IMPROVING LIDAR PROCESSING METHODS FOR ARCHAEOLOGICAL SITE MANAGEMENT: A CASE STUDY FROM CANAVERAL NATIONAL SEASHORE PARK

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Project

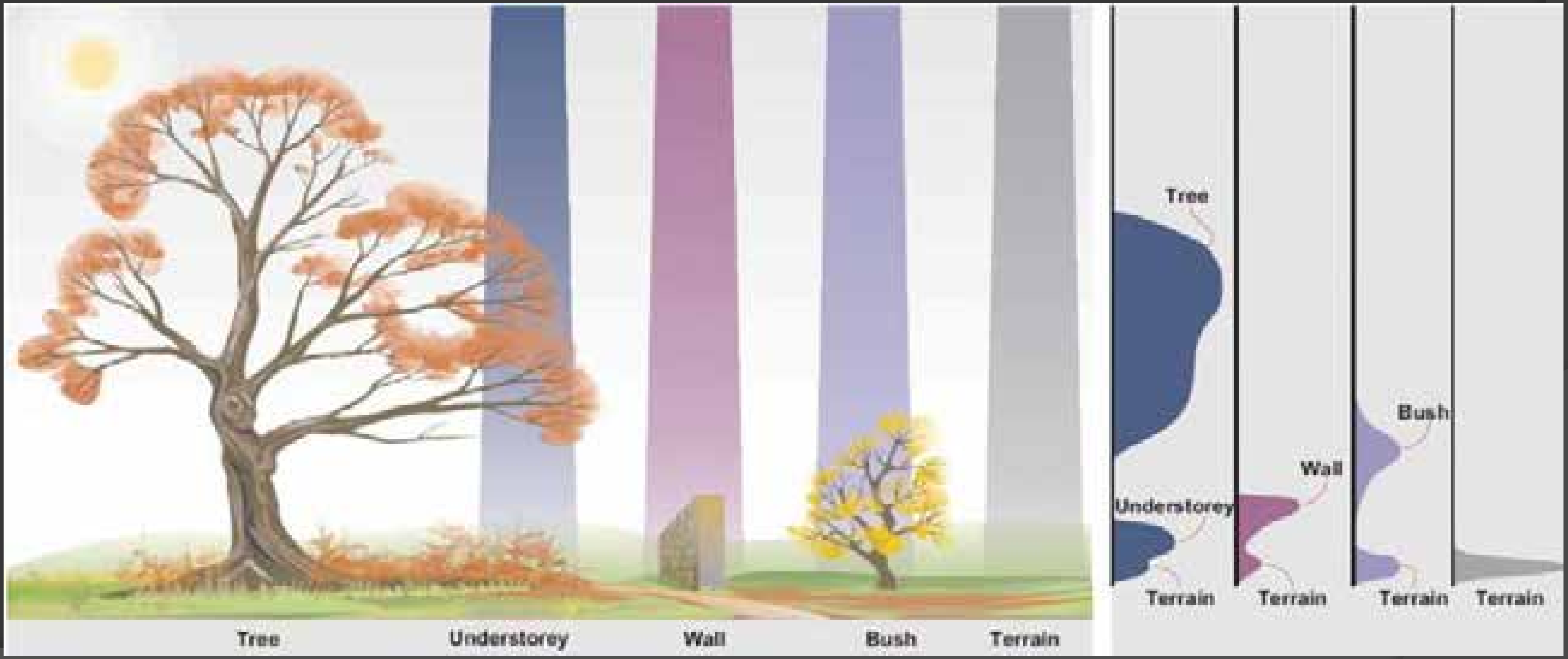
- June - August 2011: Southeastern Archeological Center (SEAC)
  - Fieldwork at the Canaveral National Seashore Park (or CANA) in New Smyrna, Florida.
  - Archeological data recovery, develop management plan.

Project

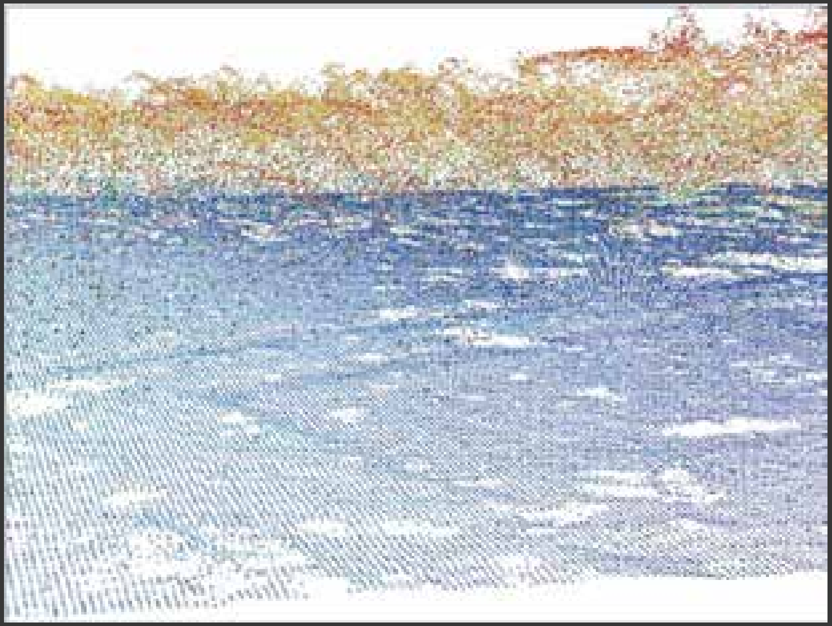
- Alliance for Integrated Spatial Technologies (AIST)
  - Research core at the University of South Florida
  - Preserving and protecting the world's cultural and natural heritage through education and global engagement.
- Management considerations include erosion processes, habitat restoration, and inaccurate sites boundaries and terrain maps.
- Total station data and survey grade GPS coordinates taken at CANA sites.

Airborne LiDAR

- Remote sensing technique (Light Detection and Ranging).
  - Uses a laser scanner mounted to an airborne platform.
  - Scanner emits near infrared light pulses directed toward the ground at a rate of 30,000 to 100,000 pulses per second.
  - Positions of objects are determined by computing the time delay between the emission of the pulse and each received echo.



