal for this case study is to demonstrate how LiDAR, historical documents and later historic maps aided in the identification of the locations of cultural features, which in turn reconstruct the South End plantation. The case presented in this paper primarily focuses on the steps taken to address the specific methodological problems with this archaeological site and its associated landscape. The data for the South End presents some methodological problems that LiDAR or archaeology alone cannot solve. The first issue is a lack of existing structures or foundation remnants. Second, there are not any historic drawings, or maps that date directly from the time the plantation was occupied, although several maps do exist after the plantation was abandoned. Third, only a small portion of the South End plantation remains clear, and the majority of its acreage lies below a dense maritime forest creating difficulties in recording the plantation features. As a result, the typical frame of reference such as maps and extant architecture used by historical archaeologists to recreate plantation landscapes is not present. Despite these issues, collating information from LiDAR with the historic maps after

the plantation's abandonment, combined with details present in various historical documents, particularly plantation journals and letters written by the owner and overseers of the South End, has produced a way to remap its layout.

In what follows, we first provide a short description of plantation layouts along the coast, followed by a brief overview of the South End plantation, and then present the methods pertinent to this case study. Secondly, we provide a more detailed explanation of those cultural features and discussions about the location, and scale of the features within the LiDAR dataset will be presented. Finally, we use the locational information derived from the LiDAR in conjunction with information from the historic maps and documents to recreate the general layout of the South End plantation.

2. General Coastal Plantation Layout

The estuarine environment of the Georgia coast is one of dynamic change and fluctuation. It contains hundreds of square miles of salt marsh, many barrier and back-barrier islands, and is dotted with 'hammocks' - stands of trees growing on slightly high soil. This salt marsh ecosystem is connected to extensive networks of tidal creeks and large rivers that rise and fall into the ocean with a three-meter tide. The ecological characteristics of the coast and the shifting tides were ideal for providing the hydraulic energy for coastal plantations to establish certain crops. Because of this, it was common for coastal plantations in Georgia to be placed on bluffs or high ground near tidal creeks, either along the mainland or on back-barrier islands with easy accessibility to the larger rivers of the area, and ultimately to Savannah, the main commercial port of coastal Georgia (Joseph et al. 2004:60-62). The central location of coastal plantations, referred to here as the plantation core, were typically nucleated, with enslaved quarters almost always in a square or rectangular pattern and a central "street" and the main house or overseer residence located close by. Outbuildings would also be near this area, although there was no general pattern for outbuildings (Joseph et al. 2004:60; Prunty 1955:465-466; Singleton 2015:95). Networks of agricultural fields, ditches, tracks and roads, extended from this central plantation core.

However, identifying a pattern for agricultural fields and how they connected with the plantation core is much more difficult. Plantation owners and overseers in coastal zones selected areas for fields based on a number of different characteristics. These included the types of cultivated crops, the viability of the soil, the rise and fall of the tides according to its specific location, and even the configuration of the land itself. As a result, the South End, like other plantations along the coast, contained variously shaped fields and landscape modifications according to the plantation's specific ecological shape and locale (Roberts Thompson 2020:113).

3. Historical Overview of South End

In January of 1849, plantation owner George J. Kollock, moved an enslaved community of 54 men, women, and children to a parcel of land on Ossabaw Island referred to as the South End. The enslaved community lived on the South End for the next twelve years (Roberts Thompson 2020). Kollock purchased the South End (approximately 2,000 acres) knowing that the area contained some existing agricultural fields (number and size unknown) and structures (number and type unknown) within the main plantation core from a previous short-term plantation occupation (Roberts Thompson 2020:9-15). The semi-primed landscape of the South End with the established plantation core and some agricultural fields provided Kollock the opportunity to immediately begin agricultural operations. Kollock immediately used the enslaved individuals to modify the existing agricultural fields, dig ditches for irrigation, and clear land for new fields. During the years that the plantation operated, the historical documents indicate the presence of 15 fields in addition to ditches, roads, ditch paths, at least one canal, banks, multiple causeways, at least one dam, houses for the enslaved, houses for Kollock and the overseer, and numerous support buildings. By December 1861, the strains and threats from encroaching skirmishes of the Civil War caused Kollock to abandon the plantation (Elliott 2007:63; Journal 1861), moving the South End enslaved community off of the island.

No one occupied the South End again until after the end of the Civil War in 1865, when Special Orders, Number 15 were issued by Major General William Tecumseh Sherman, which allotted land on Sapelo, St. Catherines, and Ossabaw Islands to families of freedmen. This occupation was short lived, lasting only a year. Eight families lived and farmed along the bluff edge of the

South End during this short time. Short-term agricultural use of the bluff edge of the South End occurred in the early 1900s with a small tenant family, but overall, post-plantation occupation appears to have been minimal.

In 1924 Henry Norton Torrey purchased the entire island and built a Spanish Revival mansion on the northern end. Torrey and his family made frequent trips to the island, and it was his daughter, Eleanor "Sandy" Torrey West, who eventually inherited the island. In 1978, Sandy sold all but 24 acres of the island to the state of Georgia. The stipulations of the sale created Georgia's first heritage preserve, and Ossabaw Island eventually became included on the National Register of Historic Places in 1996 (Edwards 1996). Today, the Georgia Department of Natural Resources (GDNR), in partnership with the Ossabaw Island Foundation, manages the island leaving the environment free from development and other modern intrusions that might impact on the historic landscape.

Historical evidence suggests that the majority of modifications on the South End today are the result of Kollock's South End plantation. While the previous owner, John Morel, Jr. did have some small-scale plantation operations on the South End, documents suggest only a few fields existed when Kollock purchased the land. The subsequent short-term occupation of the freedmen families and tenant farmers lived in the homes of those previously enslaved and primarily relied on small cultivation areas. These individuals did not have the extra labor that would have been needed to maintain large swaths of fields as had been done during the plantation period with its reliance on enslaved labor. The modern use of the island did not modify the southern end of the island to any degree except for maintaining the use of existing roads and some fire breaks placed by GDNR management (no data is available to identify where these may have been placed). All of this indicates that there were few modifications to the South End landscape after Kollock's plantation period activities and that the majority of modifications visible in the LiDAR would date to this time period (Roberts Thompson 2020:61).

4. Methods

To examine the extent of plantation modifications and recreate the South End plantation layout required concurrent and supporting lines of evidence from both the historical record and LiDAR. The LiDAR dataset shows the extent of the South End plantation period occupation through the differing topographic elevations of cultural features, while the historic maps demonstrate the presence of structures, cultivated areas, possible old areas of cultivation, and roads, but do not provide much specific detail about the South End was laid out. Similarly, the historical documents contain many references to various types of cultural features but did not include their spatial context. Since no single set of data can be used to reconstruct the layout of the South End or the extent of modifications, the data were layered within ArcGIS 10.7 using the LiDAR as a base map so that the identified cultural information from the LiDAR anomalies and locational information from the historical record could be correlated.

4.1 LiDAR

The first step taken to recreate the plantation layout of the South End involved obtaining the LiDAR data through the NOAA Digital Coast website (https://coast.noaa.gov/digitalcoast/) and importing it into ArcGIS. The data was downloaded as two large .las datasets, the northern dataset measuring 4.5km x 3.8km square and a southern dataset measuring 3.6km to 3.8km square from the NOAA website in sections. The northern dataset contains 26,197,422 ground points and 4,680,387 water points and 40,310,834 ground points and 1,008,294 for the southern dataset. The point density for both these datasets is one point per square meter. Only the bare earth (class 2) and water-based returns (i.e., water) were used to create the digital elevation maps. Flights for this data were in the winter of 2009 during leaf off conditions within two hours of low tide. Being the Georgia Coast, the flights were over mature maritime forest which includes clusters of saw palmetto, cabbage palms, large magnolias, cypress, and pine, many of which retain their foliage throughout the year due to the subtropical climate, vegetation which might impact topographic visibility. Each dataset was looked at individually looked and TIN file was created in ArcMap using the LiDAR tool in the program using 32 different classifications using the Natural Breaks (Jenks) statistic. The TIN maps were then used to create a mosaic raster DEM using the 3D Analyst extension in ArcGIS. When comparing the LiDAR digital elevation model (DEM) and hillshade maps; depending on the feature type sometimes the DEM rather than

the hillshade demonstrated better visualization. For example, low relief ditch cultural features in this area tend to show up better in the DEM. For the purposes of data presentation each TIN was turned in to mosaic raster with an approximate 1-meter resolution in ArcMap. After this, topographic differences in the LiDAR data that took the form of linear, curvilinear, or rectilinear anomalies were outlined on the mosaic raster by the primary author (Figure 2). Toggling between various color ramps was beneficial to tracing those anomalies that did not have high topographic relief.

