Do Hardened Structures Accelerate Erosion on Adjacent Properties?

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Introduction

In October of 2017, Hurricane Mathew Devastated the Vilano Beach Community in St Augustine, FL. Shoreline erosion cost many families their homes, while many others had immeasurable repairs to complete. Most damages caused by shoreline erosion could be seen on non-hardened properties adjacent to hardened properties. Therefore the thesis for this project states that ***there will be increased erosion on adjacent, non-hardened properties following severe weather events.***

Methods

Choosing Sites

When choosing profiling sites, we looked at satellite imagery on Google Earth from 2015 to determine which houses had hardened structures prior to Hurricane Matthew. We chose control sites that were at least two houses away from the nearest hardened structure.

Beach Profiling

Using the Emery method of beach profiling , we took elevation measurements in 1-meter increments starting from the top of the dune and ending at the water line.

ArcGIS

We uploaded satellite imagery from 2014 pre-Hurricane Matthew and 2017 pre-Hurricane Irma. Within that, we utilized the polygon feature to measure the area of the dunes directly adjacent to the north and to the south of the properties.

Image 1: For future studies we would like to look at post Hurricane Irma satellite images to help further conclude our hypothesis. Shown above are satellite images, to the left shown by the red circle is the progress of erosion after sever weather events directly adjacent to a hardened structure.