Crutchley 2010



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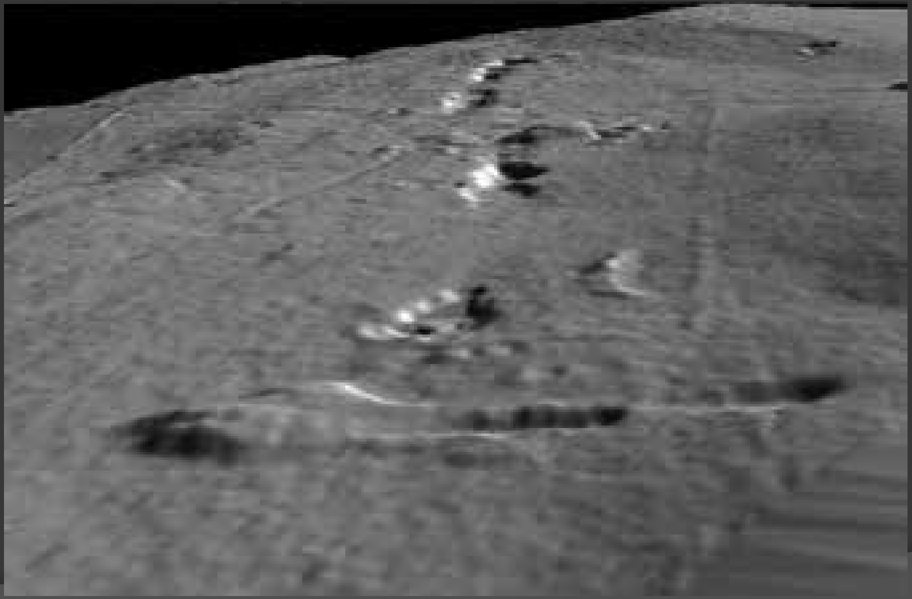


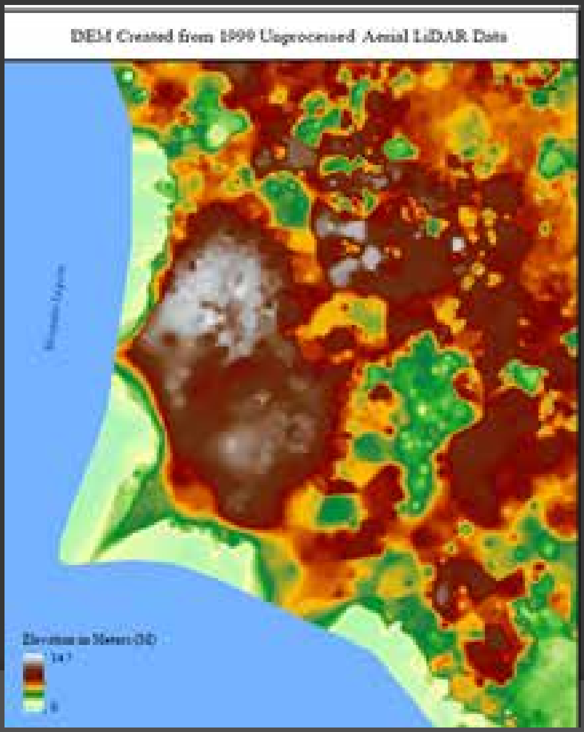
Crutchley 2010

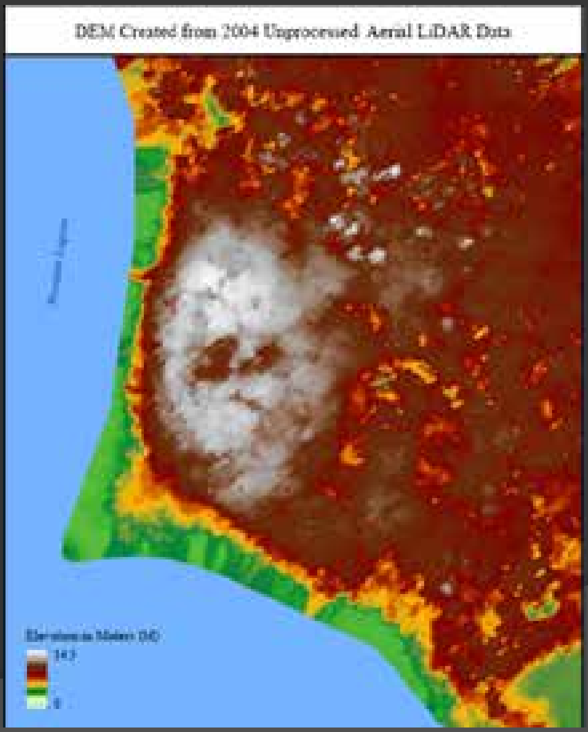
Point Clouds

- Echoes are mapped into three dimensional point clouds.
  - Provide direct range measurements between the laser scanner and earth’s topography.
- Data points are given real world coordinates through the combination of a Global Positioning System (GPS) and an Inertial Measurement Unit (IMU).
- Digital Elevation Models (DEMs)
  - Represent a “bare-earth” digital visualization of the terrain without any obscuring points related to vegetation or above ground structures.

