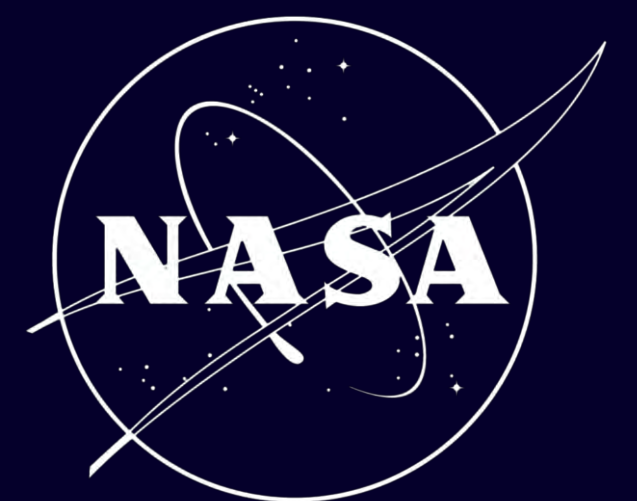# Louisiana Disaster Management and Ecological Forecasting
Assessment of Tropical Cyclone Induced Transgression of the Chandeleur Islands for Restoration and Wildlife Management
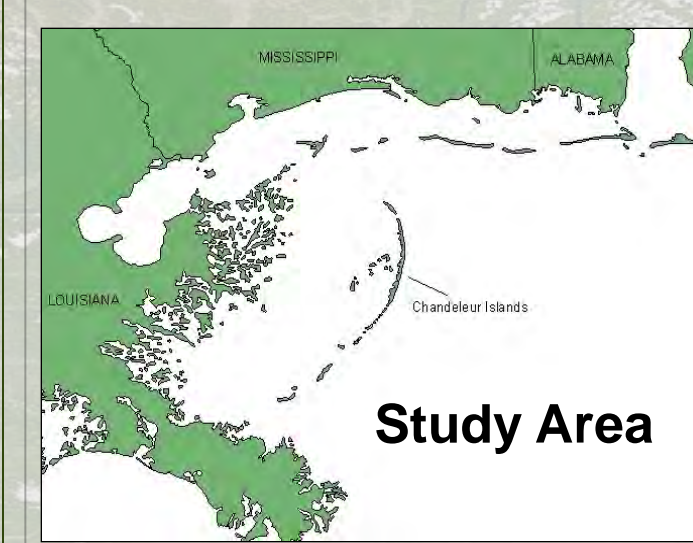
DEVELOP

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INTRODUCTION

The Chandeleur Islands comprise a 50 km long island chain located South-Southeast of St. Bernard Parish, Louisiana. As part of the Breton National Wildlife Refuge, the islands house many types of vegetation that provide the means for a suitable habitat for many species of wildlife, several of which are threatened and endangered. Over the past 2000 years, the Chandeleurs have acted as a prime target for hurricanes that pass through the Gulf of Mexico. The effect of these hurricanes have periodically deteriorated the islands' stability and wildlife population. These barrier islands are also the first line of defense for coastal cities. They protect marshes and estuaries that contribute directly and indirectly to the livelihood of thousands of people along the Louisiana coast. This project looked to assess the impact of hurricanes, tides, cold fronts, winds, and ENSO to aid resource managers in restoration projects that can benefit the islands and minimize loss.

Study Area

GOALS

- Quantify damage from tropical cyclonic events during the past 30 years
- Measure vegetation/land loss and growth over a 30-year period
- Evaluate land loss trends and correlate trends to weather and sea surface phenomena
- Assess barrier island transgression using MODIS imagery from 2000 to 2009
- Perform accuracy assessment of results
- Contribute to restoration and management efforts