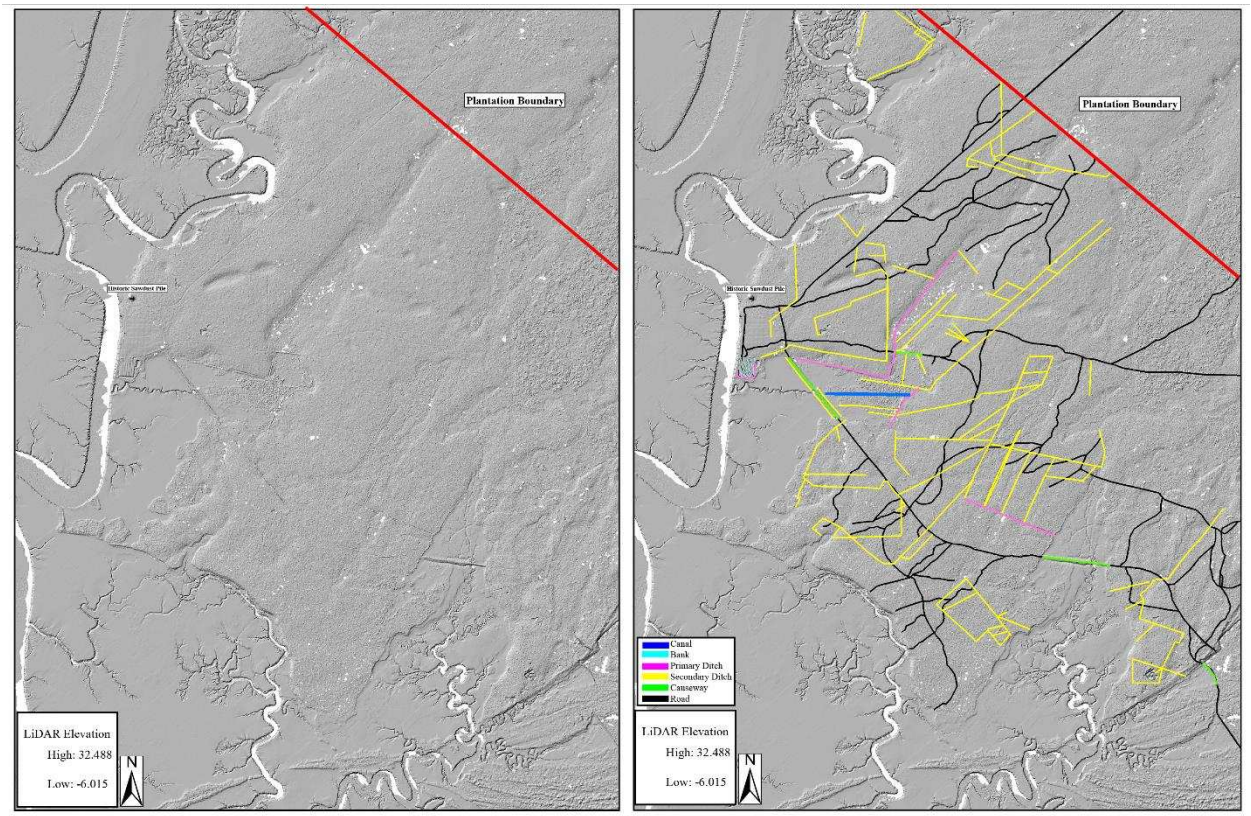


Figure 2. A: DEM of South End plantation showing features. B: DEM of South End plantation with outlined features.

4.2 Historical Record

To link cultural features to physical locations on the landscape required an in-depth examination of the historical documents for this time period. There were numerous documents from the South End plantation period, including plantation journals, letters, and Kollock's personal diaries, and maps dating to several years after the plantation's abandonment (Roberts Thompson 2020: 97-99). Any information about spatial information of cultural features, along with the number and

name of fields, size of fields, and land use modifications, were collected and organized to determine what different cultural landscape features were present and/or created on the plantation. In this case study, the area of enslaved houses and yards, the house for the overseer and Kollock, barns, and other associated outbuildings are classified more generally as one location-the plantation core. Altogether, the historic records included references to the following cultural features: banks, a canal, causeway, and dam, ditches, ditch paths, fifteen fields, roads, and numerous structures. These cultural features can be considered separate; however, their documented location was always relational – being near to, or within another feature. As a result, identifying the location of named fields became the most important organizational nodes to allow for the discussion of cultural features in the LiDAR data (Table 1). With the list of known cultural features identified from the historic documents it became possible to assign identifications based on broad characteristics such as linear, curvilinear, or rectilinear anomalies (Table 2).

Field Name in Documents	Evidence from Historic Map in Possible Field	Features in Documents	Features in LiDAR	Location Found	Reasoning Behind Placement
Bartley Field	1867 NOAA and 1881 Poe map show a cultivated area near the likely location for the property boundary. The 1895 NOAA and the 1895 Poe map shows a cleared area in this location.	ditches	ditches and roads	Yes	Bartley Field was placed near the likely property boundary between South End and Buckhead. This area also matches areas that were likely fields or former fields in the 1867 NOAA, 1881 Poe, 1895 NOAA, and 1895 Poe maps.
Cope Field	All of the maps show a cultivated area near possible location for Cope Field	road, ditches, dam, trunk	ditches and roads	Yes	Cope Field was placed in an area next to Maple Swamp as well as near Pond Field. This area is also near water
Home Field	All maps show cultivation in this area.	None mentioned	possible ditch and road	Yes	Home Field was placed in an area near the plantation core.
Jack Island	No maps show cultivation in this area.	None mentioned	ditches and possible causeway	Yes	Jack Island was placed on a hammock that had ditches present.
Jacob Field	The 1867 NOAA map shows cultivated area near the proposed area for John Field.	ditches	ditches and roads	Yes	Jacob Field was placed near a landform close to Jacob Creek. This is likely the same tidal creek referred to by Kollock as "Jacob Field Hammock Creek".
John Field	The 1867 NOAA map shows cultivated area near the proposed area for John Field.	None mentioned	ditches and roads	Yes	John Field was placed near the likely location for Jacob Field. According to documents, John Field was near Jacob Field and a pond. There is a small area behind a causeway which could be the pond referred to in the documents.
Maple Swamp Field	The 1867 NOAA map shows a small cultivated area near a probable causeway. The 1881 Poe and 1895 Poe map shows a small cleared area in one portion of the possible location. The 1895 NOAA map does not show anything in this location.	causeway, ditches, ditch paths	ditches, roads, and causeway	Yes	Maple Swamp was placed in a location that was near Cope Field, Pasture Field, a causeway and at the sudden bend in a landform.
Marsh Field	The 1867 NOAA map shows an area with hashed linepossibly representing a fence meaning that this area was not being cultivated in 1867 but could have been used as a cattle pen. The 1881 Poe,1895 NOAA, and the 1895 Poe also show the same area curtailed off by a potential fence.	ditches, ditch paths, trunks, tidal gate, canal	canal, ditches, roads, and a causeway	Yes	Marsh Field was placed in the marshy area near the likely location for Pasture Field. There is a canal is near the edge of what is likely Marsh Field. Finally, based on the historic documents, there was a higher water table present in Marsh Field and this area has that.
Morel New Ground	The 1867 NOAA map shows a cultivated area near where Morel New Ground may be but the rest of the maps do not show cultivation in this area.	ditch, fire path	ditches and roads	Yes	Morel New Ground Field was placed in an area that fulfilled the two historical document descriptions. According to the documents, Morel New Ground Field had a new area of ground that was next to a side ditch of a pond and was also near the Big Pond. Goose Pond is the largest pond in the South End area and is near Pond Field and has areas of higher land with small portion of a ditch.
Pasture Field	All of the maps show this area as being a cultivated area.	canal, ditches	canal, ditches and roads	Yes	Pasture Field was placed in an area next to Maple Swamp. There is a canal on the edge of this area which is probably the canal discussed in the historic documents and there is a sudden bend in a landform right in this area. Additionally, if Pasture Field is near where enslaved people grew supplmental foods which in this case would have been near the main plantation core, then this area matches up as well.
Point Field	The 1867 NOAA map shows a cultivated area where Point Field may be may be but the rest of the maps do not show cultivation in this area.	road, ditches, dam, trunk	ditches and roads	Yes	Point Field was placed in an area that topographically has a point, as well as near where there are ditches on the northern end of the area and near what is likely one of the main two plantation roads.
Pond Field	None of the maps show a cultivated area in this location.	ditches	ditches and roads	Yes	Pond Field was placed in an area that fulfilled a few of the historical document descriptions. According to the documents, Pond Field had low and high spots for land, had ditches, was near Cope Field, and had a road near or through part of the field that was not good for agriculture.
Rice Field	No maps show cultivation in this area.	trenches	banks and ditches	Maybe	Rice Field was placed near the area of banks and plantation core.
Sassafras Field	The 1867 NOAA map shows a cultivated area near possible location for Sassafras Field but the rest of the maps do not show cultivation in this area.	ditch, trunk on a dam, road	include ditches and roads	Yes	Pond Field was placed in an area with low and high spots for land, had ditches, was near Cope Field, and had a road near or through part of the field that was not good for agriculture.
Seder Field	Unknown	ditches	N/A	No	This field could not be placed.

Table 1. Interpretation of information from historic documents.

Cultural Feature	Shape	Additional Information
Agricultural Fields	Areal	used for growing crops; may or may not contain other cultural features
Ditches, Primary	Linear	used for drainage or irrigation; connected to other ditches and canal; relatively deep with standing water
Ditches, Secondary	Linear	used for drainage or irrigation; connected to the canal other ditches; relatively shallow with standing water
Roads	Curvilinear	prepared surface that allows passage from one place to another
Ditch Path	Curvilinear	minimally prepared surfaces that allowed passage between ditches
Canal	Linear	water-filled feature with considerable depth connecting directly to tidal creek; main tidal carrier of water
Causeway	Linear	anthropogenic landform that crosses low-lying marsh lands and connects roads other landforms.
Bank	Linear	raised linear feature located within a field
Dam	Linear	feature that forms barrier of earth obstructing a water source
Structure	Areal	Structures are buildings of any function-domestic, agricultural, etc.

Table 2. Characteristics of cultural features used in analyzing the LiDAR.

4.3 Ground Truthing

Ground truthing (i.e., visits to cultural features identified in the LiDAR) was an essential component of analysis necessary to confirm the validity of identifications. This is something that is often lacking from archaeological studies using LiDAR, but is critical in classifying features correctly. Visiting multiple types of features in different areas allows for a more accurate interpretation of LiDAR data. Multiple features around the South End plantation tract were ground truthed though occasionally the selected area of the feature proved inaccessible due to the

dense vegetation and wetlands (Appendix A). There were also several instances during ground truthing where additional cultural features were noted not directly identified in the LiDAR or documents. In these cases, observations and coordinates were recorded with a Juno 5 GPS data collector. In all cases coordinates, the type of feature, possible field name, as well as photographed sections of the feature were recorded. Where possible the width of the feature was measured from the apex on each side. Lastly, the condition of the feature was recorded, including its archaeological integrity and presence or absence water.

