

# Elevation Changes Associated with Various Salt Marsh Plant Communities

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Photo Credit: Anne Ribereau-Gayon  
Making note of crab burrows, soil sample locations and vegetation type.



Nikon DTM 550 Total Station used for surveying the marsh



Using the total station to record the survey points and the vegetation type at each point.



Salt marshes are important habitat for plants and animals.



Photo Credit: Anne Ribereau-Gayon  
Placing flags as guides for survey lines.

## Abstract

Denudation of salt marsh vegetation (salt marsh dieback) on Cape Cod, MA is driven by herbivory of a native, nocturnal crab species, *Sesarma reticulatum*. Large areas of bare sediments as well as rapid shifts in the distribution and abundance of salt marsh plants are occurring at the mouth of the Herring River in Wellfleet, where high densities of these crabs occur. We conducted ground-based elevation surveys in 2011 and 2012 to assess annual change at this site. In addition, we compared results with a 2011 LiDAR survey. Very large differences between the LiDAR and ground based elevation surveys were observed, which was likely due to the inability of the airborne LiDAR to penetrate the vegetation canopy. Where the vegetation canopy has been lost to herbivory driven dieback, airborne LiDAR may be able to produce relatively accurate elevation data. Comparison of the two ground based elevation surveys indicates that elevation loss is detectable using highly accurate survey methods and that these losses occur in sparsely vegetated or bare sections of the marsh. Shifts in plant distributions and variable sediment accumulation rates associated with these communities will synergistically lead to continued rapid change in the physical and biological characteristics of this site.



Photo Credit: Tyler Coverdale  
*Sesarma reticulatum*, the purple marsh crab, at the mouth of a burrow.



A large area of salt marsh dieback in the study area at the mouth of the Herring River, Cape Cod, Massachusetts.

## Vegetation Map

To map the vegetation in the salt marsh, a total station was used to measure and record the coordinates of each survey point. At each point was coded with the species that were present. Using ArcView, I went through the steps shown in the flow chart below to create the map below, which shows the extent of each plant species and the dieback areas.