NASA PARTNER DATA SOURCES

U.S. FISH & WILDLIFE SERVICE

Pontchartrain Institute for Environmental Sciences
The University of New Orleans

GULF OF MEXICO ALLIANCE

NOAA

USGS science for a changing world

Land Processes Distributed Active Archive Center

ACKNOWLEDGMENTS

ABSTRACT

Barrier islands are the first line of defense against tropical storms and hurricanes for coastal areas. Historically, tropical cyclonic events have had a great impact on the transgression of barrier islands, especially the Chandeleur Island chain off the eastern coast of Louisiana. These islands are of great importance, aiding in the protection of southeastern Louisiana from major storms, providing habitat for nesting and migratory bird species, and are part of the second oldest wildlife refuge in the country. In 1998, Hurricane Georges caused severe damage to the chain, prompting restoration and monitoring efforts by both federal and state agencies. Since then, multiple storm events have steadily diminished the integrity of the islands. Hurricane Katrina in 2005 thwarted all previous restoration efforts, with Hurricane Gustav in 2008 exacerbating island erosion and vegetation loss. Data from the Advanced Spaceborne Thermal Emission and Reflection Radiometer (ASTER), Moderate Resolution Imaging Spectroradiometer (MODIS), Landsat 2-4 Multispectral Scanner (MSS), and Landsat 5 Thematic Mapper (TM) were utilized to detect land loss, island transgression, and vegetation change from 1979 to 2009. This study looked to create a more synoptic view of the transgression of the Chandeleur Islands and correlate weather and sea surface phenomena with erosion trends over the past 30 years, so that partnering organizations such as the Pontchartrain Institute for Environmental Sciences (PIES) can better monitor and address the continual change of the island chain.

METHODS

Data Acquisition

- Landsat 2-4 MSS and Landsat 5 TM: USGS Global Visualization Viewer
- ASTER : Land Processes Distributed Active Archive Center (LP DAAC) using the NASA Warehouse Inventory Search Tool (WIST)
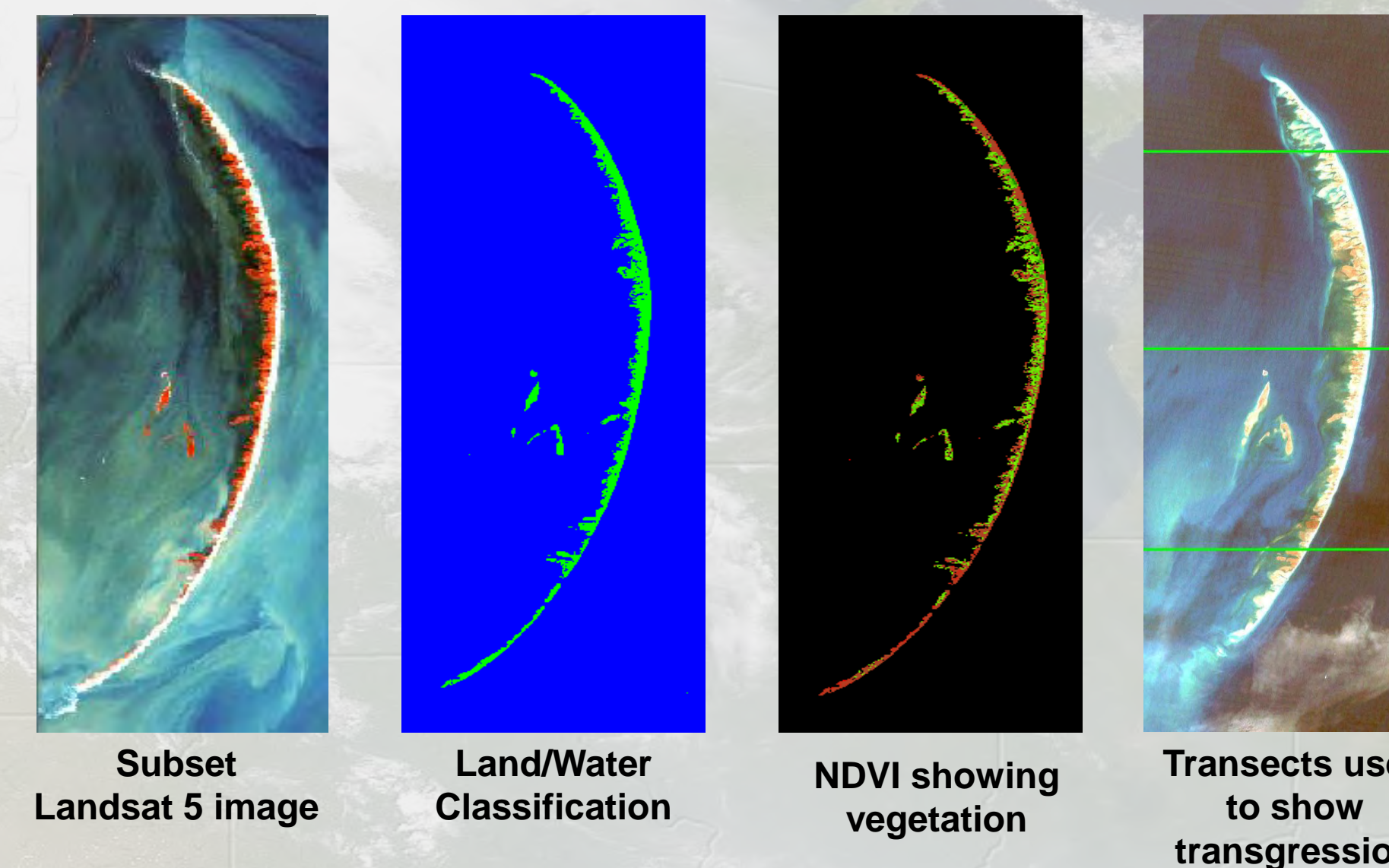- MODIS: LP DAAC