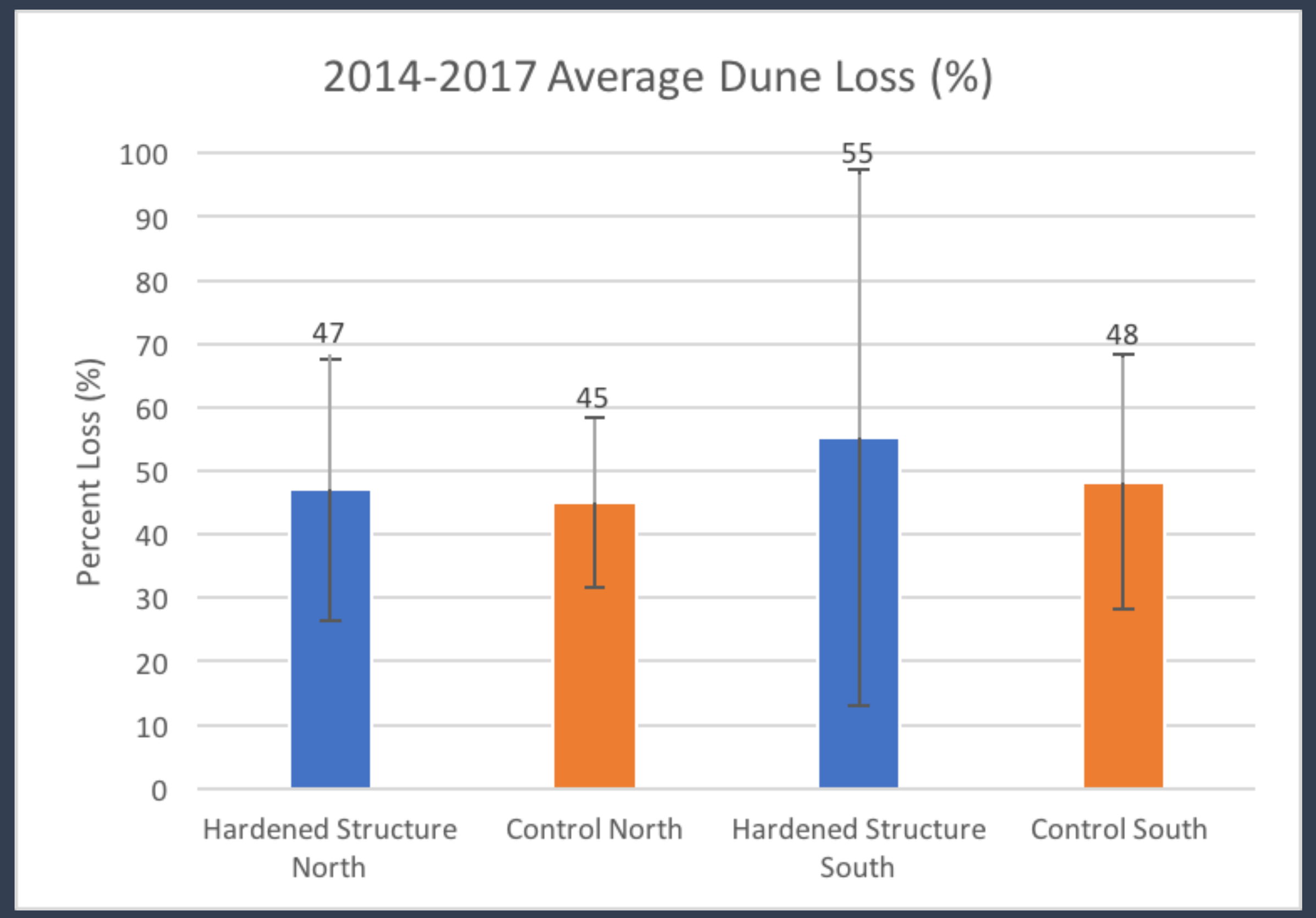
Conclusion

What?

There was more erosion to the North of the hardened structures due to near shore currents transporting sediment away from north adjacent properties.