LiDAR issues

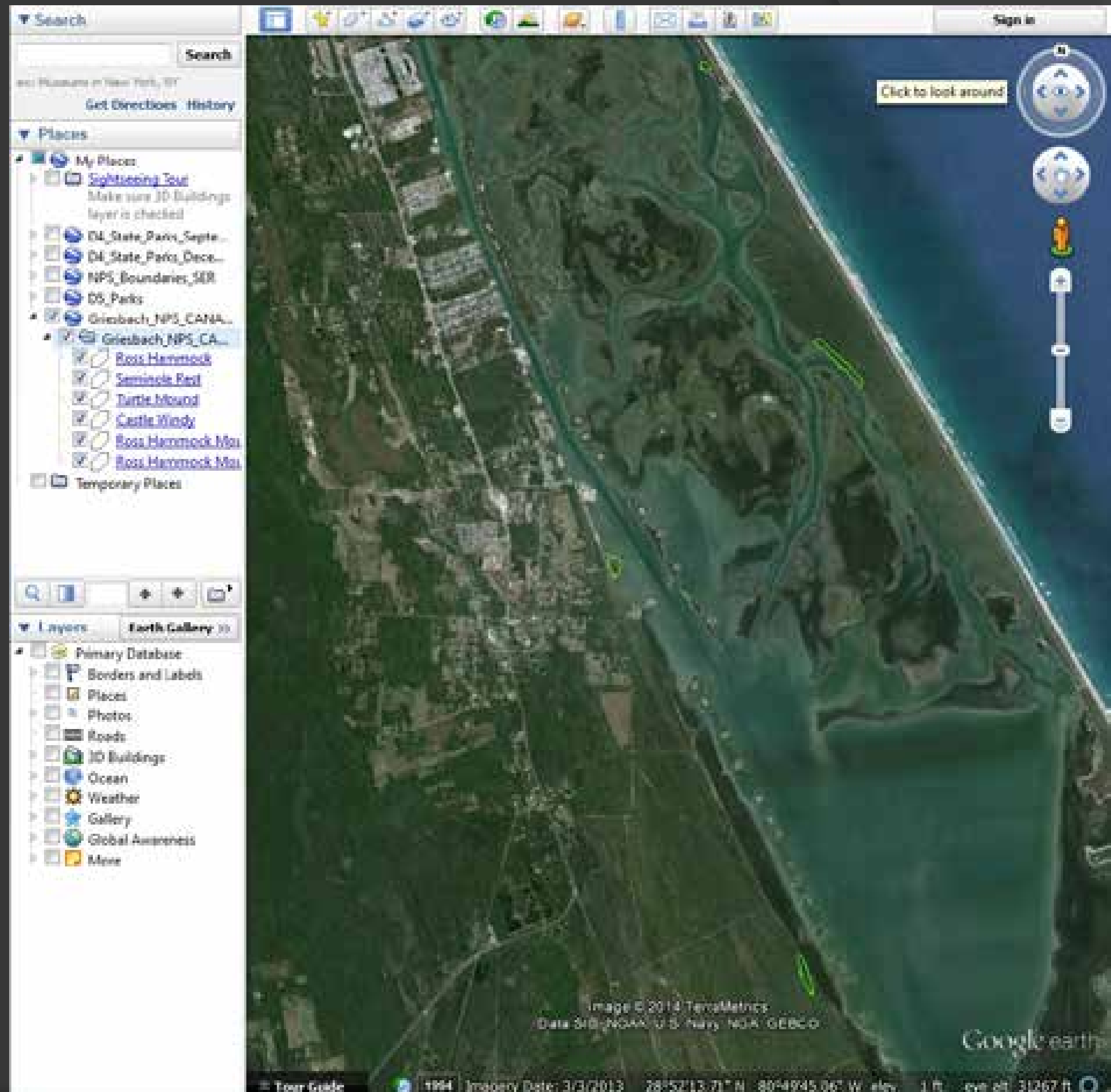
- Algorithms are used to automatically eliminate LiDAR points that are considered “errors”.
  - Archaeological features are sometimes mistaken for these “errors” and accidently eliminated from the collected LiDAR data.
  - Such occurrences can have numerous negative effects in terms of the preservation and study of the archaeological feature(s) in question.