Land Area Loss/Gain

- After water was masked out of the images, land area was measured for each image in hectares using ERDAS IMAGINE©.

Vegetation Loss/Gain

- Normalized Difference Vegetation Index (NDVI) was performed on each image ranging from August 16, 1979, to January 30, 2009. Measurements of vegetation in hectares were computed in ERDAS IMAGINE for each image.

Accuracy Assessment

- An accuracy assessment was conducted on a land/water classified 2007 ASTER scene using a 2007 QuickBird© image as ground reference data.
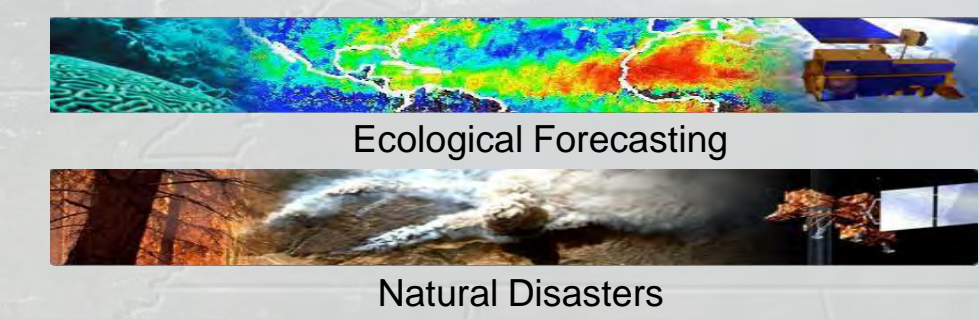
Demonstrating Chandeleur Island Transgression

- Time Series Product Tool (TSPT) processed images were collected daily from 2000-2008. MOD 9 GQ and GA were used to aid in tracking the transgression of the Chandeleur Islands over an 8-year period.

Subset Landsat 5 image | **Land/Water Classification** | **NDVI showing vegetation** | **Transects used to show transgression**