Why?

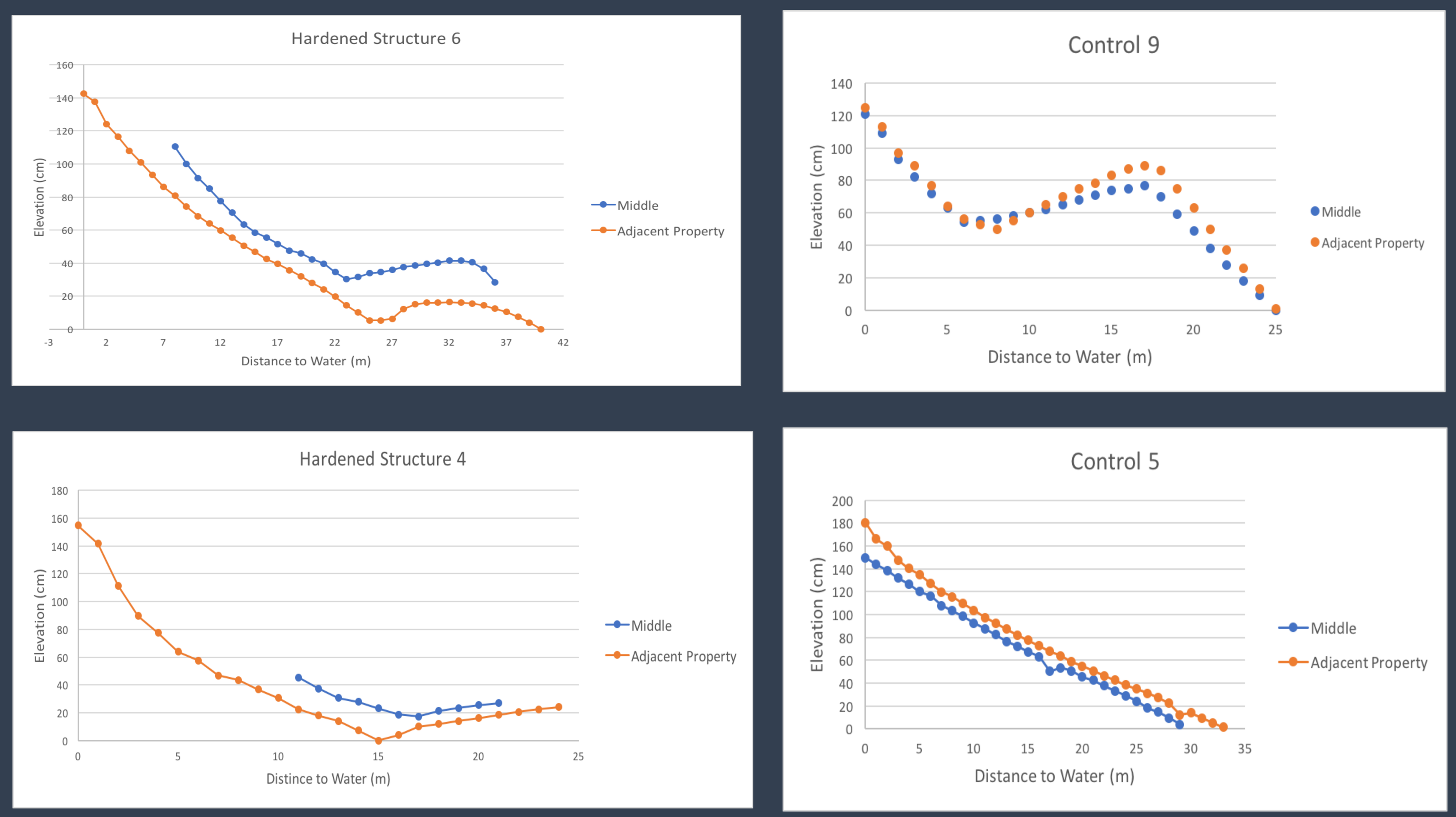
From the data collected while beach profiling selected sites the data represented increased erosion on the north adjacent properties.



