Exploring the Migration of the Roanoke Colonists

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Abstract--

Historical maps, archives, genealogies, and oral history indicate at least four (4) sites in North Carolina's Dare (2), Hyde (1) and Tyrrell (1) Counties as Native settlements. One or more of these sites may have provided sanctuary for refugees from the ill-fated colony established on Roanoke Island in 1587.

The archaeological research design of the Lost Colony Center for Science and Research consists of a predictive model using traditional data but also remote sensing applications, that is, aerial, satellite and geophysical. Environmental studies with remote sensing assist in confirming the sites as habitable. Optical imagery and processing provided the initial results about the locales being habitable (2003 URE Lost Colony Team).

Prior study of high-resolution satellite imagery of the Buckridge site in Tyrrell County identified environmental characteristics conducive to habitation. The ridge vegetation of mixed trees was distinct compared to the surrounding wetlands. However, at the highest available spatial resolution (1m) the vegetative canopy obscured the ground at these sites. This study also did not address other factors related to habitation.

The current study correlates remote sensing imagery with historical geospatial information to evaluate the suitability for settlement at three locales. For this study, settlement suitability is based upon observable, interdependent, quantifiable environmental factors governing habitability (settlement size and area), arability (soils and vegetation) and defensibility (geographical location and elevation). To determine these factors, data from satellite based Optical and ISAR instruments and aerial LIDAR are compared to observe and quantify the terrain and environment of the historical locales.

Interferometric Synthetic Aperture RADAR (ISAR) data allows penetration of obscuring vegetative canopies, although at a spatial resolution (30 m.) insufficient to detect discrete cultural features. Light Detection and Ranging (LIDAR) data provides adequate spatial resolution (<1 m.) but is subject to statistical uncertainties over small areas.

For this study, ISAR data from NASA's Shuttle RADAR Topography Mission and LIDAR data from the North Carolina Floodplain Mapping Program were compared to improve the site elevation accuracy. The use of new, public, environmental data sets provided the opportunity to refine the requisite settlement characteristics of habitability, arability and defensibility. The proximate location of sites to ECSU yielded an opportunity to establish ground truth for measurements made remotely. Once remote elevation and environmental data are validated, each site will be the focus of further *in- situ* study to confirm settlement characteristics.

The study continues with Geophysical applications, especially Ground Penetrating Radar, and geologic core samples at the sites with the requisite environmental and terrain characteristics. The 2005 URE project initiated this *in situ* study at Croatan (Dare) and at Goshen Ridge (Hyde).

I. Introduction

A. Background

In 1587, a group of about 117 colonists made a voyage from England to settle in the new land and attempt to seize one of the infinite possibilities of starting a new way of life. With this drastic jump into the depths of the unknown came many sacrifices. As time went on, resources became scarce and the colonists were in need of a representative to go back to England to obtain the materials needed for survival. It is recorded that they sent John White, governor of the colony, to England to retrieve the much needed supplies. Upon his

departure, he promised to be back in three months. Three months just so happened to turn into three years, and when he returned, there was no trace of the colonists anywhere. The only thing he found was a tree with the word CROATOAN carved into it. White vividly recalled a discussion he had with the colonists saying that if they were to abandon the settlement, then they should "not fail to write or carve on the trees or posts of the doors the name of the place where they should be seated."

B. Archeological Research Design

There are federal guidelines for archeological investigations. *Archeology and Historic Preservation; Secretary of the Interiors Standards and Guidelines (48 FR 44716-44742, September 29, 1983)* provides national general regulations for researchers. Cultural, natural, and historic landscape features, artifacts, and historic background information may be used to determine archeological site boundaries. The research team, this year, focused on Phase One, Identification. Background research for the study included previous archeological research that had been performed by our mentors and others. Mr. Fred Willard had a collection of historic maps of the projected sites. In the beginning of the research program, Mr. Willard showed the research team maps, copies of deeds, and other historical documents. A conventional survey may include an archeological site inventory, cultural resource reports, residents and people with local knowledge, archeological site and structures inventory, archival map research and local county histories.