5. Results

5.1 Structures

Historic maps showed that there were several structures located in a clear area along Newell Creek in the years following the plantation abandonment (Figure 3). The parallel arrangement of the structures match what is known about the layout of other plantation cores along the coast. These structures depicted in the historic maps would have been the location of the plantation core of the South End. In terms of construction, these structures would have been a simple wooden construction and raised off the ground on piers (Joseph 1991:100; Roberts Thompson 2020:52). Archaeologically, the remnants of structures such as ones detailed in the documents for South End would be difficult to discern for several reasons. First, wooden frame structures without regular maintenance would not be sturdy enough exist for many years; additionally, many structures were not built with substantial foundations, and either was constructed directly on the ground or were raised on brick and tabby piers. Storms hitting the island would cause rapid destruction to such structures. Secondly, the structures, once abandoned, would likely have been dismantled to be recycled elsewhere on the island. While no documentation specific to reusing the materials on the South End in this way was known, recycling materials was a common practice, such as when the documents recorded enslaved individuals retrieving bricks from an old house in Sassafras Field (Journal 1854). All this being said, the structures likely did not last long after abandonment. Their close proximity to the actively eroding bluff, likely contributed to rapid loss of these structures.

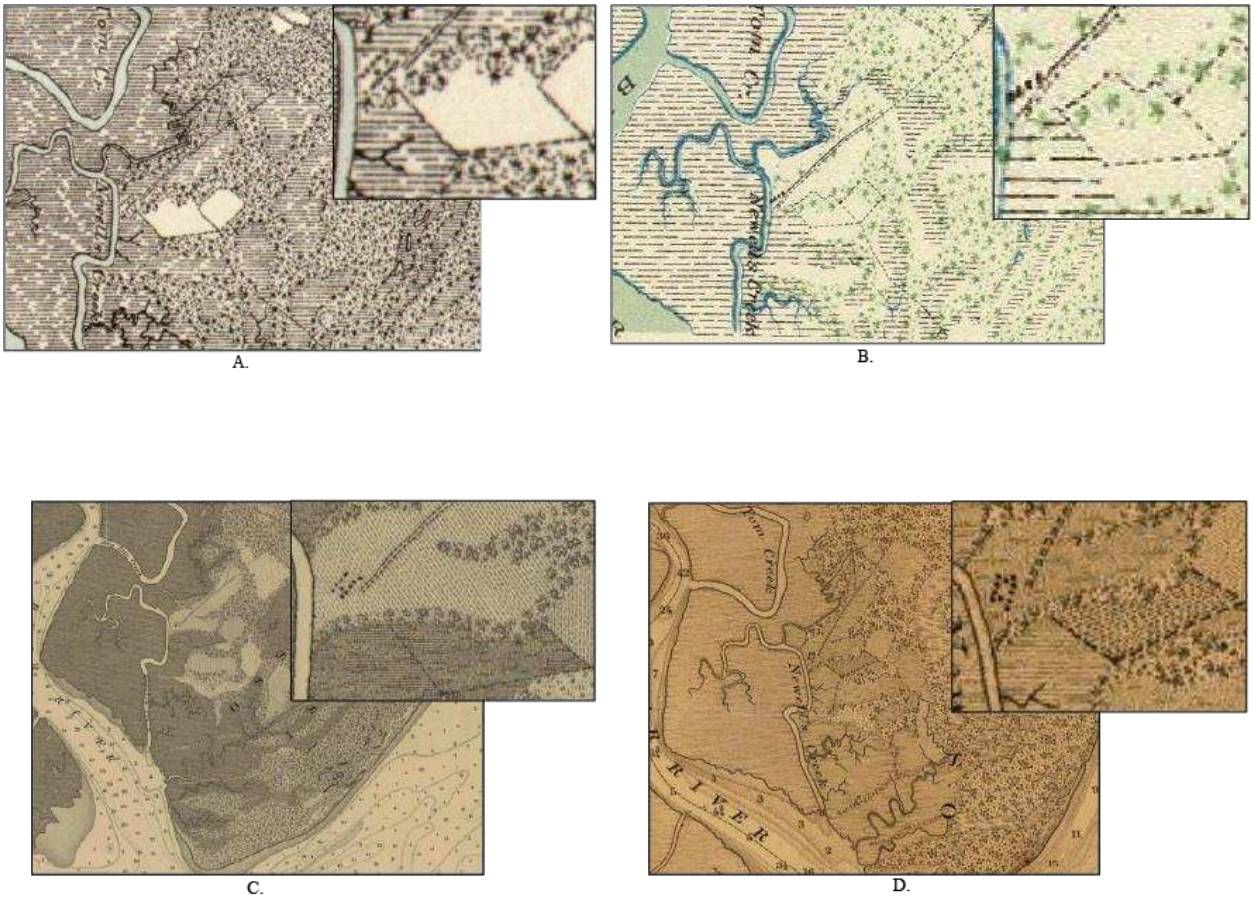


Figure 3. Maps showing the South End Plantation after it was abandoned in December 1861. A: 1881, Poe O.M Map recorded in 1864; B: 1895, Poe O.M Map recorded in 1864; C: 1867, NOAA Coastal Map; D: 1895, NOAA Coastal Map, drawn in 1876.

Indeed, the LiDAR did not reveal rectilinear features that could be identified as the structures depicted in the historic maps, or other buildings, either domestic or agricultural. This is to be expected considering LiDAR would have difficulty in picking up structures without topographical features, something the wooden structures used on the plantation would not have. While the LiDAR data was not able to identify any specific structures, the historic maps demonstrate the presence of some structures in parallel rows along the bluff of Newell Creek (Figure 4). Although not explored here in this paper, intensive archaeological investigations of shovel testing and excavations identified that the majority of the plantation core had eroded into Newell Creek. The remaining evidence for the plantation exists primarily along the bluff edge in some clustered artifact densities which indicate the presence of several domestic spaces, an outdoor kitchen, privies, and other small activity areas. In general, there was a lack of density in

historic objects anywhere else but the bluff edge. Based on the available evidence, the areas to west of the bluff (open area in Figure 3-4) were not locations for structures but rather might have been used for enslaved gardens, yards, and fields. Additionally, this open area was likely the location for small scale agriculture that occurred after the occupation of the South End during the short periods of occupation by freed enslaved individuals and later tenant farmers (Ritchison et al. 2018; Roberts Thompson 2020:150-223).

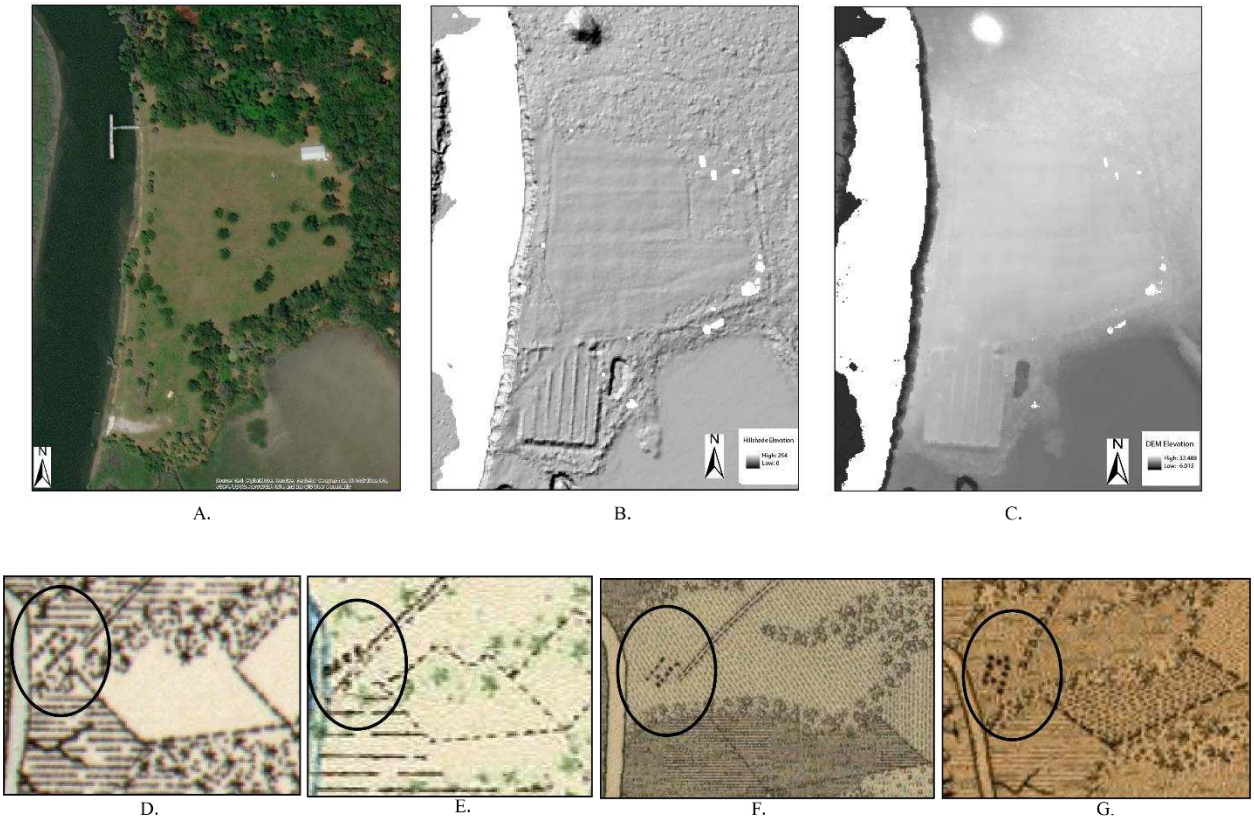


Figure 4. View of the South End plantation core (large raised feature in A-C is remnant from recent historic timbering activities).This same location is shown outlined in D-G. A: Aerial view; B: Hillshade DEM; C: DEM; D: 1881, Poe O.M Map recorded in 1864, showing twelve structures; E: 1895, Poe O.M Map recorded in 1864, showing four structures; F: 1867, NOAA Coastal Map showing ten structures; G: 1895, NOAA Coastal Map, drawn in 1876, showing eleven structures.

