Coastal Salt Marsh Change in Grand Bay National Estuarine Research Reserve (GBNERR) from 1955 to 2014

Heather Nicholson
University of Southern Mississippi
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Introduction

Image Credit: Gretchen Grammer – From Marine Debris NOAA
Texture analysis - horizontal variability in brightness values
Grand Bay National Estuarine Research Reserve

Image Source: DNR
Mississippi Gulf Coast Examples

- Hilbert 2006
  - Used NDVI and three bands from the Principle Component Analysis to detect habitat change in GBNERR
- Wells 2010
  - Used panchromatic imagery to detect salt marsh change in GBNEER (non-texture methods)
- English 2011
  - Used Landsat data to conduct a full coastal land use classification to detect habitat change
- Jeter and Carter 2016
  - Observe and Describe the change on Horn Island habitats using texture methods

Image Credit: USM- GCRL
Estimate change in marsh coverage in the present-day Grand Bay NERR over ca. 60 years using panchromatic aerial image data.
Methods

- Download Data
  - USGS Single Frame Imagery
- Pre-Processing
  - Mosaic images
  - Geo-rectify
  - Convert 2014 image to panchromatic
  - Mask as needed

Image Credit: Gulf Coast Geospatial Center
Methods
Continued

- Supervised Classification
  - Compute image textural features
  - Run maximum likelihood classifier
  - Conduct accuracy assessment
- Compute loss in marsh surface area

Image Credit: Aero-Data Corporation LLC
### 1955 Classification

<table>
<thead>
<tr>
<th>Classification</th>
<th>Area (%)</th>
<th>Area (ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water</td>
<td>1.8</td>
<td>97.5</td>
</tr>
<tr>
<td>Woodland</td>
<td>5.9</td>
<td>489.3</td>
</tr>
<tr>
<td>Salt Panne</td>
<td>0.4</td>
<td>34.9</td>
</tr>
<tr>
<td>Marsh</td>
<td>48.9</td>
<td>4041.6</td>
</tr>
</tbody>
</table>

Overall Classification Accuracy: 93.53  
Kappa Coefficient: .8578
2014 Classification

<table>
<thead>
<tr>
<th></th>
<th>Area (%)</th>
<th>Area (ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water</td>
<td>4.5</td>
<td>367.6</td>
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<tr>
<td>Woodland</td>
<td>10.6</td>
<td>876.4</td>
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<td>Salt Panne</td>
<td>1.0</td>
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<tr>
<td>Marsh</td>
<td>40.7</td>
<td>3358.0</td>
</tr>
</tbody>
</table>

Overall Classification Accuracy: 97.6452
Kappa Coefficient: .9577
Mid-Reserve Changes

1955 GBNERR: Salt Marsh Area (ha): 2280.54

1992 GBNERR: Salt Marsh Area (ha): 2152.51

2014 GBNERR: Salt Marsh Area (ha): 2025.99
Shoreline Loss (Enlargement)

90 m
122 m
227 m
290 m
Methodological Limitations

- Data availability (Spectral, Spatial, Temporal, Ground Truth)
- Geo-rectification due to a lack of well-defined ground control points

Image Credit: NOAA NERR
In Progress

- Classification of 1970s data
- Change detection among dates

Image Credit: BHI Conservancy
Conclusions

• Marsh surface area has declined
• Results will help model future change
• Results may influence protection and restoration efforts