NASA MISSIONS
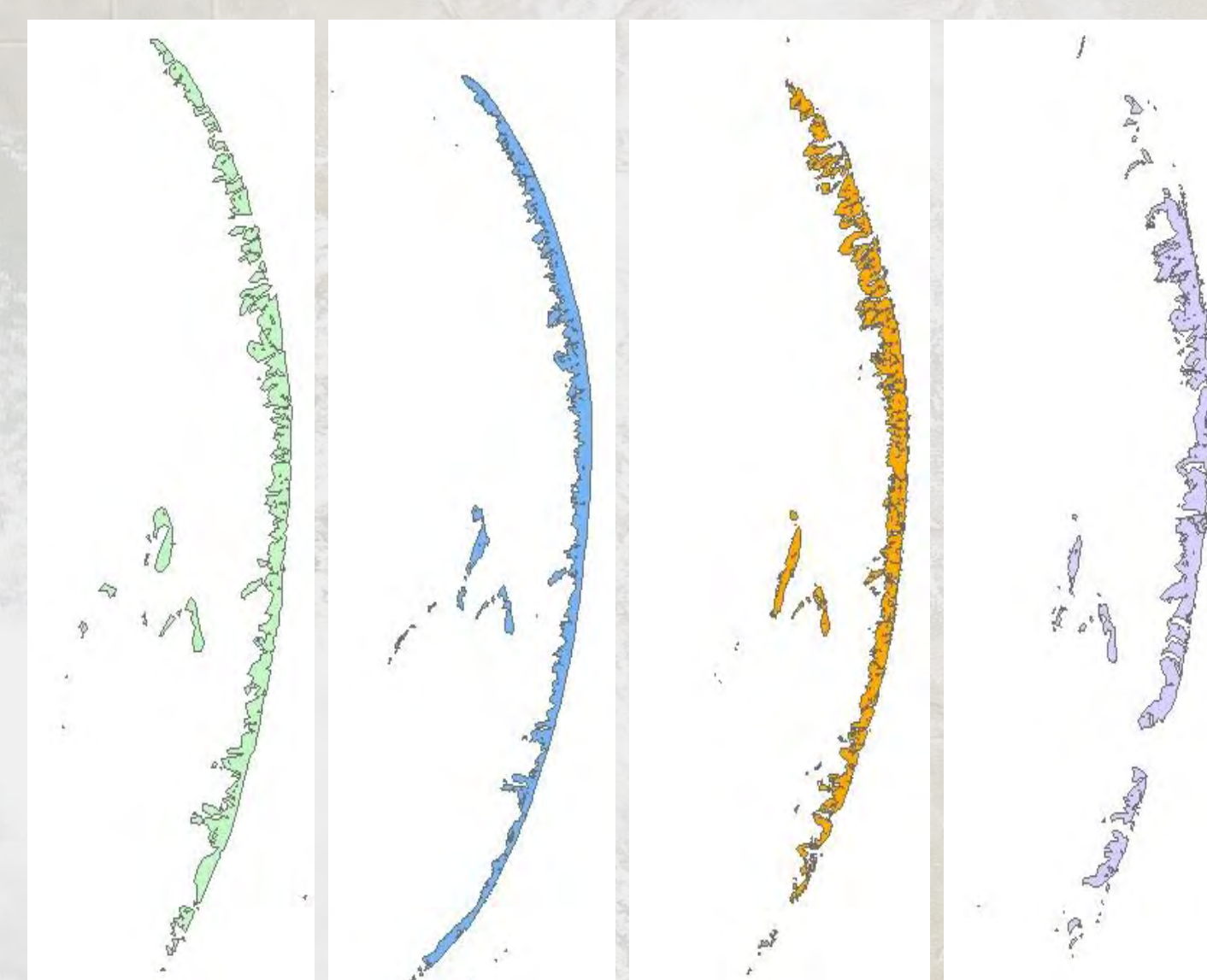Terra

NASA PARTNERED MISSIONS
Landsat 2-4 MSS & Landsat 5 TM

NASA APPLIED SCIENCES NATIONAL APPLICATIONS
Ecological Forecasting
Natural Disasters