5.2 Agricultural Fields

Agricultural fields were defined as rectilinear areas that would have been used for growing crops and may or may not contain other landscape cultural features, for example, many fields

contained ditches used for drainage or irrigation. The historic maps show several areas that appear to be cultivated or cleared field areas (see Figure 3). The evaluation of plantation documents identified fifteen agricultural fields, but the documents also contained information on presence of ditches in fields, information on the geographic location of the field (e.g., located next to a road or water), and occasionally the size of the field (Table 1). The documents also provided some information on chronology, indicating that agricultural fields expanded over the years to fill much of the usable land on the South End tract (Roberts Thompson 2020:88, 260). Correlation of these types of data was first accomplished by compiling all available information from the historical documents for each named field, comparing the information to historic maps, and then applying all information about each field to the LiDAR data. The LiDAR data was then used to verify information noted in the historical documents, such as the presence of ditches in a particular field (Table 1). Despite the detailed information within the historical record, the lack of specific information in the maps and plantation documents and other details, for example the shape of each field, meant that only a general area for each field could be identified (Figure 5). Despite these issues, there was enough evidence to pinpoint the general location of the South End's agricultural fields (see Table 1).

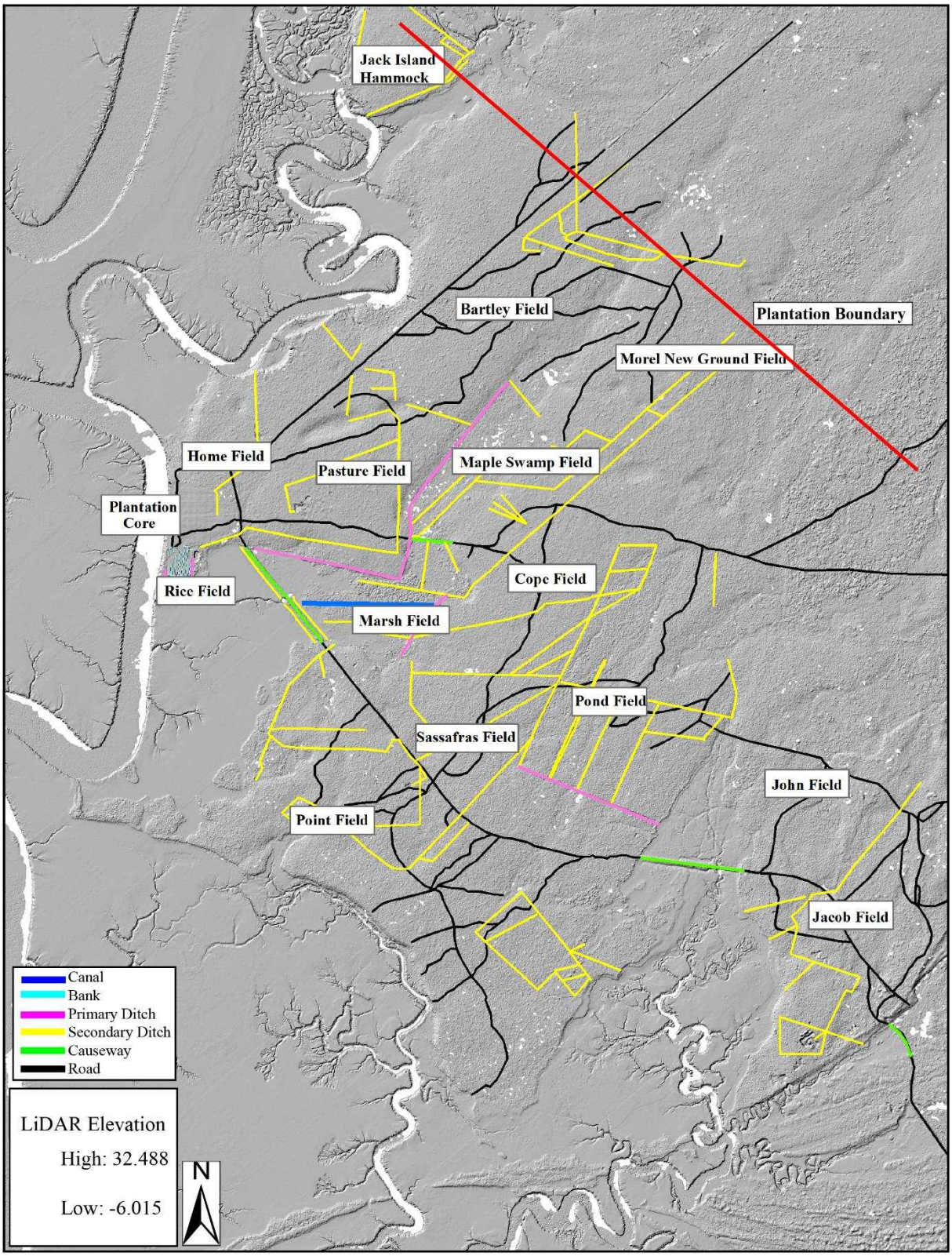


Figure 5. LiDAR of the South End plantation with projected location of agricultural fields.

In terms of ground truthing, areas of agricultural fields were visited but there were no characteristics present, such as fence lines, that reflected past use of agricultural except for the presence of features such as ditches. As mentioned above, the historic documents mention 15 fields that were present during the occupation of the South End plantation; however, when looking at the LiDAR data it was not possible to differentiate specific boundaries for these fields. One likely explanation is that it was common during this time to not use substantial fences or other boundary markers. For example, Dodge (1872:503) notes that 95% of fencing in Georgia in 1871 was comprised of the crooked rail fence style. While the historical documents mention the use of fences, there were no specifics to what type. However, it is most likely, the fences at the South End were crooked rail fences, which would not have resulted in significate modification to the landscape. Additionally, if crooked rail fences were used, they have long deteriorated, although certainly the presence of metal may be detected, although no metal detecting was used in this study.

5.3 Ditches

Ditches were defined as curvilinear features used for drainage or irrigation connected to a canal, depressions, or other ditches. The LiDAR data for the South End revealed extensive ditch networks, something corroborated by the documents which indicate the presence of ditches in nearly all of the fields (Roberts Thompson 2020:135). The documents also detail which field the ditches were located in, but the documents do not provide specific information such as length, width, depth or relationship to water sources. The documents also provide some sense of chronology, with ditches spreading from the plantation core out to other areas of the plantation as the area of cultivation was extended (see Table 1).

It is apparent that the ditches were placed according to the geological characteristics of the South End property. For example, the LiDAR data shows that some ditches were deeper than others based on an arbitrary scalar depth classification. These ditches, termed ‘primary ditches’ for this case study, had depths greater than 55 cm. Primary ditches only occurred in a few spots around the South End (Figure 6), but were linked to known aquifers and in one case, a canal (detailed below).