Graph 4: Geospatial Analysis: Average dune loss in percent between, pre Hurricane Matthew (2014) and post Hurricane Matthew (2017), directly north and south of the hardened structure sites and the control sites. The P-value of the hardened structures and controls for the north measurement was 0.42 and the P-value of the hardened structure and controls for the south measurement was 0.36. This shows that though there was erosion following the severe weather event there was not enough to fully support our hypothesis.

Beach Profiling Data

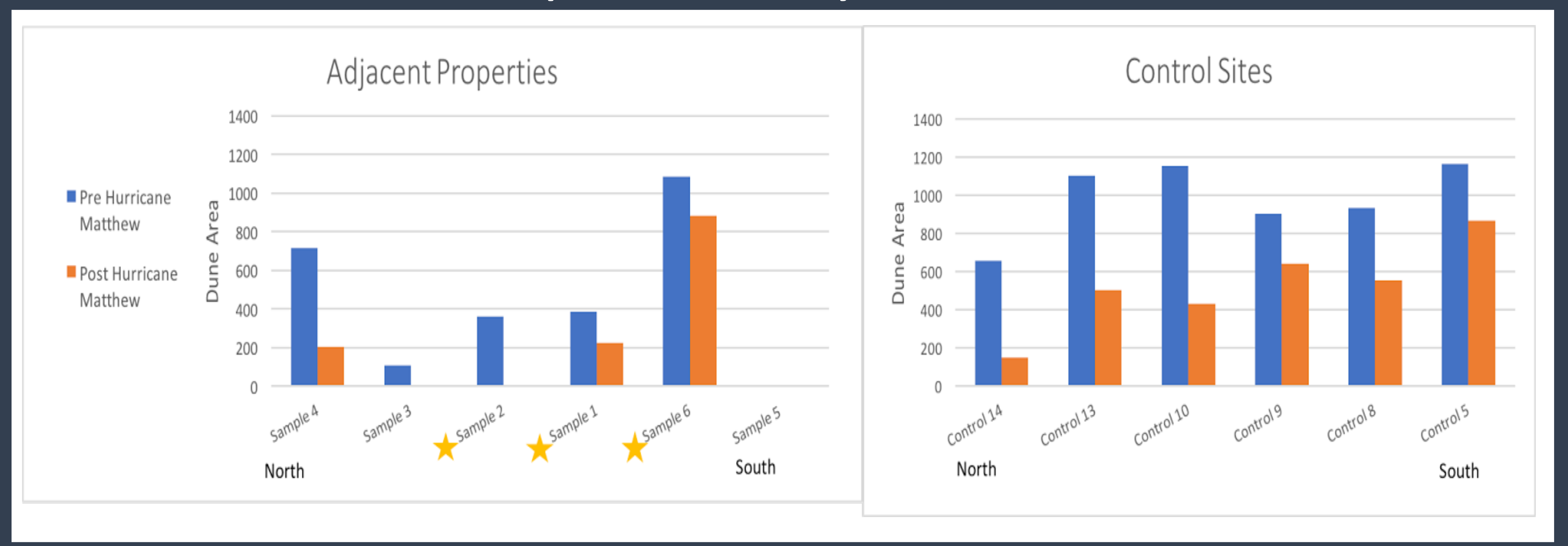
Field Methods



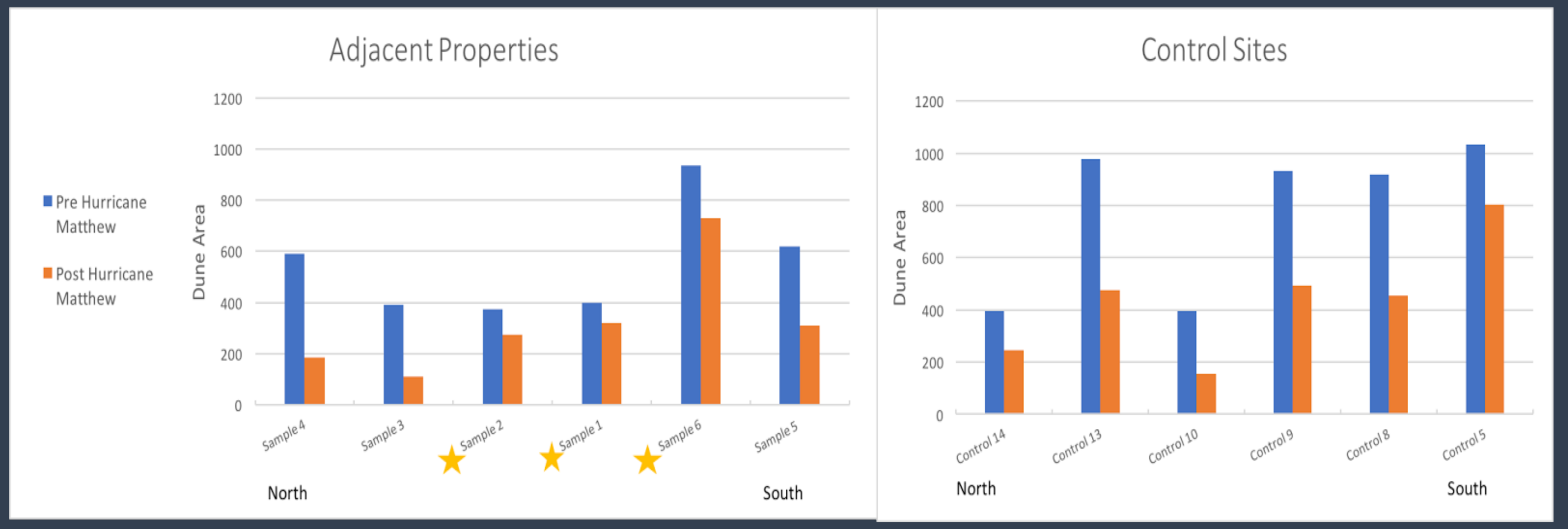
Graph 1: Coss sections of various Vilano beach locations. Six harden structure sites (left) and six control sites (right) were measured.

ArcGIS Data

Geospatial Analysis Methods



Graph 2: Geospatial analysis between pre Hurricane Matthew (2014) and post Hurricane Matthew (2017) satellite images, south of each individual hardened structure properties (left) and control sites (right). Yellow stars represent hardened structures constructed of rocks rather than a wall. P-value of hardened structure properties is 0.16 and P-value of control sites is 0.002 mean we can accept the hypothesis that there was erosion following Hurricane Matthew for the control sites but not for the hardened structure sites



Graph 3: Geospatial analysis between pre Hurricane Matthew (2014) and post Hurricane Matthew (2017) satellite images, North of each individual hardened structure properties (left) and control sites (right). Yellow stars represent hardened structures constructed of rocks rather than a wall. P-value of hardened structure properties is 0.049 and P-value of control sites is 0.01 mean we can accept the hypothesis that there was erosion following Hurricane Matthew.

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