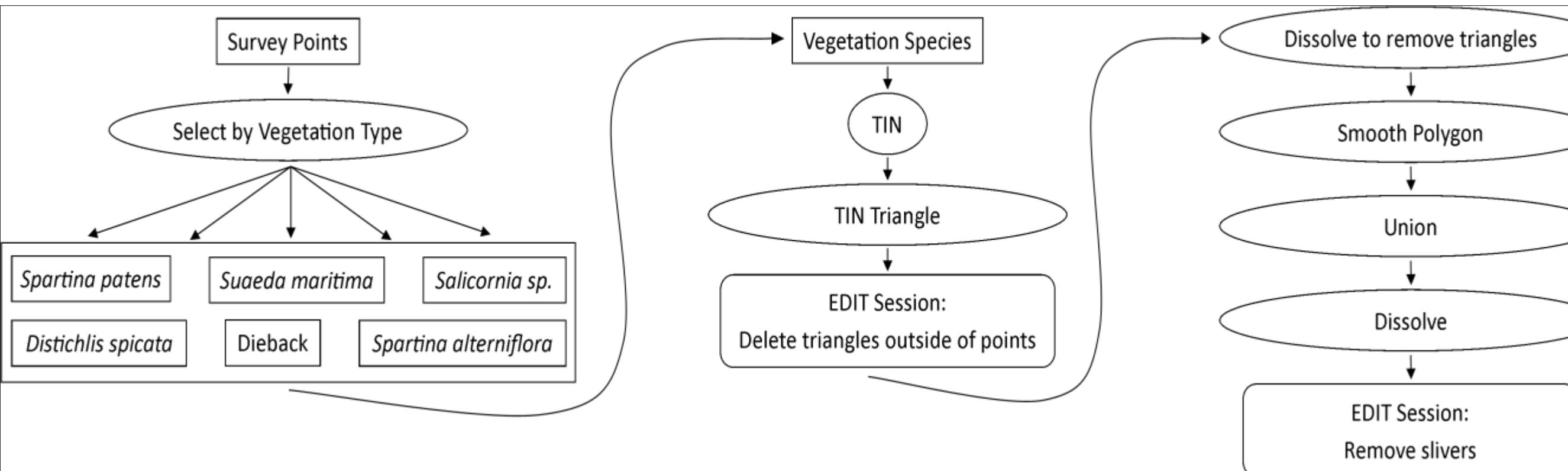


Photo Credit: Stephen Smith, NPS



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