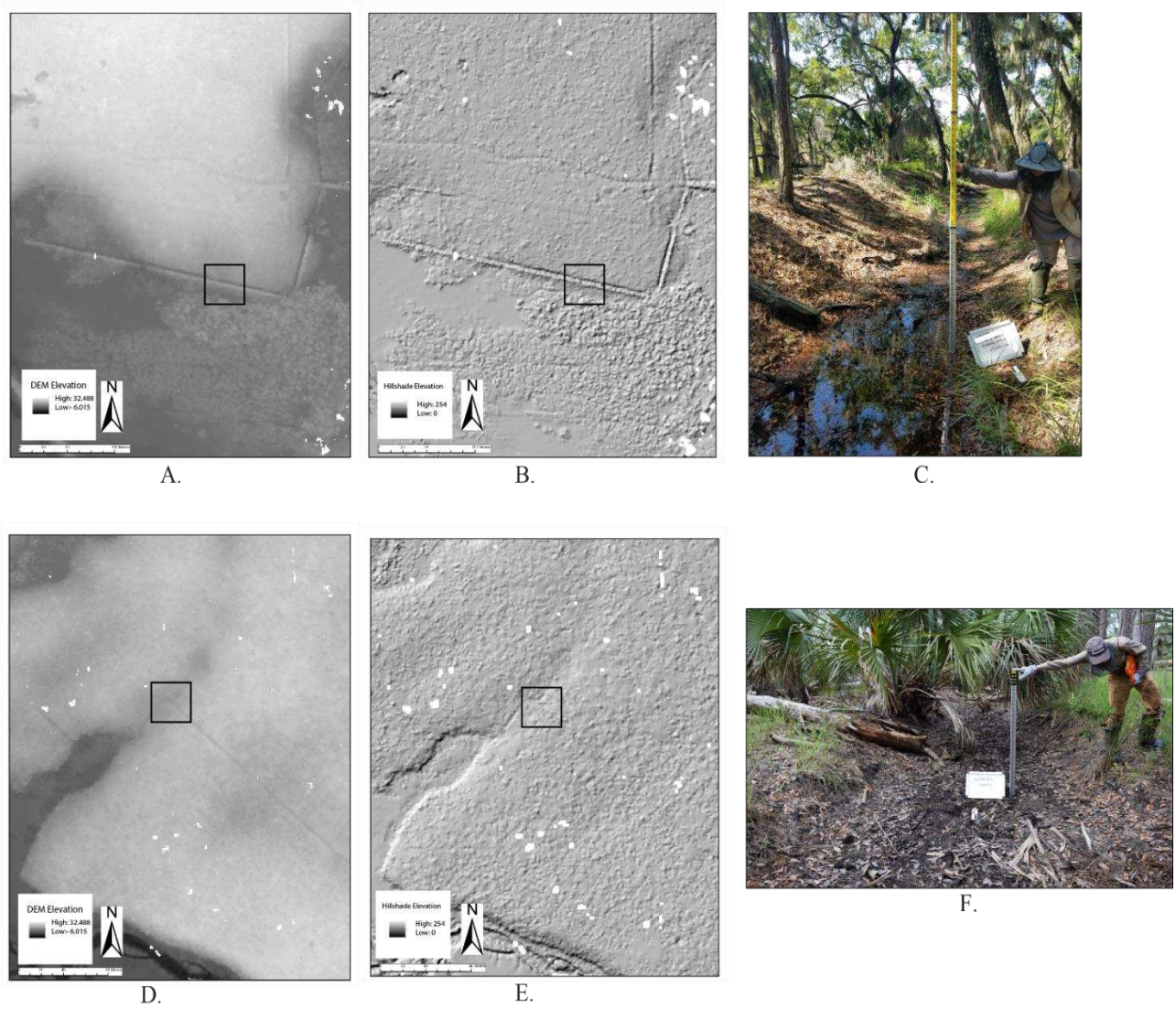


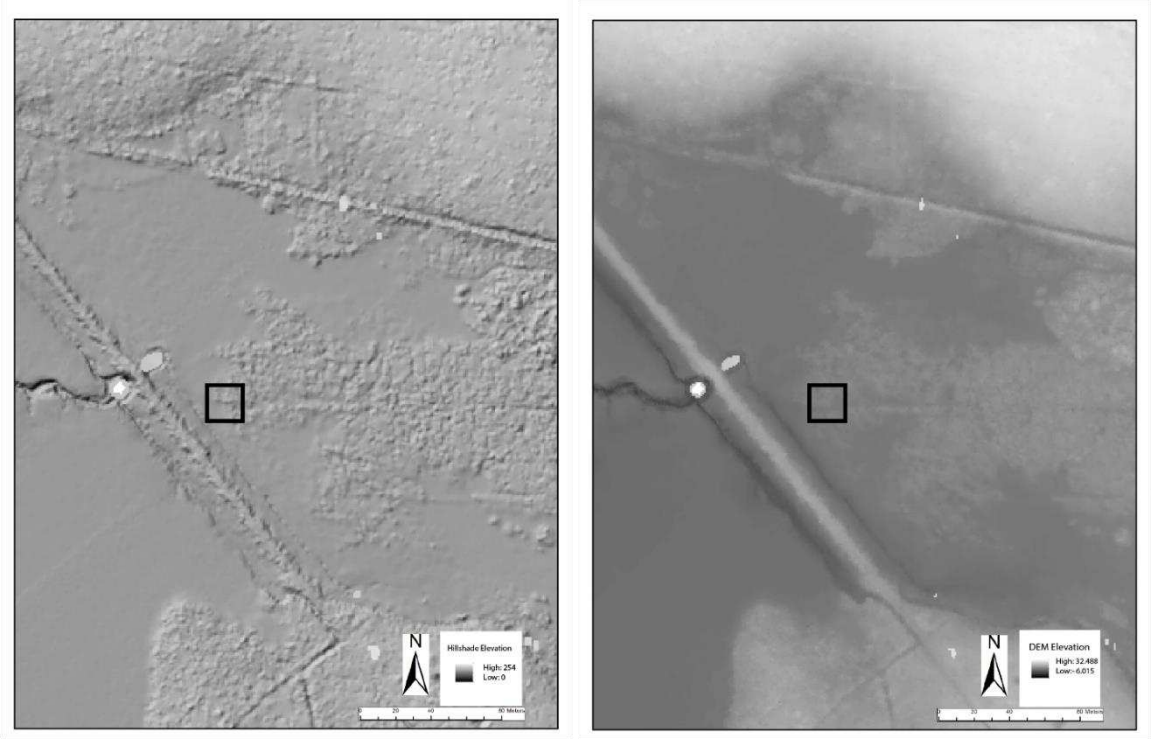
Figure 6. Example of primary and secondary ditches identified in LiDAR. A: DEM of primary ditch in Pasture Field; B: Hillshade DEM of primary ditch in Pasture Field ; C: Groundtruthing visit to this primary ditch; D: DEM of secondary ditch in Point Field; E: Hillshade DEM of secondary ditch in Point Field : F: Groundtruthing visit to this secondary ditch.

Four areas on the plantation contained primary ditches and likely would have been the main feeder ditches for irrigation as they have other ditches branching off of them. These ditches were termed ‘secondary ditches’, as they generally had a depth of less than 55 cm, and were the most common across the plantation. Some linked directly to the primary ditches, while others linked to low areas that contained water after rain or directly into low lying marsh areas, suggesting that secondary ditches likely had both irrigation and drainage functions.

Ground truthing visits of ditches occurred to forty-one different areas of ditch features, and at both primary and secondary ditches (Table 3). All of the features visited were indeed ditches, meaning that that we can, with a relatively high degree of confidence, assume that all other features with the same characteristics identified in the LiDAR data are also ditches (Figure 6).

5.4 Canal

Canals were defined as a water-filled feature connecting directly to a tidal creek. Historically, on coastal plantations, canals were the primary source of irrigation that supplied the ditches with water. The plantation documents indicate that there was at least one canal on the South End, although it was not constructed until 1856 (Hazel 1856a). A closer look at the documents indicate that the canal appeared to have been dug near a landform with a "sudden bend" and was also located near a causeway (Hazel 1856b). Using the documentary information as a guide, one linear feature was identified in the LiDAR data, located near a curve in a landform and a causeway (Figure 7). This feature was visible in the LiDAR but not detectable on the ground surface. The historic maps do not show evidence of a canal (see Figure 3), but they all show two creeks in this area. This location was also visited during ground truthing, but no topographic elevation difference was noted. However, as seen in Figure 8, today there are three creeks in this area.



A. B.

C.

Figure 7. Example of the canal identified in LiDAR. A: DEM of canal; B: Hillshade DEM of canal; C: Groundtruthing visit to canal, looking east.

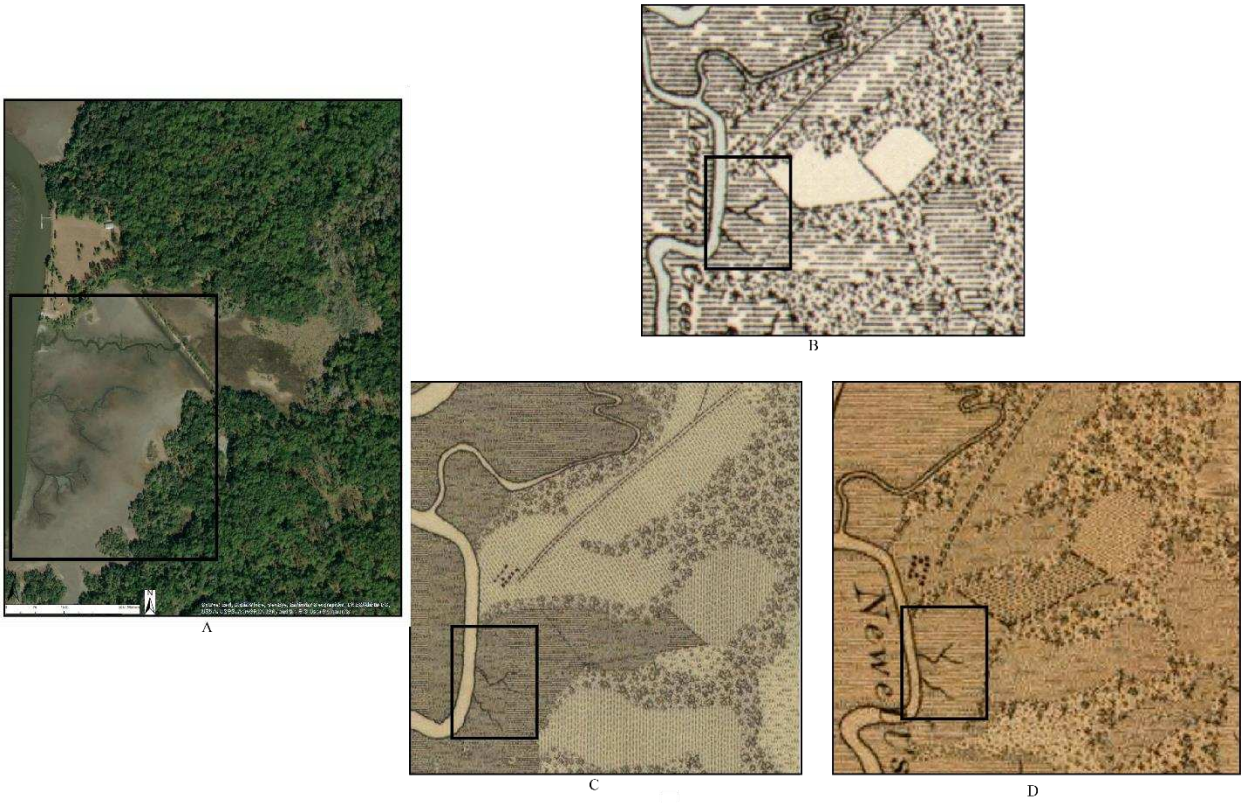


Figure 8. Comparison of tributary creeks at South End to three historic maps. A: modern topography; B: 1881, Poe, O.M Map, recorded in 1864; C: 1867 NOAA Coastal map; D: 1895 NOAA Coastal maps, drawn in 1876. Please note, the 1895, Poe O.M Map recorded in 1864 is left off of here because the map ends after the first tributary creek.

After the plantation was abandoned in 1861, it appears that the part of the canal east of the causeway became clogged and infilled, losing any sense of canalization, while the western section of the canal changed to a more natural and meandering form caused by the tidal flow influx from the adjacent Newell Creek. As a result, part of the historic canal has changed into what is now considered a tributary creek, explaining the difficulty in identifying the canal during the ground truthing visit.

5.5 Roads

Roads were defined as linear features with a prepared surface and they were referred to in the historic documents either as a “public road”, “highway roads”, “plantation road”, “home road”,

and on one occasion “Beach road,” but many times references to the term were generic and only noted “road”. Documents only occasionally identified roads in a specific location such as references to roads in Sassafras Field, Morel New Ground Field, Point Field, and Pond Field. The plantation documents occasionally detail the creation of new roads, such as in 1852 when a new road was cut in Morel New Ground Field, and in 1854, a road was laid out through the margin of Sassafras Field. Another road was cut near the margin of Point Field in 1857 (Journal 1852, 1854, 1857). The documents also detail instances related to general upkeep, for example, roads on the South End were worked on in 1856, when between 25-28 enslaved individuals worked the road in Point Field over a period of five days. Another road, referred to as “Beach road”, was worked on and in 1857 the roads to Pond Field were cleaned.

