March 2008 Newsletter

Remote Sensing Analysis at Olivewood Cemetery, Houston, Texas

By Robert Marcom*

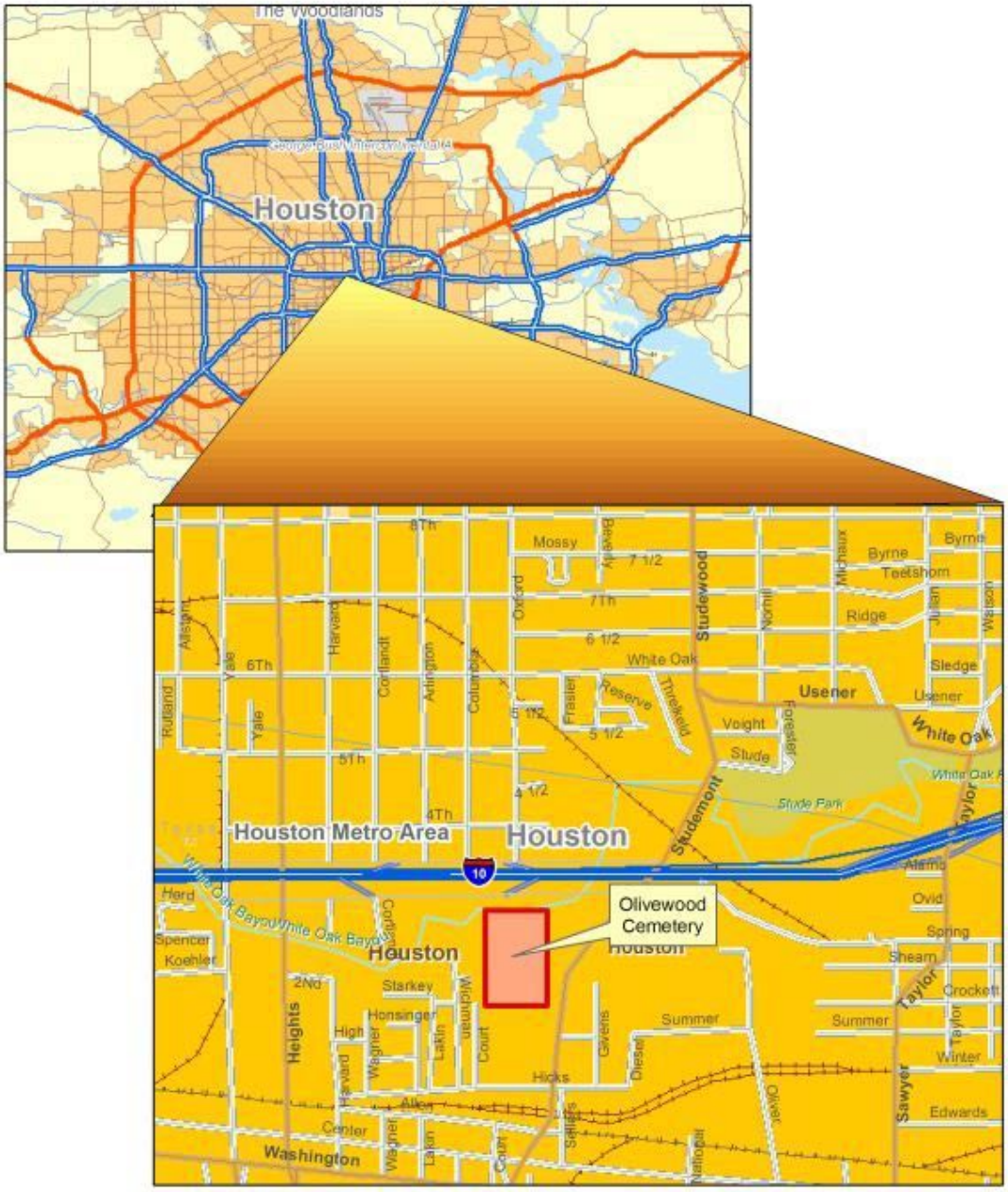
One of the earliest African American cemeteries in Texas may be found near the intersection of Interstate Highway 10 and Studemont Street in Houston. Officially incorporated in 1875, the Olivewood Cemetery is thought to contain graves dating as early as 1828. The Olivewood Cemetery is bounded on the south and west by city streets, on the east by a grocer's supply warehouse and on the north by the White Oak Bayou (Figure 1). Burials were first noted to be eroding out of the ground near the bayou during a pedestrian survey conducted by the Yates Community Archaeology Program (YCAP) in 2004. Human remains were found and documented during the survey, and the Olivewood Descendants, Inc. preservation group was notified.