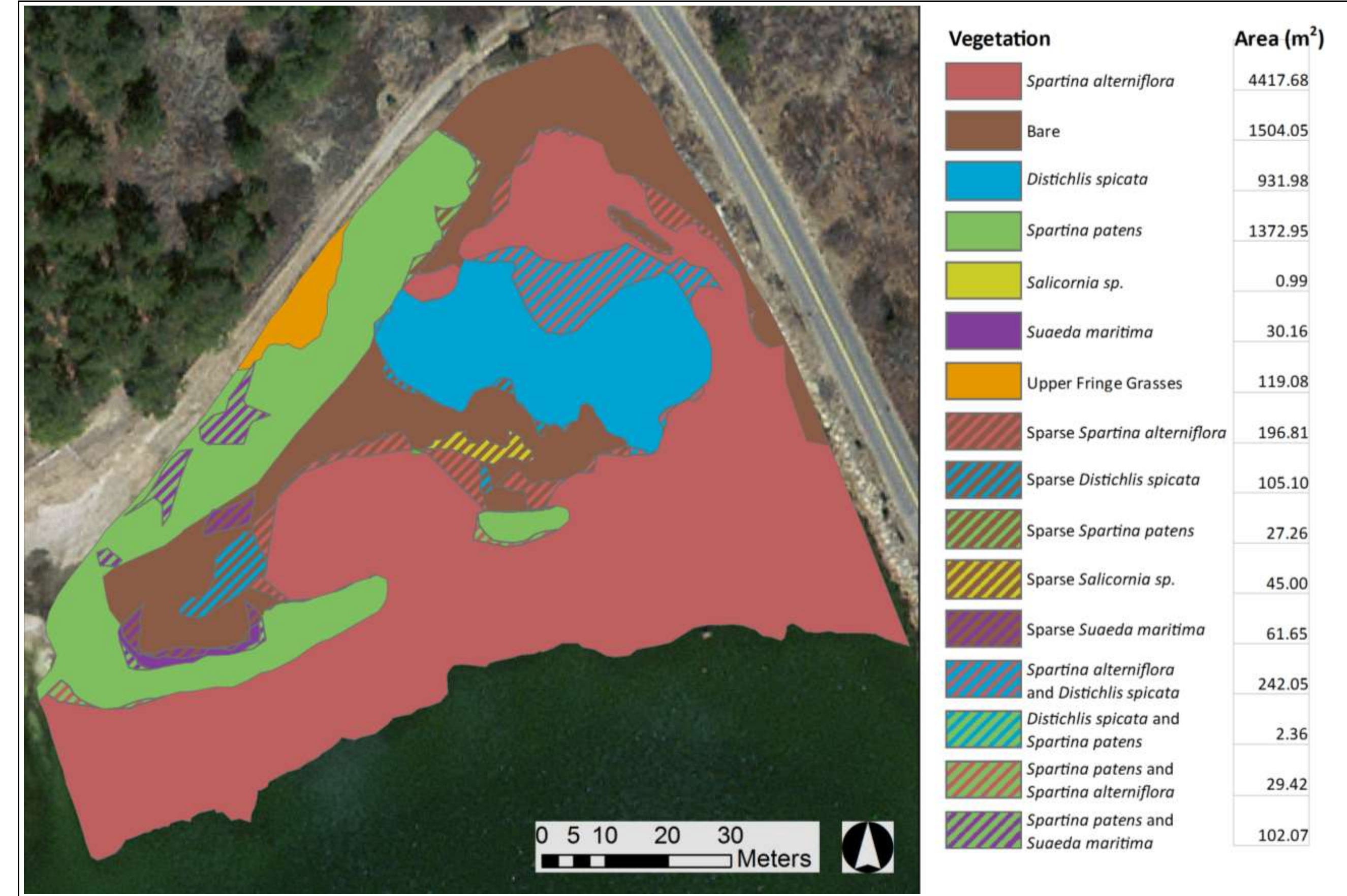
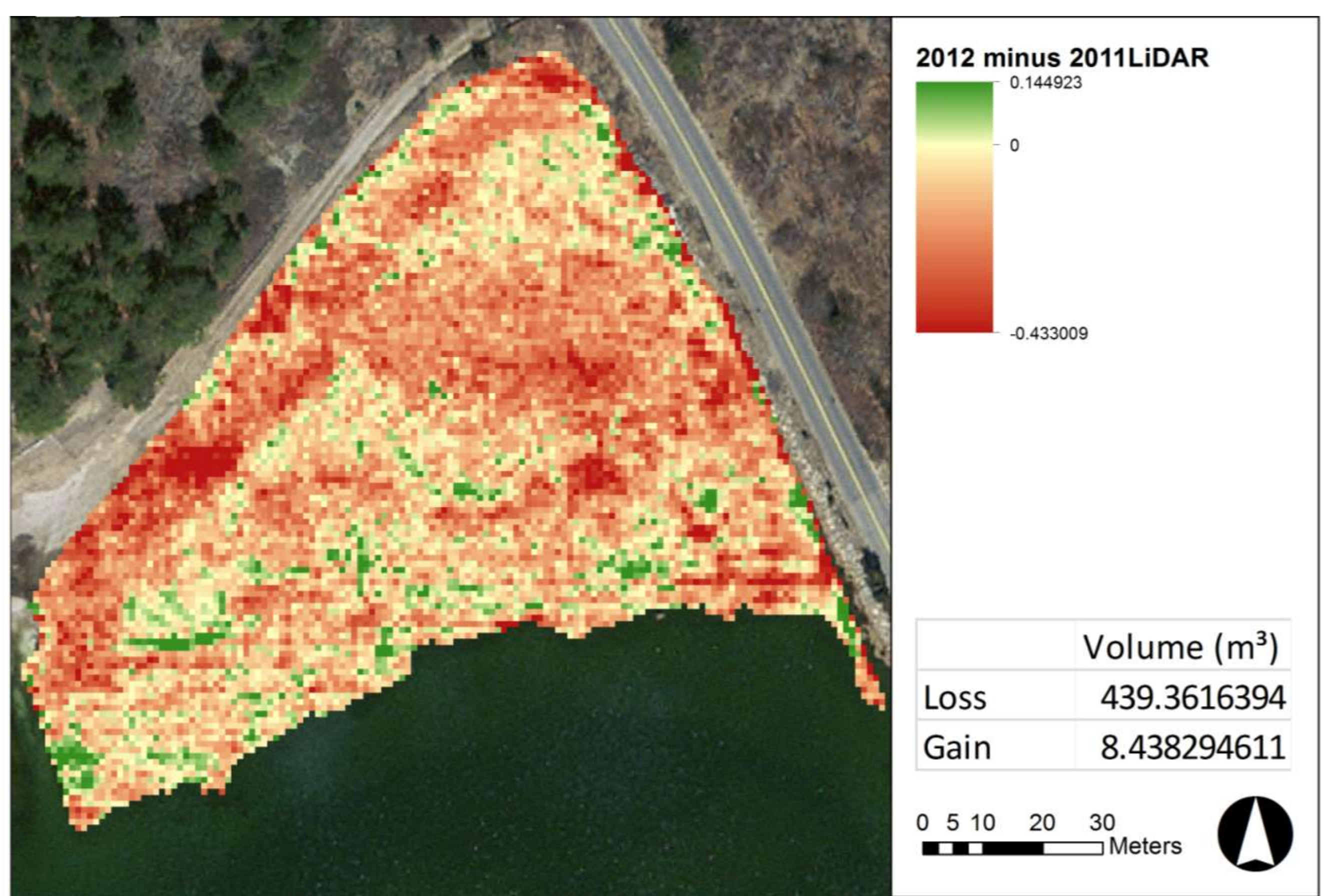