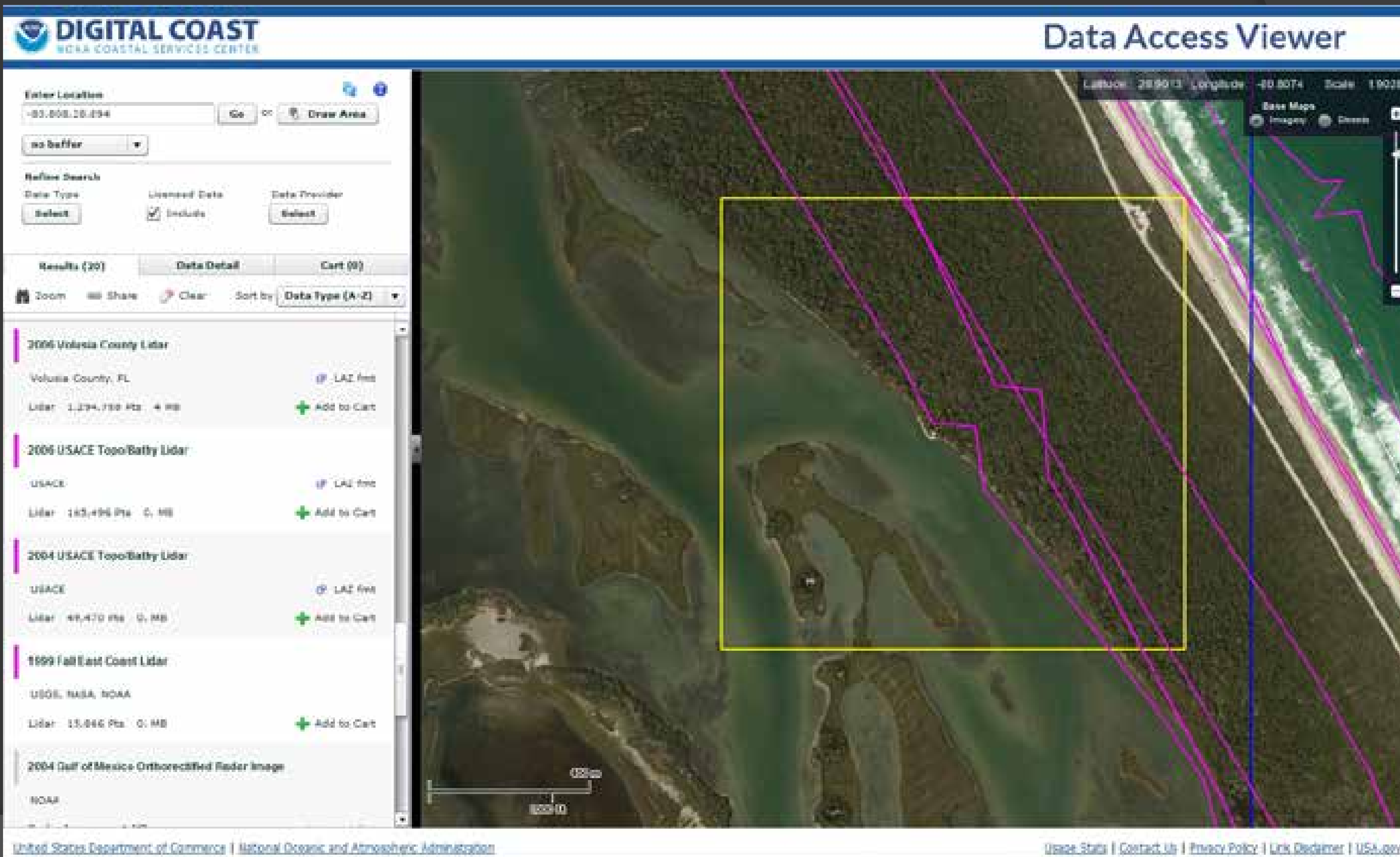


Thesis

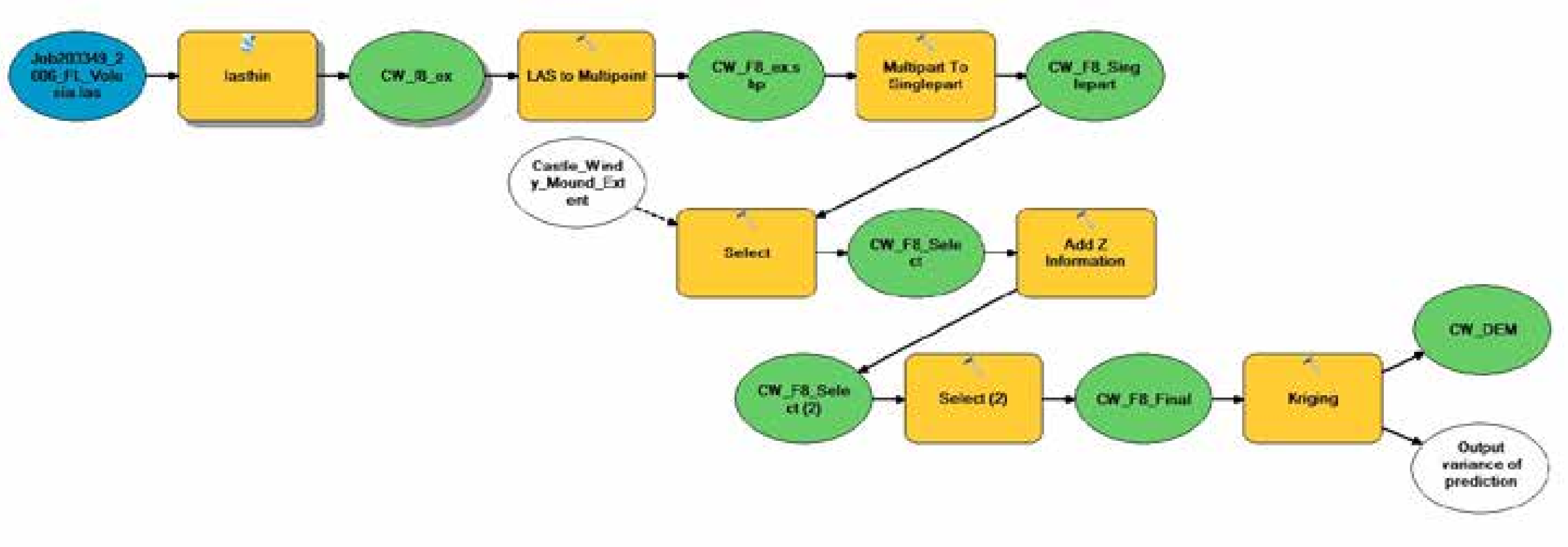
- Ground-based, survey-grade GPS coordinates and total station data can complement LiDAR data.
  - Provide multiple sources of additional information regarding archaeological features at different scales of precision.
- What data processing methods can be used in conjunction with supplemental data to improve archaeological site LiDAR signatures?