On August 1, 2007, during an interview with the *Eyes of Texas* television magazine, I was approached by Debra Sloan and Margott Williams regarding the erosion at the Olivewood Cemetery and the resulting exposure of human remains. I agreed to undertake a Remote Sensing study to arrange for a boundary and elevation study of the cemetery, and to provide a report free of charge.

This article provides the findings of my interim report for this project, including a brief summary of the research design, methods, and preliminary conclusions resulting from the Remote Sensing data. For this project, I obtained images from the satellite instrumentation aboard the National Aeronautics and Space Administration's Earth Observing Program vehicles, otherwise known as the Landsat Program. These images contain data consisting of visible and infrared light captured during individual passes over Houston, Texas during 1984 and 2003 (Figures 2 and 3).

Of particular interest to this study are the infrared portions of the light spectrum. These frequencies capture information regarding the vegetation and soil moisture within and in the vicinity of the cemetery. The patterns of absorption, retention, and runoff may be inferred according to the amount of absorption and reflection of infrared energy (Jensen 2007: 512-15). In the case of soil and canopy moisture content for Landsat images the computer software program, ENVI was used for exploitation of the images. Infrared bands 4 and 5 were useful, as well as processes such as the Tasseled Cap Transformation for wetness, the Normalized Difference Vegetation Index, and the Normalized Difference.

Olivewood Cemetery Location
Remote Sensing Project Figure 1



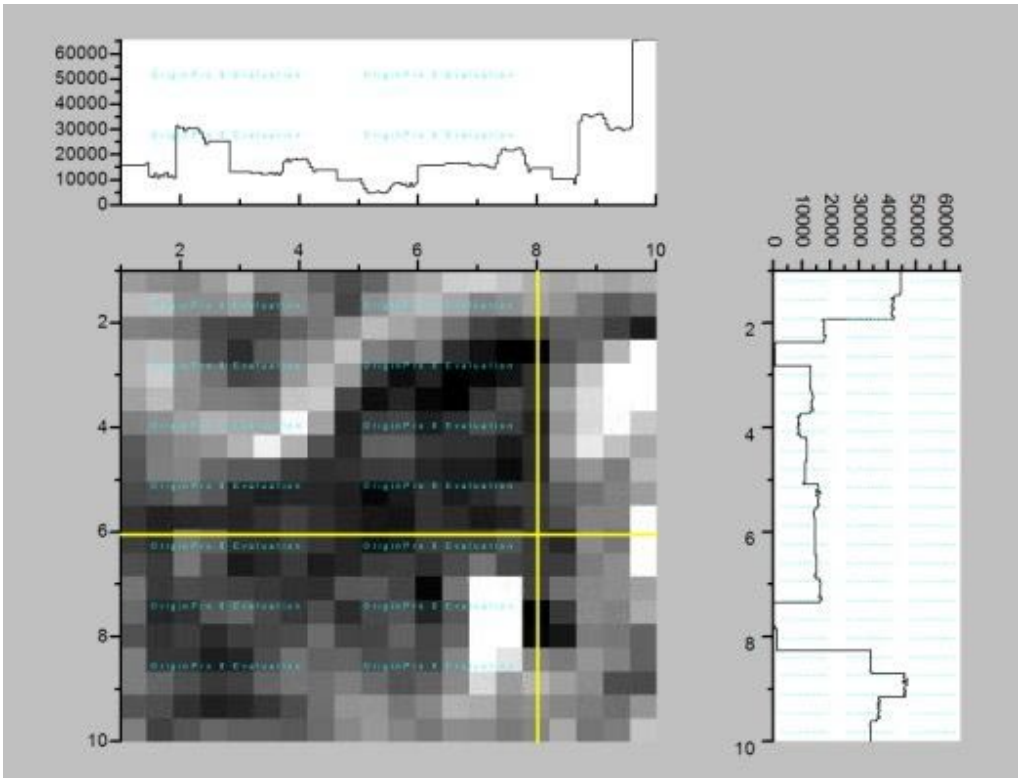


Figure 2: 1984 Landsat data, Band 5.