Photo Credit: Ben Kimball



## Elevation Loss



By comparing the 2011 LiDAR and the 2012 elevation survey, I calculated there has been 439m<sup>3</sup> of elevation loss. This is not realistic and reflects the ability of ground based elevation surveys to detect the bare earth marsh surface while LiDAR returns are unable to penetrate the persistent vegetation canopy. Nevertheless, rapid erosion is likely occurring as reflected in the differences between the 2011 and 2012 ground based surveys.

## Comparison of LIDAR to Total Station Surveys

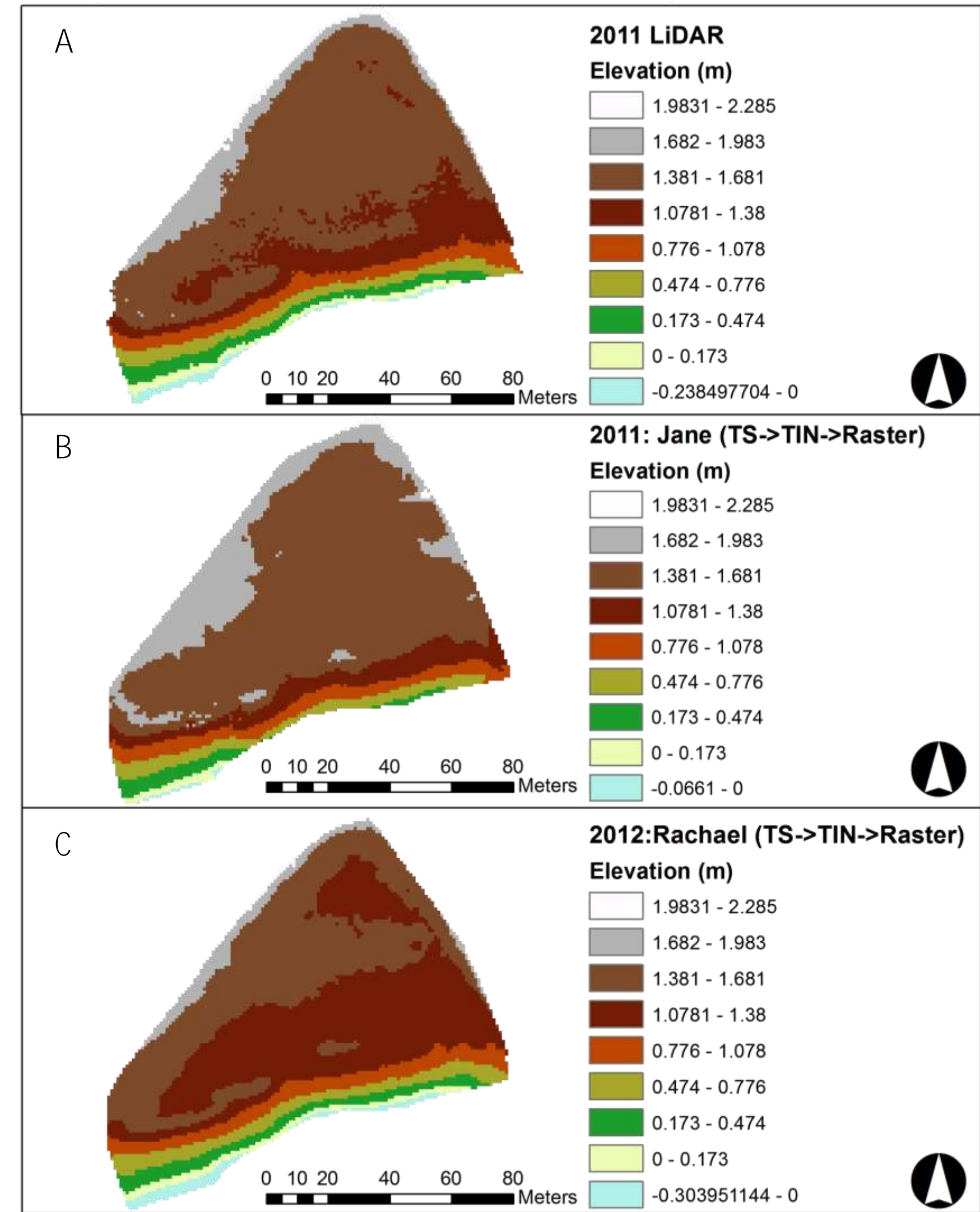


Figure A, B, and C show three different surveys, a LiDAR survey conducted in early spring 2011, a total station survey conducted in late summer 2011, and a total station survey conducted in mid summer 2012, respectively. The most notable differences between the three surveys are the presence or absence of the low area at the northern extent of the marsh, and the presence or absence of the higher berm along the southwestern seaward edge of the marsh.

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## Citations

Cape Cod National Seashore, National Park Service. *Characteristics of salt marsh dieback on Cape Cod*. Web. 10 May. 2013  
Weldy, Troy, David Werier, and Andrew Nelson. 2013 New York Flora Atlas. New York Flora Association, Albany, New York.