RESULTS

Shoreline Change

1979 | **1989** | **1999** | **2009**

LAND AREA CHANGE IN HECTARES 1979 - 1998

LAND AREA CHANGE IN HECTARES 1998- 2009

VEGETATED AREA CHANGE IN HECTARES:1979-1998

VEGETATED AREA CHANGE IN HECTARES:1997-2009
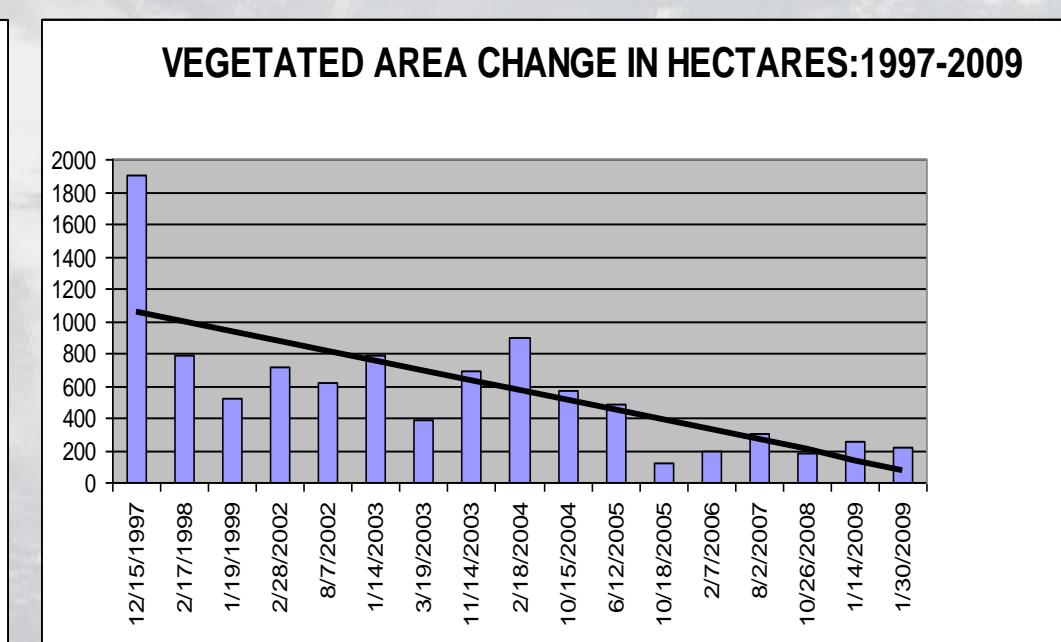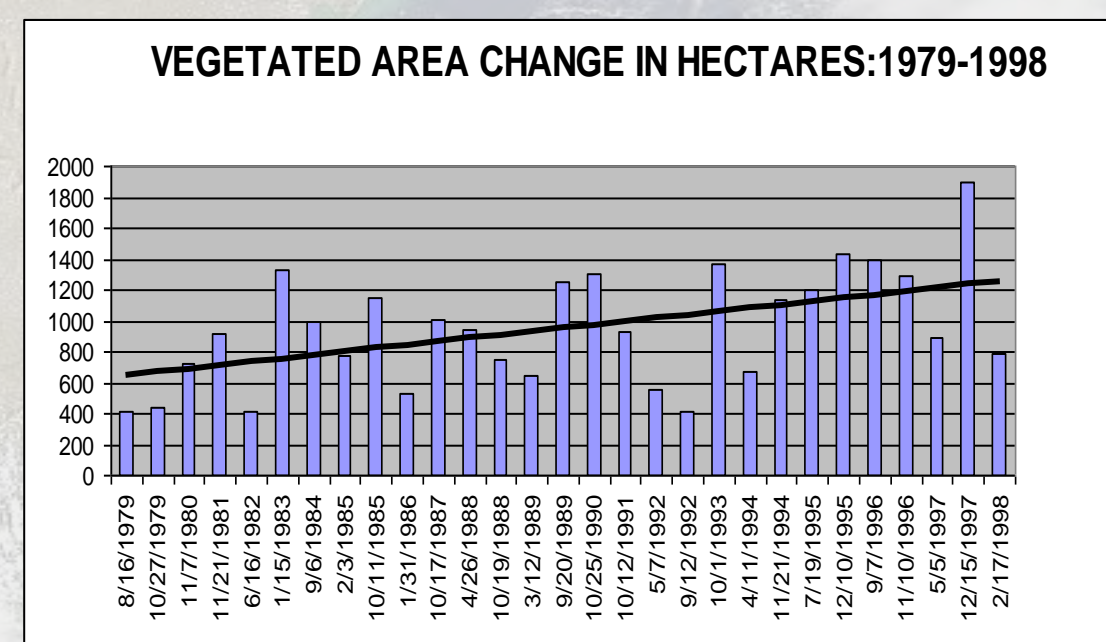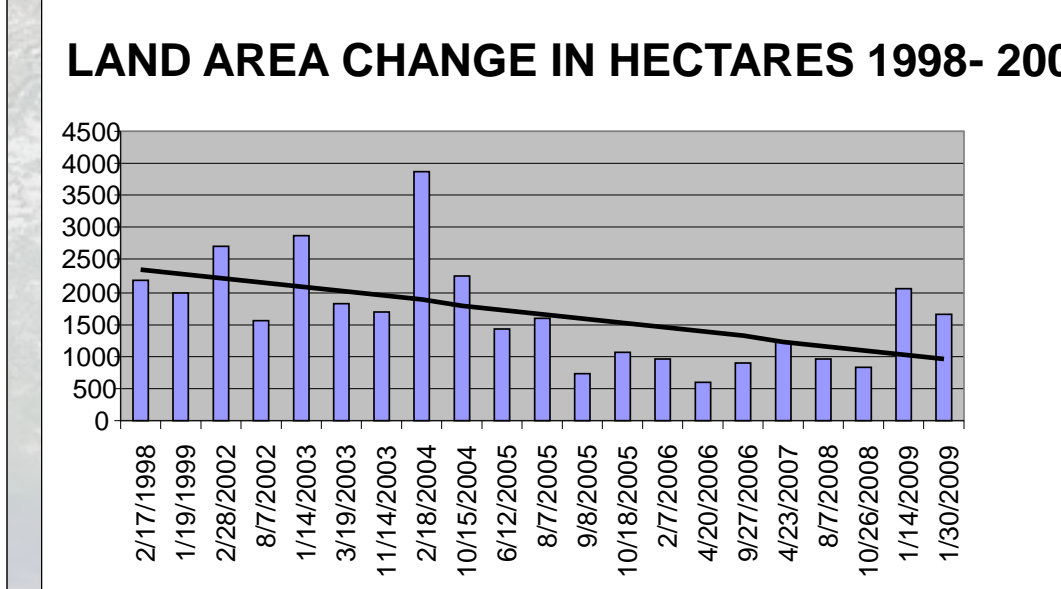
Area calculated using Landsat and ASTER classified images