In our research, we addressed the federal guidelines for archeological investigations and used modern day technology to assist in our progression. With the technological advances that occur in the field of science everyday, we are fortunate to be able to utilize these advancements as an aide in archeological studies. The combination of archeology and technology provides us with a dynamic opportunity to delve into the depths of American history using state of the art remote sensing applications.

C. Remote Sensing in Archeology

Detection of archaeological sites may be accomplished by several means including visual aerial reconnaissance and the use of remote sensors as aerial cameras, thermal infrared scanners, multispectral scanners, and space-borne radar. Remote sensing has proven to be useful in locating both surface and subsurface archaeological features. Much of human history can be traced through the impacts of human actions upon the environment. The use of remote sensing technology offers the archeologist the opportunity to detect these impacts which are often invisible to the naked eye.

Trying to locate archaeological sites is limited by several factors. Number one, it has to be small enough to be seen and comprehended from visible remains. Second, it has to be recognizable and visible in spite of subsequent human activities and constructions. Third, long exposure to the effects of nature, such as weathering and erosion should not make it unrecognizable.

Remote Sensing can overcome these limitations. Very large sites can only be seen in its entirety. Patterns of sites that may not be noticed or understood at ground level may be viewed at another perspective. Subtle variations in the soil color, in the density, height, or types of vegetations, or patterns of shadows may give suggestions to the underlying buried features.

We used a few types of remote sensing imagery in our research. LIght Detection And Ranging (LIDAR) operates at optical wavelength. Radio Detection And Ranging (RADAR) operates at Radio wavelengths (1 cm - 1 m). Ground Penetrating Radar detects inconsistencies underground (1 ft – 30 ft). The Shuttle Radar Topography Mission displays topographic imagery. We also used imagery from the IKONOS satellite.

II. METHODOLOGY

A. Hypothesis

We will compare and contrast the different imagery we obtain from the different remote sensing applications. The colonists removed to sites associated with Native American habitation and characterized by agricultural suitability, defensibility, sufficient settlement size, economic Prospects and whether they were within support range of Native American allies (Croatan) . Sites near Buxton on Cape Hatteras and near the Alligator River headwaters may conform to colonist proposed settlement requirements.

B. Approach

Locate remnant features indicating the location of the "Lost Colony" using an amalgam of remote sensing data processing and GIS techniques. Data: Optical imagery, LIDAR, ISA-RADAR, GPR. GIS Technology: GPS. The archeological methodology will include historical map comparison to locate known sites

The lost colony research team from summer 2003 examined IKONOS data. To continue the quest for information about the migration of the colonists, additional data was collected and analyzed. First, PG-Steamer was used to manipulate IKONOS data. The data enabled the team to focus in on optical data of one of the sites that the team would later visit. Buck Ridge appeared to have vegetation and levels of elevation at certain parts; this was confirmed by visiting the location.

C. Site Validation

Using remote sensing applications such as LIDAR and SRTM, we are able to distinguish the height differentiation between natural land features. With the retrieval of this data, we can evaluate the possible places the "Lost Colony" can be located. The data we possess shows the relevance to "Lost

Colony" studies because the fort would have been built on a ridge to escape flooding and for defensibility. This factor gives us a reason to assume that Buck Ridge, Goshen Ridge, and Buxton are possible sites where the "Lost Colony" could have migrated. Added to the fact that John White has documented writings saying the colonists were prepared to move 50 miles into the mainland. The area of Goshen Ridge (fig. 1) is approximately 50 miles from Roanoke Island.

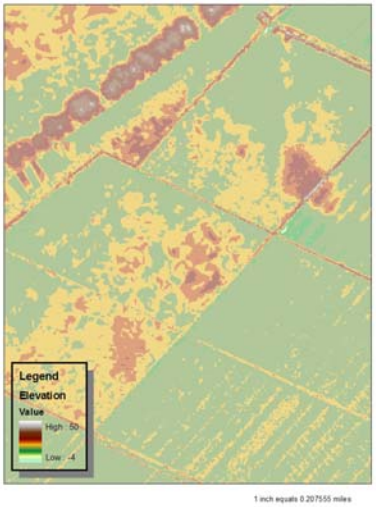

Figure 1 LIDAR image of Goshen Ridge (Tyrell County, NC)