LiDAR Data Acquisition



Methods



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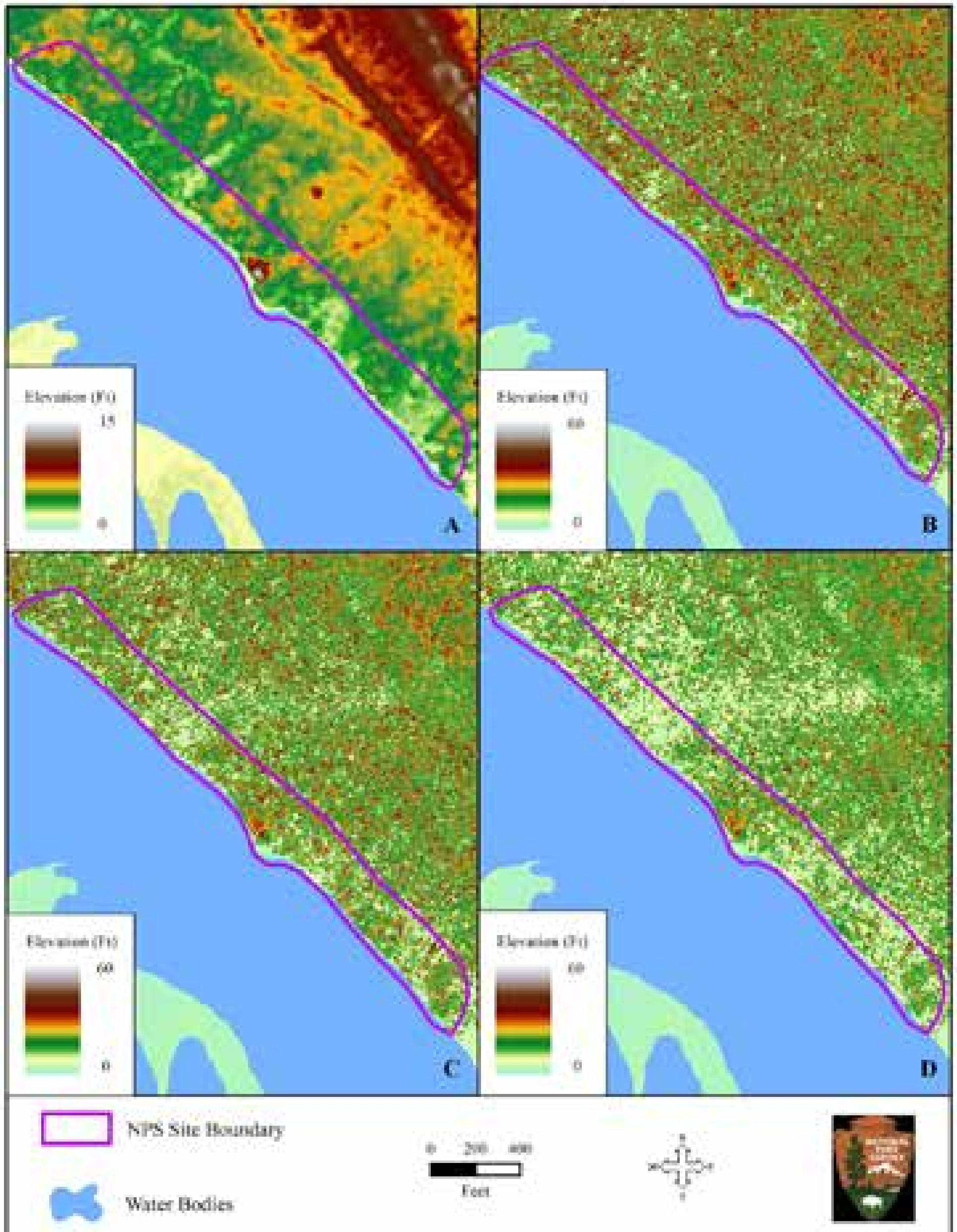
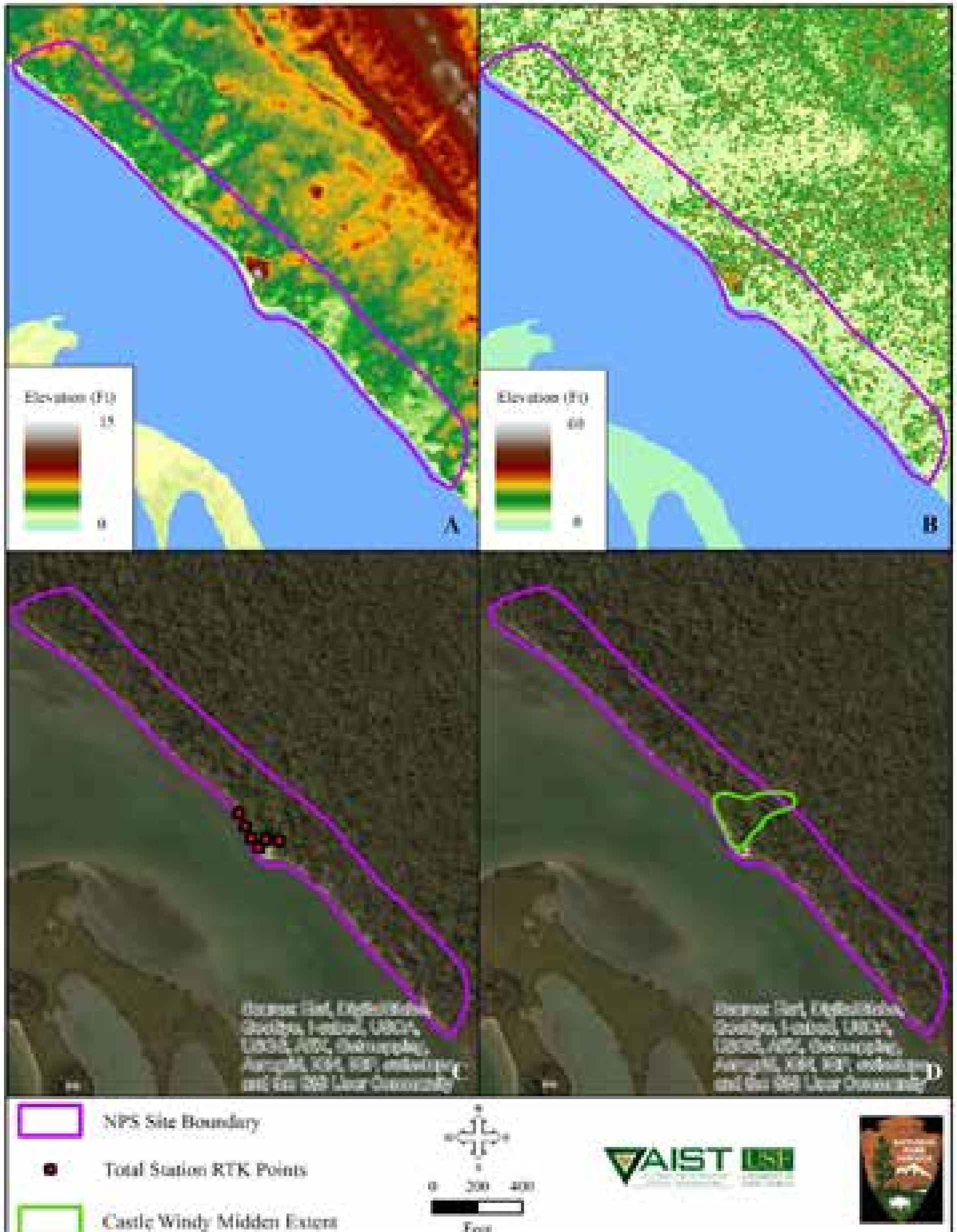


Figure ###: A) Digital Elevation Model (DEM) of Castle Windy derived from "Ground" classified NOAA LAS data points. B) DEM derived from unclassified, any return LAS data points. C) DEM derived from unclassified LAS data points thinned by a factor of 4 using LASthin tool. D) DEM derived from unclassified LAS data points thinned by a factor of 6.