RESULTS CONTINUED

Transgression of the southern portion of the Chandeleur Islands from 2000-2008 using MODIS

April 1, 2000 | June 30, 2004
September 13, 2006 | October 24, 2008

The peak NIR reflectance value of each plot indicates the location of the island. From 2000-2008, the southern end of the islands moved 4 pixels, or approximately 1000 m, to the west.

Elevation Change in Meters of the North Chandeleur Islands: September 2005 to June 2007

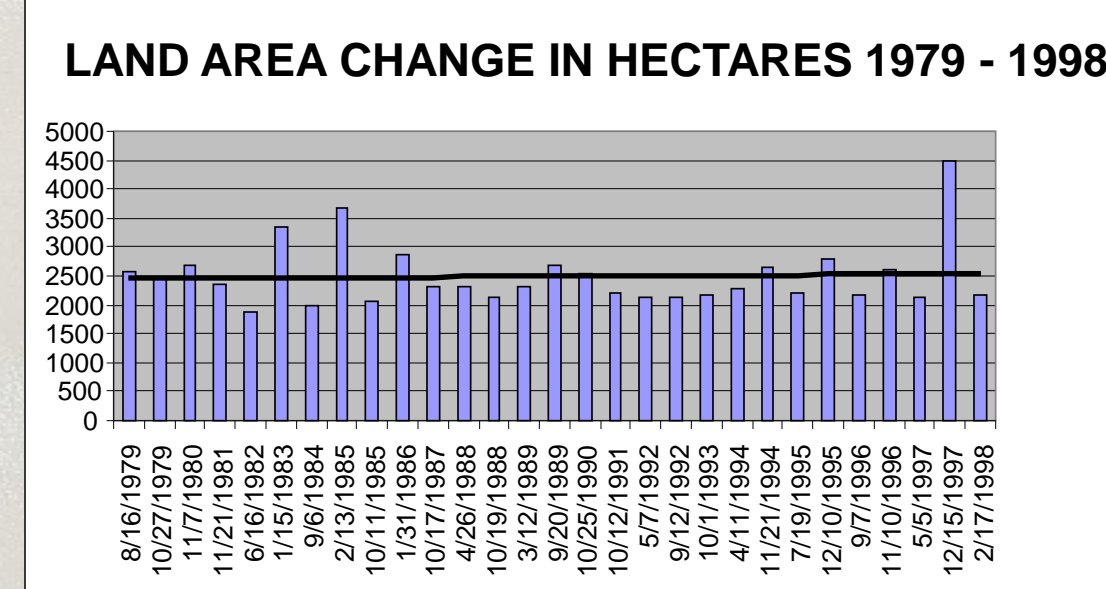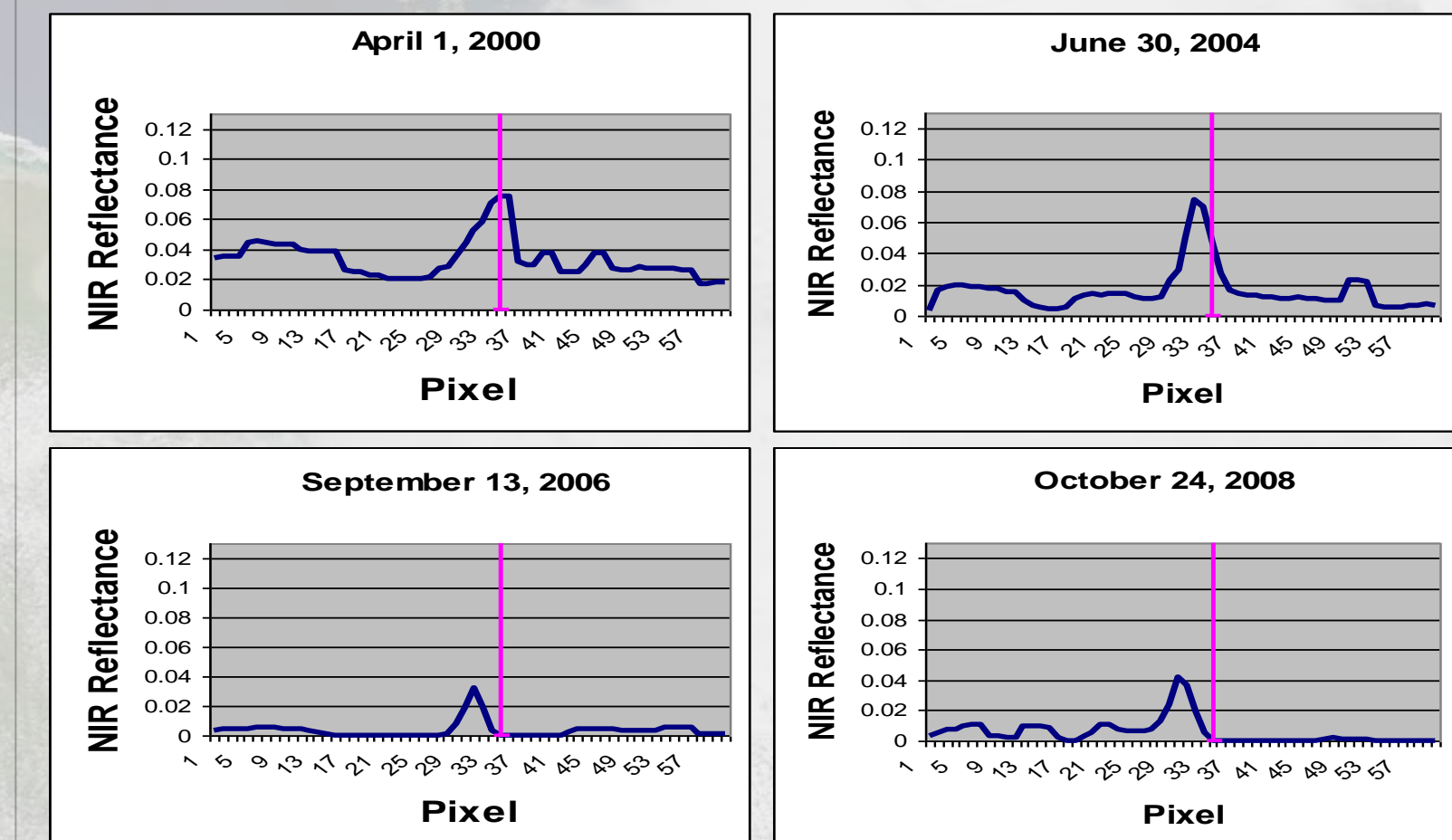| Point #	Sept-4-05	Mar-15-06	Sept-21-06	Jun-28-07
1	0.27	0.36	0.57	0.56
2	0.17	0.39	0	0.68
3	0.53	0.42	0.52	0.6
4	0.45	0	0	0.63
5	0.41	0.55	0.6	0.77
6	0.28	0.6	0.59	0.94
7	0.41	0.55	0.42	0.63
8	0.78	0	0	0
9	0.85	1.04	1.03	1.32
10	0.47	0.79	0.65	0.77
11	0.92	1.05	1.18	1.37
12	0.07	0.96	1.14	1.48
13	1	1.13	1.1	1.36
14	1.1	1.36	1.38	1.71
15	0.35	0.88	0.44	0.72
16	0.89	1.12	1.22	1.31
17	1.01	1.02	0.9	1.02
18	0.63	0	0.62	0.62
19	0.36	0.75	0.62	0.95
20	0.4	0.61	0.66	0.88
21	0.99	1.25	1.53	1.33
22	0.29	0.84	0.75	0.99
23	0.25	0.64	0	1.03
24	0.63	0.4	0.53	0.63
25	0.9	0	0	0
26	0.19	0.51	0.48	0.46
27	0.63	0	0	0.55
28	0.14	0.29	0	0.81
29	0.65	0.82	0.79	0.9
30	0.42	0.65	0.77	0.78
31	0.35	0.42	0.74	0.88
32	0.42	0.52	0.67	0.88
33	0.58	0.91	0.72	0.9
34	0.54	0.34	0	0.96
35	0	0	0	0
36	0.16	0	0	0.78
37	0.41	0.67	0	0.67
38	0.21	0.54	0	0.72
39	0.17	0.73	0.68	0.71
40	0.44	0.28	0.41	0.5
41	0	0.42	0	0.67
42	0	0	0	0.72
43	0.19	0.62	0.56	0.62
44	0.48	0.71	0.44	0.48