The historic maps (see Figure 3) also show two to three unnamed roads located in the South End plantation. All three roads continue to be used today, the northern road is referred to as South End Road, the road going south is called South End Beach road, the third road on the maps appears to be Log Road. The South End Road would have been the primary road out of the plantation and links to the Main Road of the island that bisects the island connecting the South End to the three other plantations on the island. When the documents recorded tasks on the ‘public road’, it likely was the Main Road that they were referring to, meaning groups of enslaved individuals would have traveled to areas off the plantation so that their labor could be used to maintain the roads used by the entire island.

In general, there was not enough information to definitively assign the other roads noted in the plantation documents to specific locations on the current landscape of the South End. The roads referred to as the ‘plantation road’ within the documents likely are the roads that are referred to today as the South End Road and South End Beach Road. These two roads appear to be what would have been the primary roads through the plantation, linking the plantation core to the fields. It could be that Log Road may have also been referred to as the ‘plantation road’ within the documents. The “Beach road” that was mentioned in the documents may refer to the section of the current South End Beach road that leads to the beach on the southern edge of the island.

When looking at the LiDAR data, distinct linear features with similar topography were readily apparent and many aligned directly with the modern-day roads on the South End (Figure 9). These road features were distinct and easily identified within the data. However, there were other linear features recognized in the LiDAR that were less distinct and may represent roads utilized during the plantation period to facilitate easier movement between fields, but later fell out of use after the South End was abandoned. Five of these less distinct linear features were ground truthed. All demonstrated little discernable difference in elevation on the ground and all still remain fairly clear of vegetation and large trees (Figure 9).

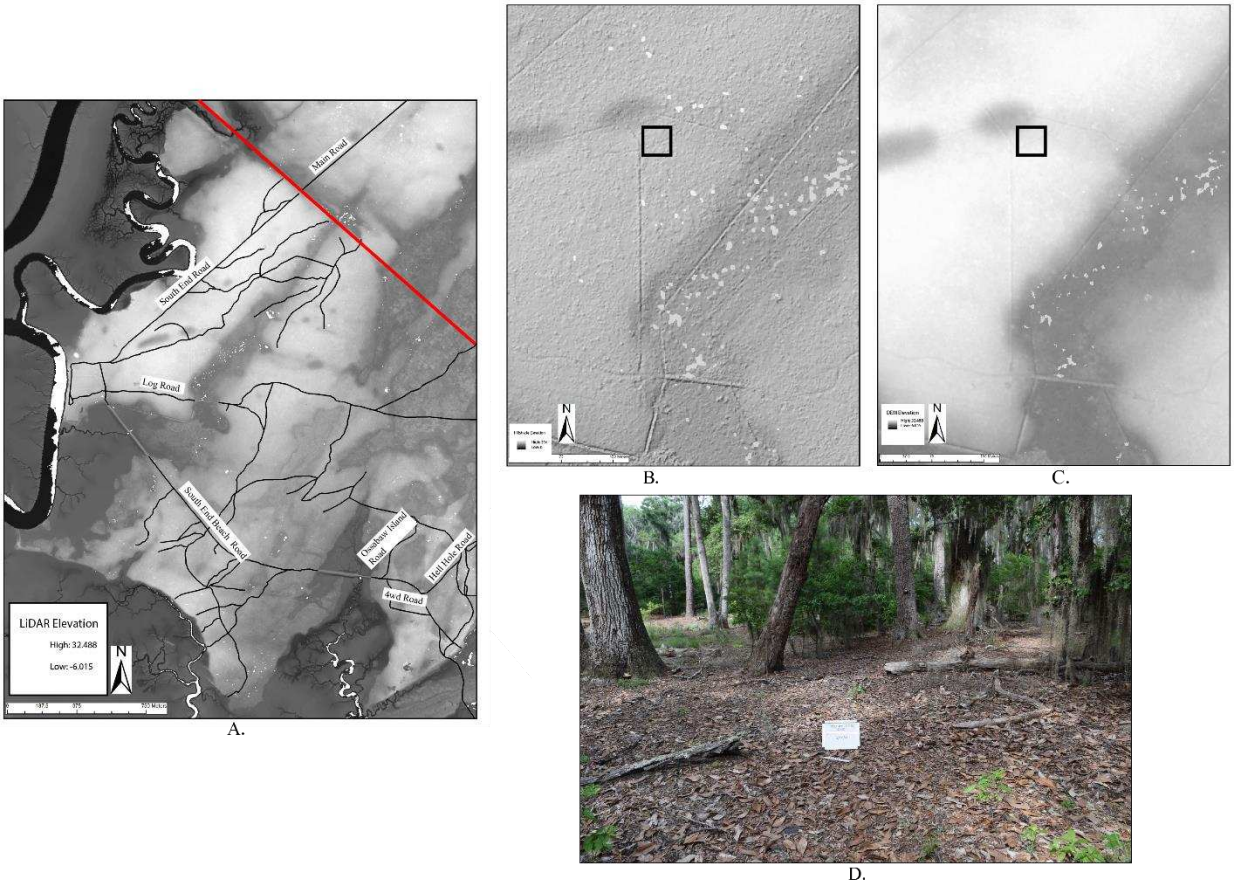


Figure 9. Example of road in Pasture Field identified in LiDAR. Primary roads still in use today are labeled. A: DEM of road; B: Hillshade DEM of road; C: Groundtruthing visit to road.

There were many linear features that were classified as roads for this project. It is possible - but unlikely - that some of the linear features do not date to the time the South End was occupied by the plantation, or some features classified as roads might represent paths instead. Large-scale maintenance of roads does not appear to have occurred after the South End abandonment, likely

as a result of the later smaller population. For example, families of freedman and later tenant farmers who lived on the island would have used some, but likely not all of the roads and paths previously utilized during the plantation period and those traveling on the island likely focused on using the primary roads. In general, the labor to create and maintain new roads did not exist after the South End was abandoned. Even later with GDNR management of the area, it does not appear that there were new roads created, but rather the focus was on maintenance of the primary roads meaning that most likely the majority of the linear features identified as roads in the LiDAR data likely date to the plantation period.

5.6 Ditch Paths

Ditch paths were defined as minimally prepared surfaces that allowed passage between ditches. The historical documents only mention the presence of paths, referred to as ditch paths, in two fields - Maple Swamp and Marsh Field (Journal 1856, 1858, 1859). The historical maps, however, do not show any features that could be ditch paths (see Figure 3). Overall, the LiDAR data did not show any defining topographic differences to assign identification confidently, and no defining characteristics were demonstrated within the historical maps. It is important to note that some of the curvilinear features assigned as roads, particularly ones with diminutive topographic relief might be better classified as paths. However, the resolution of the LiDAR data used here (1 meter) may not have been detailed enough to distinguish linear features that could be interpreted as paths. In general paths, would likely have been less than 1 meter in length. As a result, ditch paths could not be identified or have been possibly included as features under the road category.

5.7 Causeways

Causeways were defined as anthropogenic embankments that crossed low-lying marshlands. Causeways would have been important features during the plantation period to traverse the marsh areas but the term causeway was only mentioned twice in the documents, potentially because causeways could have been lumped under the maintenance work conducted on the roads. Or, it is possible that causeways were already built during the short-term plantation

occupation prior to Kollock beginning plantation operations and therefore did not require large amounts of specific enslaved labor to construct. The LiDAR data revealed four definite causeways (Figure 10).

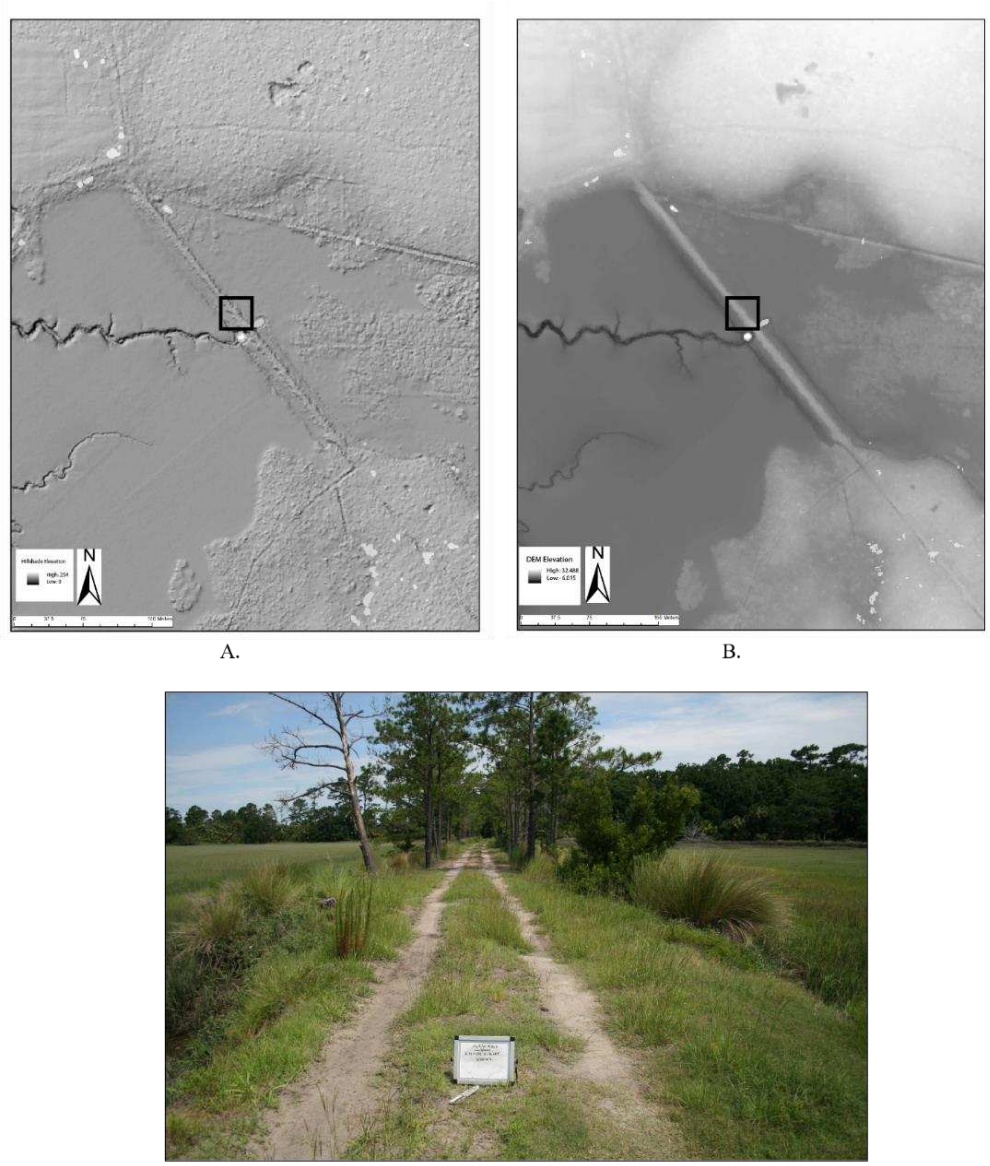


Figure 10. Example of causeway along South End Beach Road identified in LiDAR. A: DEM of causeway; B: Hillshade DEM of causeway; C: Groundtruthing visit to causeway.