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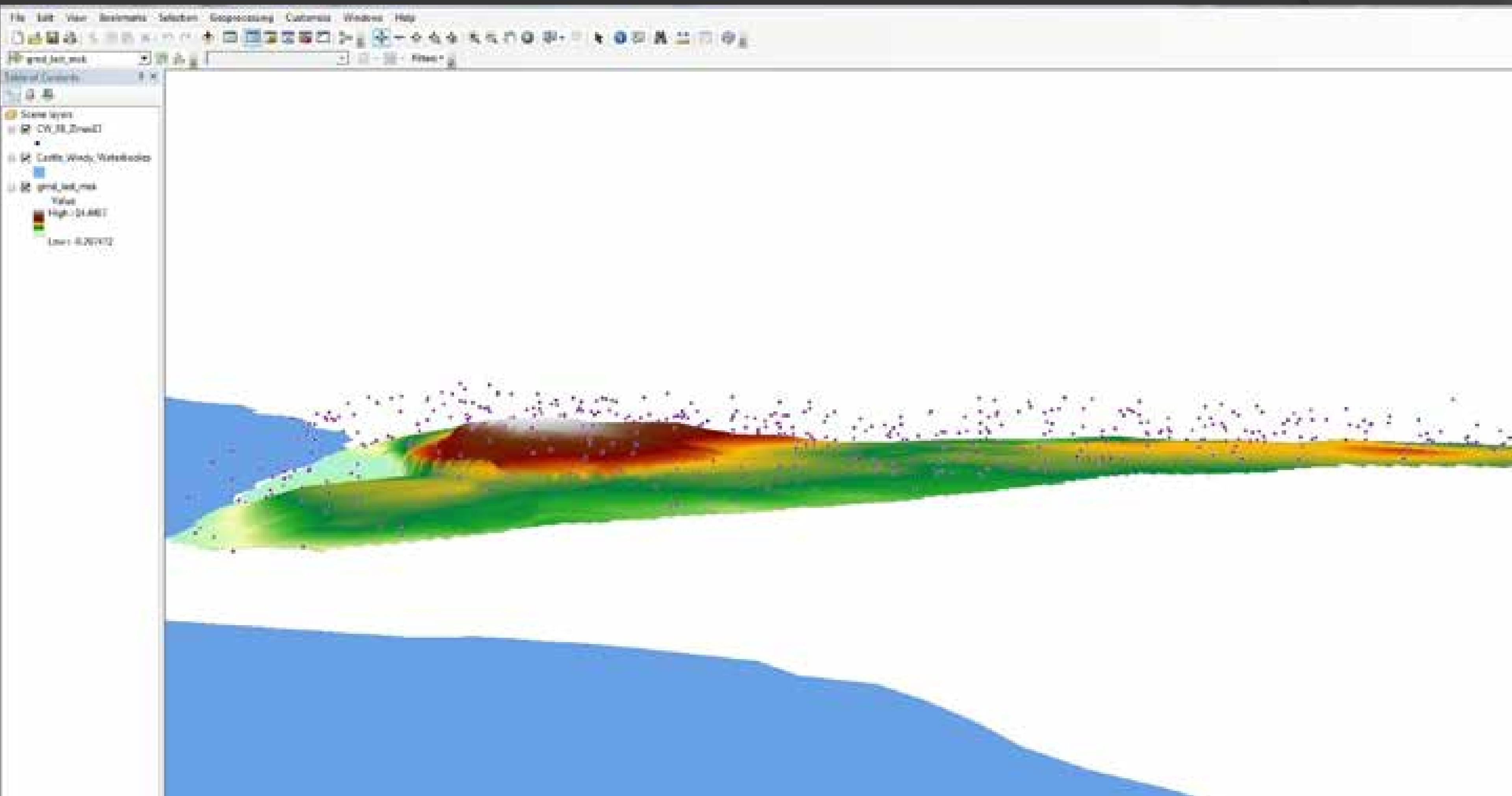
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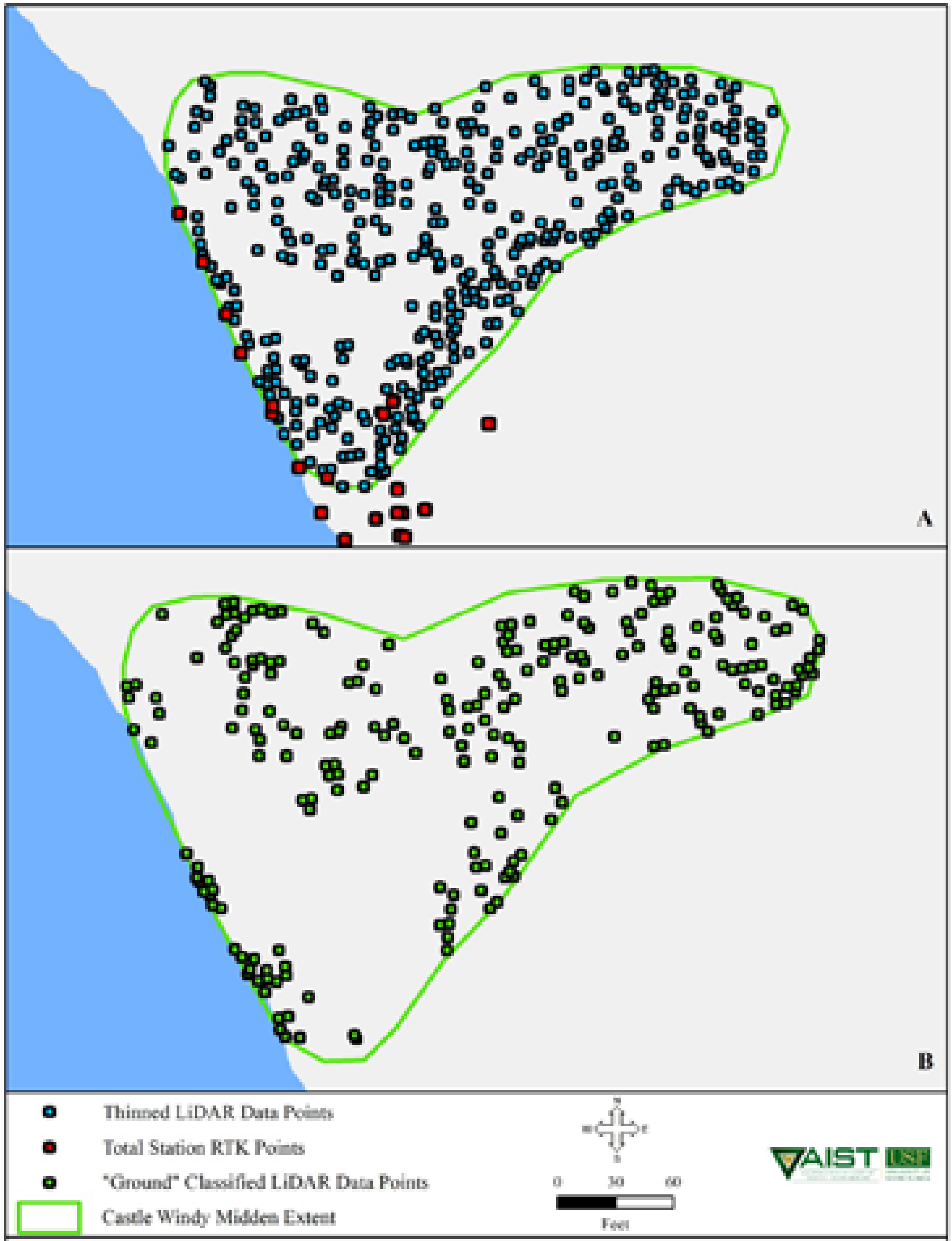


Figure ###: A) Unclassified LiDAR data points thinned by a factor of 8 using the LASthin function within LAStools. Data points considered to not be representative of the ground surface have been manually removed. Total Station RTK data points points collected by AIST are shown in red. B) LiDAR data points automatically classified as "Ground" through slope-based algorithms.