45	0.13	0.39	0.66	0.9
46	0.42	1.09	0.48	0.8
47	0.33	0	0	0.6
48	0	0	0	0.64
49	0	0	0	0.5
50	0	0	0.69	0.7
51	0.21	0	0	0.7
52	0.34	0.64	0.44	1.05
53	0.51	0.39	0.58	0.49
54	0.32	0.96	0	0.53
55	0	0	0	0.53
Average	0.4245	0.5189	0.4707	0.7787

Elevations derived from LIDAR data sets provided by PIES

0 1 2 4 Kilometers

CONCLUSIONS

- An increase in frequency and intensity of storms over the past decade has hindered regeneration of the islands and has made them more susceptible to damage from natural phenomena, such as cold fronts, winds, and waves.

- Results demonstrated that vegetated areas and land areas began decreasing dramatically in 1998. These results are consistent with the most recent study conducted by PIES and USGS.

- Accuracy assessment conducted on the results from Phase 1 proved to be 91% accurate.

- Northern and middle portions of the islands remained mostly stationary throughout 2000-2008, except directly following Hurricane Katrina in 2005. The southern portion of the islands steadily transgressed landward throughout the entire period, but transgression was accelerated by Hurricane Katrina's impact in 2005.

- Chandeleur Islands have experienced an increase in vegetation and land loss over the past decade. The transgression of the islands has also been accelerated because of tropical cyclones. Without restoration efforts, coastal Louisiana will lose its first line of defense from future tropical cyclones.

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