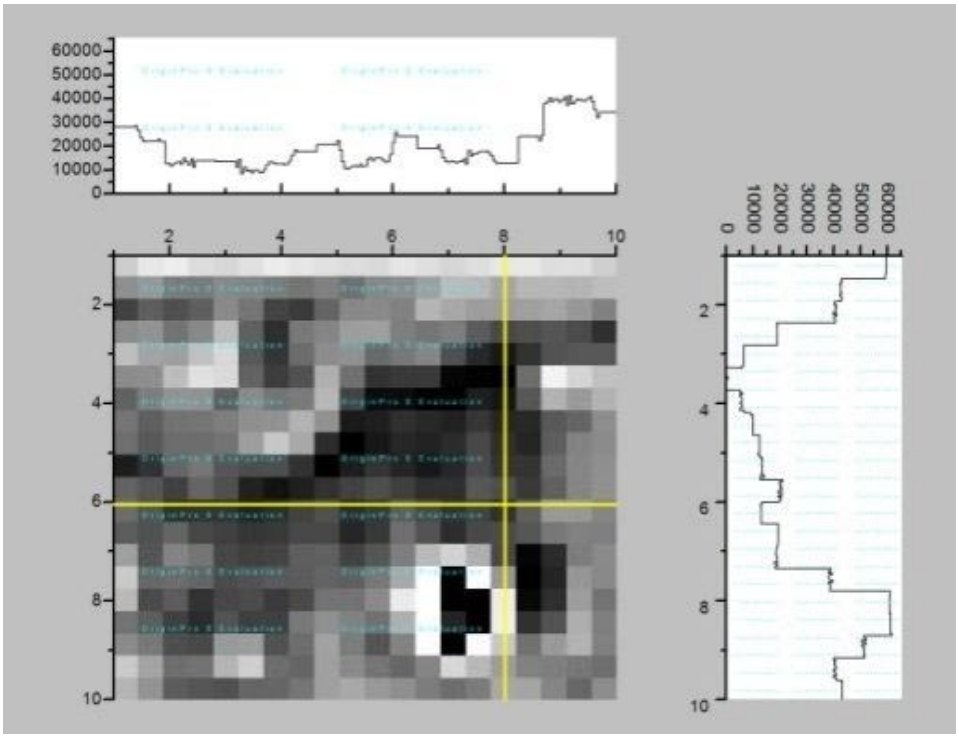


Figure 3: 2003 Landsat data, Band 5

Water molecules absorb infrared energy, so that energy is not available for reflection. Therefore wetter areas will appear darker on infrared images. This is especially true for the frequencies of infrared band 5 between 1.55 and 1.75 micrometers. The images, seen to the right, were further processed and graphed using the scientific graphing application, OriginPro version 8. The results were converted from the grayscale values in Figures 2 and 3 to color representation. Greyscale values for Landsat images range from 0 to 255. The colorized graph utilizes an arbitrary scale which is not important for our purposes. The colors are arranged from cool (blues and greens) to warm (reds, oranges and yellows).

The Resolution of these images and graphs is rather coarse when considered alongside ordinary aerial photographs, but this resolution is more than sufficient to our purposes. Each pixel represents approximately 30 square meters, or 100 square feet in the original Landsat image. These images have been enlarged times 10, so each colored block represents 3 meters, or about 10 feet. The graph in Figure 4 demonstrates two areas of interest: a broad area of wetness (A) across much of the cemetery and adjoining property, and an area of dryness (C) which coincides with the area of erosion and exposure of human remains.