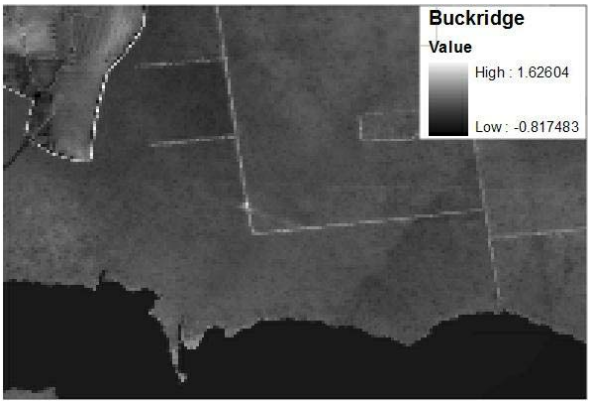

Figure 2, SRTM image of Buck Ridge

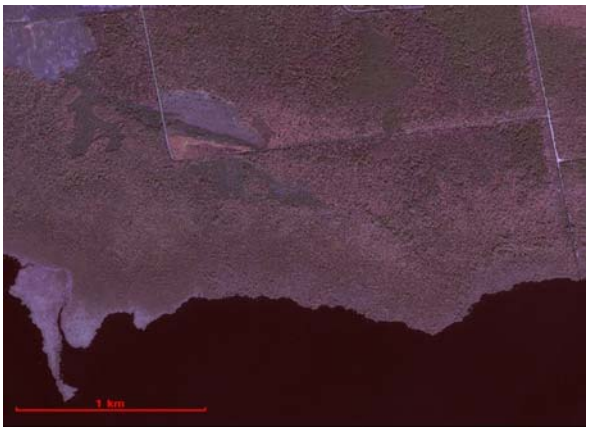

Figure 3, IKONOS image of Buck Ridge

The Alligators River has changed tremendously from 1585 to present and will still alter due to weather and other natural and environmental changes.

Figure 4, Historical Map of North Carolina

A. Abbreviations and Acronyms

LIDAR: Light Detection and Ranging
SRTM: Shuttle Radar Topography Mission
GPR: Ground Penetrating Radar
GPS: Geographic Positioning System
ISAR: Interferometric Synthetic Aperture Radar
NCFPMP: North Carolina Flood Plain Map
NASA: National Aeronautics and Space Administration
USGS: United States Geographic Survey

III. RESULTS

In the duration of our research we have tabulated outcomes displaying elevation, distance, and area measurements using locations off the Eastern Coastal Shores of North Carolina pertaining to IKONOS, LIDAR and SRTM satellite images. The chart above shows various calculations of Croatan (Dare County), Goshen Ridge (Hyde County) and Buck Ridge (Tyrrell). The figure above show a variety of elevations, distances, and areas at potential brumes. Berms on the IKONOS elevation chart indications range from dark green and grey to a purplish grey color. LIDAR indications range from dark orange to white, and SRTM indications range from light grey to white. The following assumptions articulate the locations of North Carolina Coastal berms along with precise elevation, distance, and area measurements.

Buck Ridge Data Table

Attributes (Buck Ridge)	IKONOS	LIDAR	SRTM	Soil 1988
Elevation		4.0 ft	2.5 ft	
Distance	1.27 mi	0.07 mi	0.97 mi	0.14 mi
Area	62.2 acres	1.1 acres	221.4 acres	166.4 acres

Goshen Ridge Data Table

Attributes (Goshen Ridge)	IKONOS	LIDAR	SRTM	Soil 2001
Elevation		7.0 ft	4.3 ft	
Distance	0.19 mi	0.05 mi	0.76 mi	0.50 mi
Area	133.1 acres	127.4 acres	233.7 acres	275.2 acres

Croatan Data Table

Attributes (Croatan)	IKONOS	LIDAR	SRTM	Soil 1992
Elevation		3.0 ft	4.8 ft	
Distance		0.18 mi	0.11 mi	0.19 mi
Area		7.7 acres	3.1 acres	89.6 acres

IV. Discussion

Our recommendations for future studies consist of historical map (GIS) study, airborne ISAR data, and Ground Penetrating Radar data. After the imagery study, we must also go to the sites in question and ground-truth the area, evaluate via archaeological survey, study living descendants, and also research other possible locations.

V. Acknowledgment

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