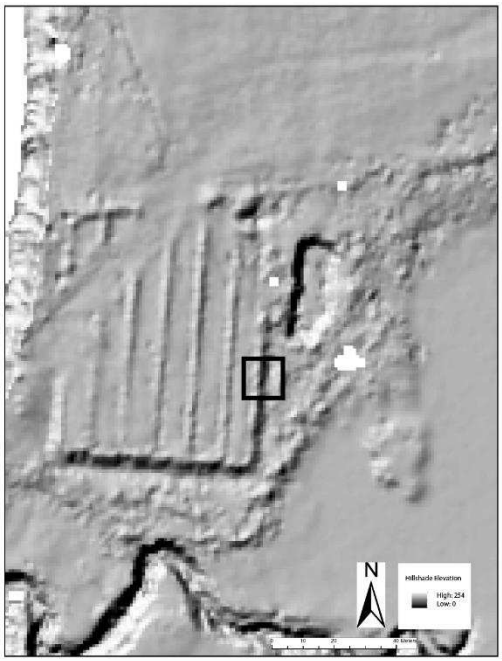
The largest and most prominent causeway was located adjacent to the cleared area of the South End and was part of South End Beach Road. It is possible that this causeway is the "causeway on the marsh" noted in the documents, since the field referred to as Marsh Field is located directly

adjacent. Another prominent causeway was just northeast from this and is likely the Maple Swamp causeway mentioned in an 1856 overseer letter to Kollock. In this letter, the overseer writes to Kollock updating on the plantation including that the enslaved individuals had been tasked with digging out a canal near Pasture Field (Hazel 1856b).

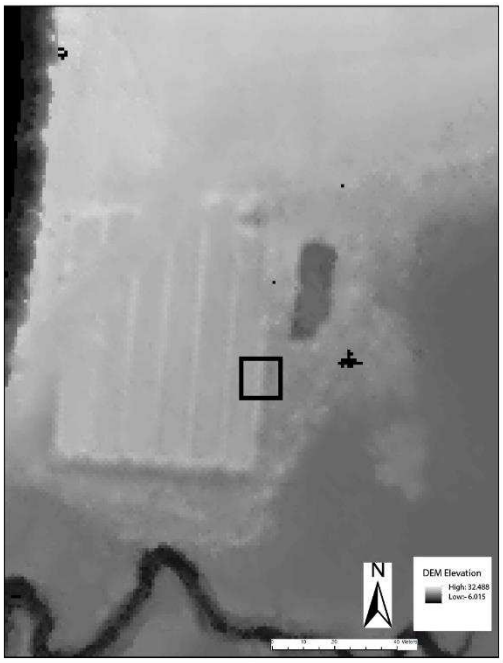
The other two causeways identified in the LiDAR were located in the southern portion of the South End but could not be tied to any of the other references within the documents. Overall, the elevation of the causeways ranged from between 0.5 m and 1 m on each side with the center ranging from 1.5 m to 2.5 m. Three of the four causeways identified in the LiDAR data were groundtruthed and all were found in good condition due to their continued maintenance by GDNR and use by visitors to the island.

5.8 Banks

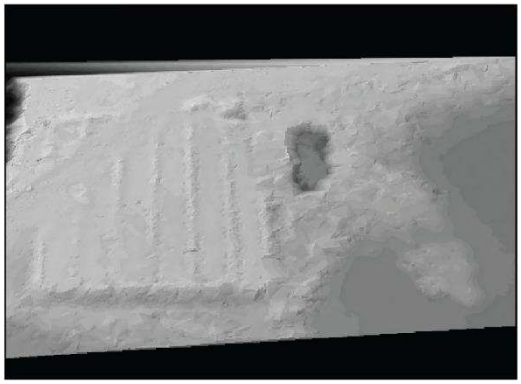
Banks were defined as raised linear features located within a field. Banks were not specifically mentioned within the historical documents, and the historic maps did not indicate any such features. While banks were not detailed in the historical record, the documents do note that small-scale cultivation of rice occurred during the South End and constructing banks was a common landscape modification to facilitate the growing of rice (Floyd Smith 1985; Stewart 2002). However, the LiDAR data only showed one area with banks, which may be the location of Rice Field which was under cultivation in 1858 (Figure 11).



A.



B.



C.

D.

Figure 11. A: LiDAR closeup of bank features; B: 3D digital elevation model of the banks; C: Groundtruthing of bank.

Figure 11 also demonstrates that a portion of the banks were destroyed at some point after their construction. However, this area could have also been created after the plantation was abandoned by the freed population or the later tenant farmers. No documentation has yet been found to confirm this. This area was visited during fieldwork, and besides the area that was destroyed, the banks were still visible and in good condition.

5.9 Dams

The historic maps did not detail the presence of dams and overall, the historical documents for the South End only detail the presence of two dams. A letter was written from Hazel to Kollock in October 1856 states, "I have finished the Marsh ditching I am not dredging off the dams and draining the dirt away from the ditches" (Hazel 1856b). In March of 1860, Kollock notes in his diary that enslaved individuals "finished planting corn in Sassafras No. 1 put down trunk Sassafras dam" (Diary 1860). Even though two fields- Marsh and Sassafras were mentioned as having dams, there were not any features in the LiDAR data that could be differentiated as dams. This could be a result of lack of good resolution in the data to identify dams or that while they may have existed in the South End, their structural integrity may not have lasted long enough to be able to discern them in the LiDAR.

6. Discussion of Reconstructed Layout

In order to reconstruct the layout of the South End plantation it required the incorporation of the datasets of both LiDAR and the historical record, as no single set of data accurately or comprehensively captured the plantation layout. Although those datasets were not without methodological problems, taken together, the reconstruction of the general layout for the South End was possible (Figure 12).

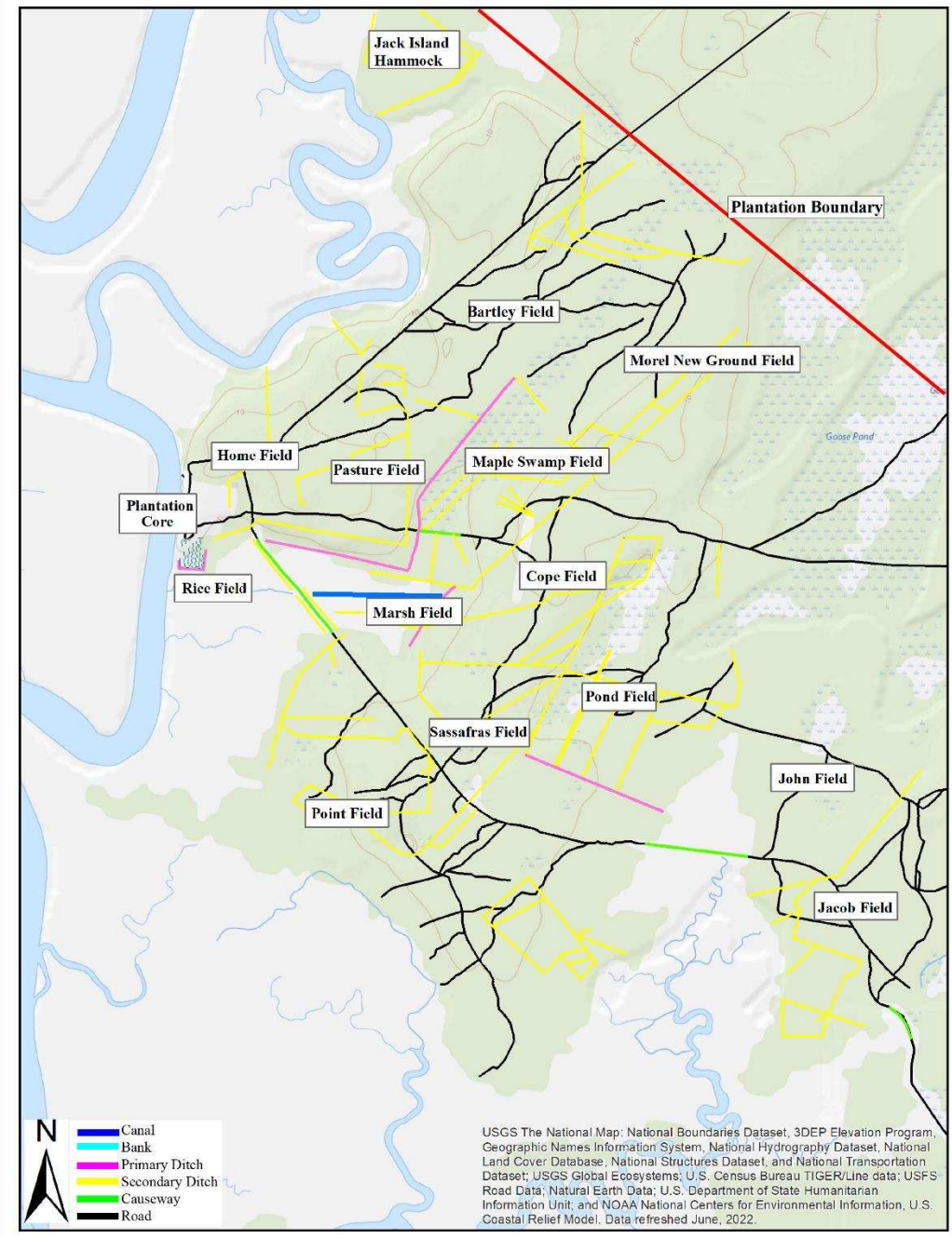


Figure 12. Reconstructed layout of the South End plantation.