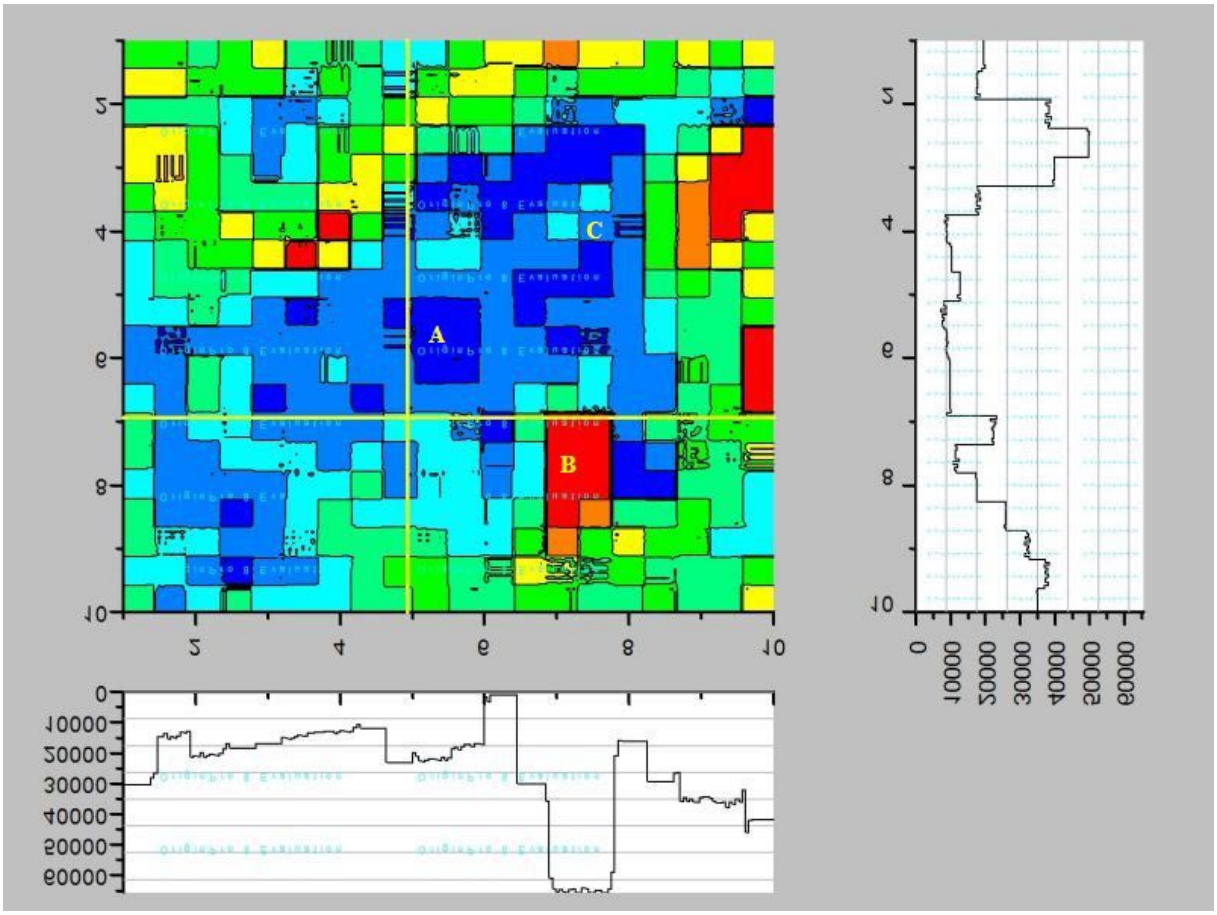


Figure 4: Graph of the 1984 Landsat image, Tasseled Cap Wetness Transformation

In Figure 5 we see that the area of wetness is significantly decreased indicating that less water is being absorbed. In addition the area (B) which had previously been indicated as dry (red) now appears saturated (blue).