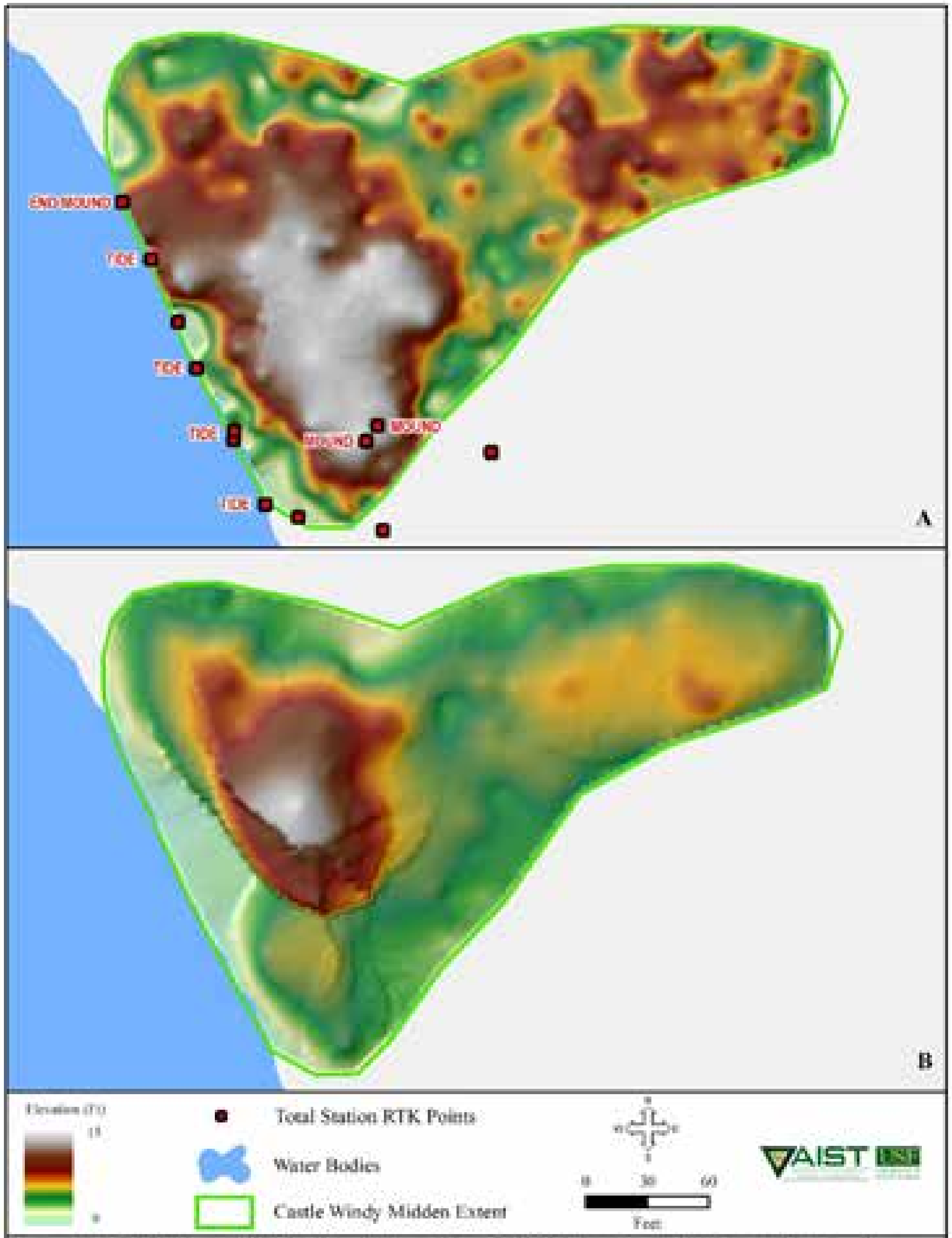
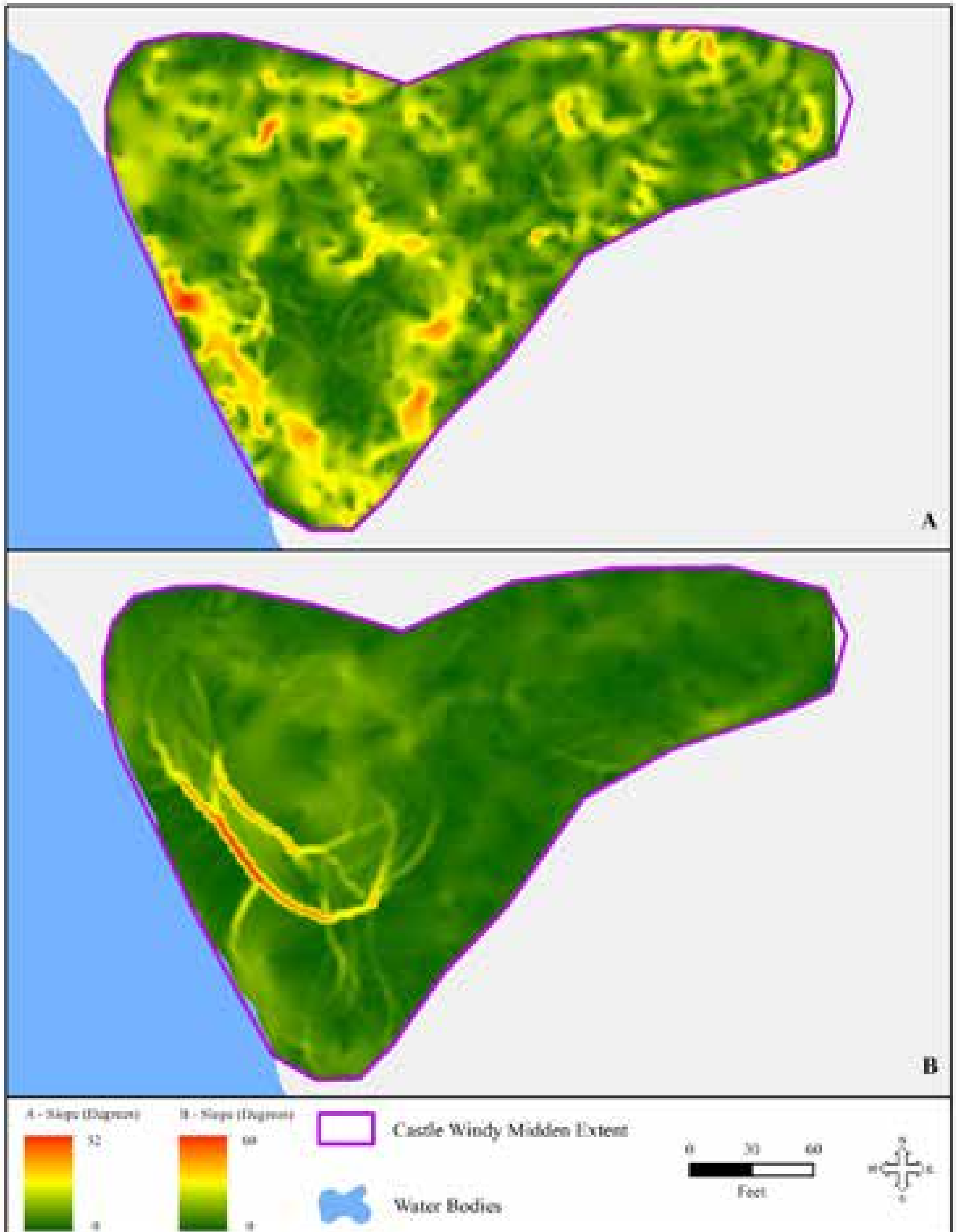