The LiDAR data for the plantation showed consistent evidence of landscape modifications, particularly ditches, but did not show evidence of structures. The utility of the publicly available LiDAR proved essential for this particular research and such a wide view reconstruction of the South End layout would not have been possible without it. For example, the utility of the information recorded within the historic documents was indispensable in providing useful

context about enslaved labor and movement to different areas and agricultural fields within the plantation (see also Cochran 2021). The historic maps, although they depicted the South End after the plantation was abandoned depicted key markers to support the general location of structures, cultivated areas, and roads (see also Cochran 2021).

By layering and linking information from the different datasets, it was possible to reconstruct a general layout of the South End plantation. What has emerged is a wide scale view that reflects the typical layout of plantations in the region during the nineteenth century. The South End's plantation core was located on a bluff near a tidal creek with enslaved quarters arranged in a parallel arrangement with a central "street". Based on the evidence from the datasets, agricultural fields spread out from the plantation core with landscape modifications present through nearly the entire plantation boundary. As mentioned above, it is common for historical archaeologists to focus exclusively on the main core of plantation sites. Much of this has to do with the constraints presented to the archaeologist for the site itself. This leaves archaeologists to focus on small areas within a plantation, primarily the areas that held domestic structures and other outbuildings, while the wider layout and marginal edges of plantations are left unexplored. In leaving out a broader view, a complete picture of plantation life cannot be known, and it is increasingly evident that these areas were where the enslaved could exercise some degree of resistance or autonomy.

The surrounding environment of a plantation was a cultural landscape interwoven directly with power and authority, but also one known intimately by the community of enslaved workers. Now that a general layout of the South End agricultural landscape and extent of plantation period modifications have been reconstructed, it is possible to begin mapping out the enslaved landscape of the South End. LiDAR, particularly when combined with other datasets, can therefore become a tool for the voiceless. In this particular case, there is the ability to now investigate more fully the lived landscape of the enslaved community by mapping routes and activities of the enslaved in and throughout the plantation via the archaeological topographical evidence. As a result, it is possible to conceptualize, spatially, where enslaved individuals or groups were from day to day, and delve more deeply into rebuilding their lost geographies (see Roberts Thompson (2020).

7. Conclusion

One way for archaeologists to broaden the scope of plantation research is to incorporate LiDAR, when available, with other archaeological methodologies to construct a more comprehensive view of plantation landscapes. LiDAR, if it is not publicly available, is expensive and often difficult for archaeologists to incorporate. However, it is available in an increasing number of locations and with ever increasing coverage. In the United States at least, there is a nationwide effort by the U.S Geologic survey to collect LiDAR data for the country (USGS 2022). Additionally, the National Oceanographic and Atmospheric Administration (NOAA) also have LiDAR datasets available. State level LiDAR programs are also becoming increasingly available.

This research demonstrates the possibilities that exist for archaeologists whose research areas have publicly available LiDAR data. Further, this study offers a multi-method approach incorporating publicly available LiDAR data with information from the historical record, and how it can be used to reconstruct the broader cultural environment, in the case here a coastal plantation site. Without both the LiDAR and the information from the historical record, it would not have been possible to reconstruct such a complete view of the plantation layout nor would it have been possible to see the scale of modifications that occurred. The data presented here shows that by broadening the scope of research, with interlaced methodologies, beyond the plantation core, creates a way to provide a more holistic and complete understanding of enslaved life on a plantation.

While the research presented here is focused on a specific site type, elements incorporated in this research do have applicability beyond plantation period sites. Problems such as not knowing the layout of the site or having difficulty in identifying the scale and extent of cultural modifications due to a dense vegetative environment are common. Creative incorporations of other datasets, however, when articulated with LiDAR data provide a way to empirically evaluate the use of the landscape to reveal specific knowledge of places and movements within it (Johnson and Ouimet 2018). Thinking in such ways allows for archaeologists to give agency back to unrepresented populations within archaeological interpretation.

Acknowledgements

First and foremost, we want to honor and offer respect to the disenfranchised and marginalized people in the area in which this research occurred. We would like to acknowledge the Native American communities that originally inhabited Ossabaw Island and Georgia. Their story is not told in this case study, but is nonetheless an important part of the landscapes that came to be the home of enslaved individuals on the coast. The descendants of these peoples exist today and retain their ancestral connection to the land of Ossabaw Island. Secondly, we would like to acknowledge the enslaved people of the South End plantation who lived there from 1849-1861. Their names are as follows: Davy, Billy, Cudjoe, Andrew, Sam, Mingo, Lee, Big Jim, Little Jim, Big Ned, Little Ned, Christmas, Cyrus, Harry, March, Smart, Joshua, William, Prince, Caty, Juno, Die, Grace, Kate, Binah, Big Betsey, Beck, Sue, Ranger, Phillis, Jinney, Dolly, Mary, Harriett, Little Betsey, Alice, Eleanor, Moosa, Mira, Patty, Rose, July, Amelia, John, Little Andrew, Bob, Cornelia, Siah, Norris, Little Mary, Little Billy, Little Dick, Little July, Sarah, Peter, Fanny, York, Eliza, Carpenter Billy, Juno's Billy, Tumbler, Sam, Jupiter, Peggy, Little Primus, Kate, Adam, Little Abraham, Charlotte, Minty, Sarah Ann, Diannah, Catherine, Polly, Caty, Margaret, Little Ranger, Toney, Clara, Little Cyrus, Moses, Nero, Thomas, Martha, Henrietta, Lizzy, Little Grace, Hetty, Flora, Lucretia, Stephen, and Polly. Finally, we would like to thank the Georgia Department of Natural Resources, the Ossabaw Island Foundation, the Laboratory of Archaeology University of Georgia, and the University of York for their support on this project.

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Appendix A. Information associated with groundtruthing of LiDAR features.

Feature Type	Possible Field Name or Location	Recorded Width	Notes
bank	Rice Field	2.68 m	good integrity
bank	Rice Field	2.84 m	good integrity
bank	Rice Field	4.82 m	good integrity
canal	Marsh Field	n/a	hard to see
causeway	Maple Swamp Field	3.60 m	good integrity
causeway	South End Road	4.21 m	good integrity
causeway	South End Road near Jacob Field	4.80 m	good integrity
depression	Bartley Field/Morel New Ground	n/a	little water
pond	Jacob Field	n/a	water present; links to ditches
pond	Plantation Core	n/a	good integrity
possible pond	Jack Island Field	n/a	water present; rectangular shape
primary and secondary ditch intersection	Pond Field	2.30 m	water present; good integrity
primary ditch	Marsh Field	3.07 m	water present; hard to see
primary ditch	Marsh Field	4.40 m	water present; good integrity
primary ditch	Marsh Field	4.24 m	water present; good integrity
primary ditch	Marsh Field	4.79 m	water present; good integrity
primary ditch	Pasture Field	5.80 m	good integrity
primary ditch	Pasture Field	5.70 m	good integrity
primary ditch	Pasture Field	3.07 m	medium integrity due to slumping
primary ditch	Plantation Core	5.20 m	good integrity
primary ditch	Point Field	2.92 m	water present; good integrity
primary ditch	Point Field	measurements not taken	water present; good integrity

primary ditch	Pond Field	2.70 m	no water; good integrity
primary ditch	Pond Field	2.69 m	good integrity
primary ditch	Pond Field	4.89 m	water present; medium integrity due to slumping
primary ditch	Pond Field		good integrity
primary ditch	Pond Field	3.52 m	water present; good integrity
road	Cope Field	n/a	hard to see
road	Jacob Field	n/a	road hard to see but the area is clear of large trees
road	Pasture Field	n/a	fairly clear with large trees on the side
road	Point Field	2.56 m	fairly clear with some trees
road	Point Field	measurements not taken	fairly clear with large trees on the side
secondary ditch	Bartley Field/Morel New Ground	measurements not taken	hard to see; poor integrity
secondary ditch	Cope Field	2.40 m	hard to see/blown out
secondary ditch	Cope Field	2.51 m	hard to see/blown out
secondary ditch	Jack Island Field	2.03 m	good integrity
secondary ditch	Jack Island Field	2.05 m	good integrity
secondary ditch	Jacob Field	2.50 m	no water; good integrity
secondary ditch	John Field	2.06 m	water present; good integrity
secondary ditch	Maple Swamp Field	3.55 m	water present; good integrity
secondary ditch	Marsh Field	3.17 m	water present; good integrity

secondary ditch	Marsh Field	measurements not taken	water present; poor integrity
secondary ditch	Marsh Field/Sassafras Field	2.66 m	low water; medium integrity due to slumping
secondary ditch	Marsh Field/Sassafras Field	2.22 m	poor integrity due to slumping
secondary ditch	Pasture Field	2.60 m	poor integrity due to slumping
secondary ditch	Pasture Field	measurements not taken	poor integrity due to slumping
secondary ditch	Pasture Field	3.10 m	poor integrity due to slumping
secondary ditch	Pasture Field	measurements not taken	medium integrity due to slumping
secondary ditch	Point Field	3.01 m	medium integrity due to slumping
secondary ditch	Point Field	2.86 m	appears to be naturally widening due to proximity to marsh
secondary ditch	Point Field	1.63 m	poor integrity
secondary ditch	Point Field	2.68 m	good integrity
secondary ditch	Point Field	2.52 m	medium integrity due to slumping
secondary ditch	Point Field	4.01 m	medium integrity due to slumping
secondary ditch	Point Field	2.93 m	medium integrity due to slumping
secondary ditch	Point Field	3.70 m	
secondary ditch	Pond Field	2.88 m	water present; good integrity

secondary ditch	Pond Field	measurements not taken	water present; good integrity

Author Statement File

Amanda Roberts Thompson: Conceptualization, Methodology, Validation, Formal analysis, Investigation, Resources, Writing – original draft, Writing – review & editing

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