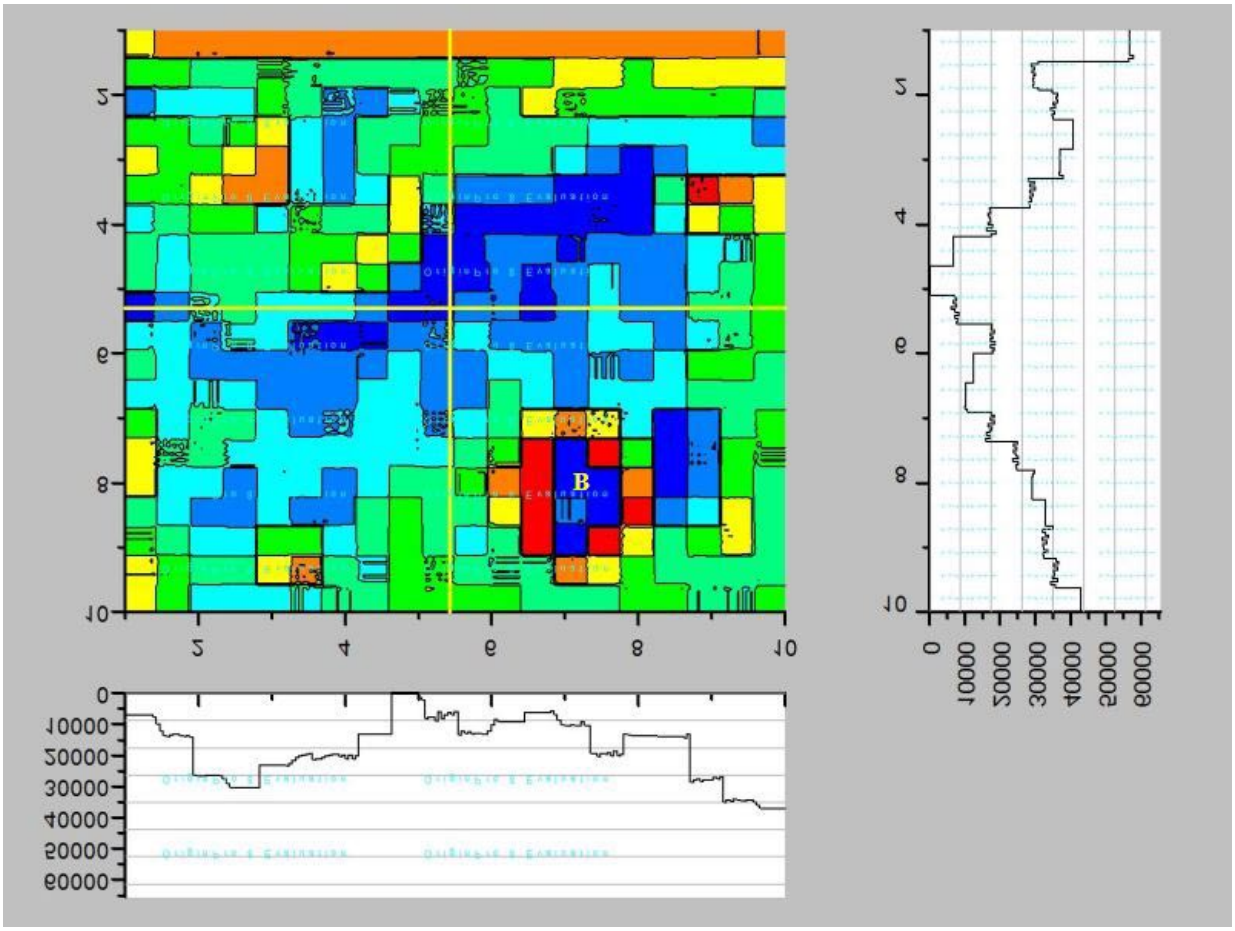


Figure 5. Graph of the 2003 Landsat image, Tasseled Cap Wetness Transformation

Seasonal differences, variation in shadowing, foilage cover and perspective due to track and field of view have been considered and accounted for. Other explanations for these changes are required.

Preliminary analysis indicates that absorption across the area including the cemetery has been decreased. The entire eastern margin of the cemetery is now wetter, and a significant increase in wetness is observed in an area known to be eroding. This change may be due to construction to the south of the cemetery.

Harris County Appraisal District records indicate the construction of 3 warehouses by Grocer's Supply since 1986. Aerial photographs (Figures 6 and 7) demonstrate that rain water

which falls on these structures must run into the cemetery and eventually make its way to the White Oak Bayou. During periods of torrential downfall over the past 20 years, a frequent occurrence in the Houston area, the rainwater runoff may have caused the erosion and consequent exposure of buried remains. It is my preliminary and tenative conclusion that there is sufficient cause to suspect the construction south of the cemetery to be the primary reason for the increase of erosion.

Further analysis is necessary before a conclusive statement can be made regarding causes and effects for the changes in runoff patterns at the Olivewood Cemetery. I have recommended that both boundary and elevation surveys continue as planned. Other spectral and spatial data will be analyzed, a determination of correlation undertaken, and a formal report of the findings of that analysis will follow in a next phase of the project.

Figure 6. Aerial photograph of the Olivewood area

Figure 7. Close view of the structures south of the cemetery

References Cited

Jensen, John R. *Remote Sensing of the Environment.* Upper Saddle River, NJ: Pearson Prentice Hall, 2007.

Computer Applications:

ESRI ArcGIS 9.0; 9.2
http://esri.com/software/arcgis/index.html

ENVI Remote Sensing Data Exploitation Software
http://www.ittvis.com/envi/

OriginPro 8 Data Analysis and Graphing Software
http://www.originlab.com/index.aspx?s=8&lm=10

Note

* Robert Marcom is currently Site Supervisor for the Yates Community Archaeology Program, a project of the Rutherford B. H. Yates Museum of Printing History, in Houston, Texas, and also Associate Director for the Community Archaeology Research Institute. He may be reached by email at rmarcom@uh.edu.

Return to March 2008 Newsletter:

http://www.diaspora.uiuc.edu/news0308/news0308.html