Figure ###. A) Digital Elevation Model (DEM) produced with unclassified LiDAR data points thinned by a factor of 8 and manually cleaned of error points. Total Station RTK data points points collected by AIST are shown in red, with labels denoting landscape features where points were taken. B) DEM produced with LiDAR data points automatically classified as "Ground" through slope-based algorithms.



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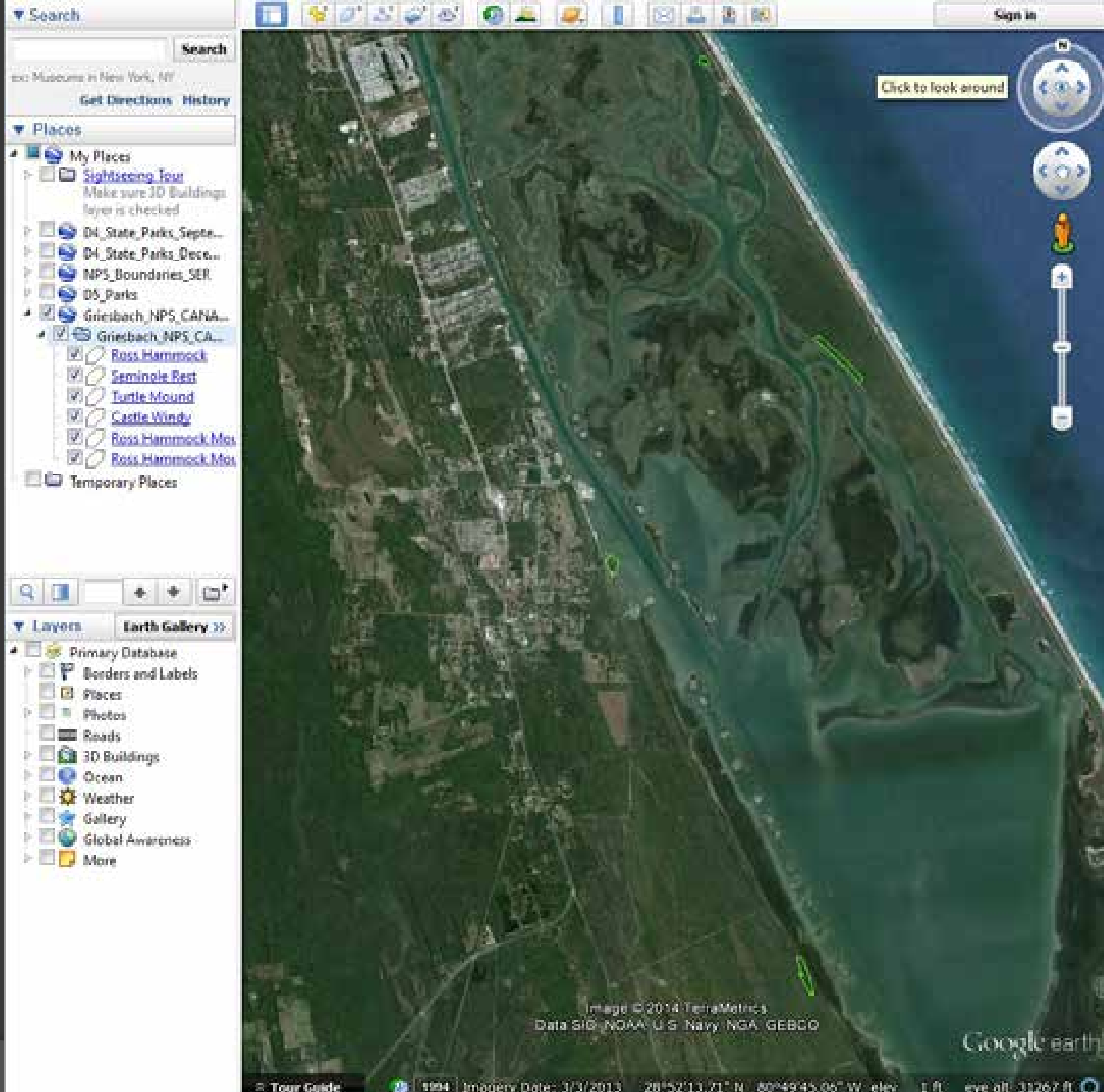
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Reference Cited

Crutchley, Simon

2010 The Light Fantastic: Using airborne lidar in archaeological survey. Swindon: English Heritage.