Living shoreline stabilization at Tomoka State Park:
protecting cultural and ecological resources

Annie Roddenberry, Dr. Linda Walters, Dr. Melinda Donnelly, Alice Bard, Suzanne Connor
Living shoreline stabilization

**GREEN - SOFTER TECHNIQUES**

- **VEGETATION ONLY** - Provides a buffer to upland areas and breaks small waves. Suitable for low wave energy environments.

- **EDGING** - Added structure holds the toe of existing or vegetated slope in place. Suitable for most areas except high wave energy environments.

- **SILLS** - Parallel to vegetated shoreline, reduces wave energy, and prevents erosion. Suitable for most areas except high wave energy environments.

**GRAY - HARDER TECHNIQUES**

- **BREAKWATER** - (vegetation optional) - Offshore structures intended to break waves, reducing the force of wave action, and encourage sediment accretion. Suitable for most areas.

- **REVETMENT** - Lays over the slope of the shoreline and protects it from erosion and waves. Suitable for high energy settings and sites with existing hardened shoreline structures.

- **BULKHEAD** - Vertical wall parallel to the shoreline intended to hold soil in place. Suitable for upland areas with high energy settings.
Many shades of ‘green’
Tomoka State Park
Volusia County, Florida

Legend
- Tomoka State Park

Volusia County (FL) Boundaries

Project Site Area - Tomoka State Park

Project Shoreline Boundary 2,600ft / 0.54 ac
Nocoroco was a Timucuan Village which dates as early as 1300 CE and was in existence when the area was visited by Alvaro Mexia in 1605. Mexia noted that you “emerge at a bay which is called Nocoroco, where canoes are boarded. This bay has a gravelly bottom and there is a cove on the west side, and on the flats of the said cove are four villages. On the point of land extending on the south is the town of Nocoroco”.

Mexia’s map
Tomoka State Park

- Recreational, cultural, and ecological resources
- 6,000 year old shell middens
- Nocoroco settlement (1300 CE – 1760 CE)
- Mount Oswald indigo and rice plantation in 1700s
- Campground, hiking, fishing, boating, wildlife viewing, etc.
- Parts of middens and remains of 3 slave burials uncovered by erosion over the years
Stabilization of point in 2016

- Coquina boulders along slope
- Oyster bags in front of rocks
- ‘Hard’ living shoreline
Stabilization of point in 2016

- Coquina boulders along slope
- Oyster bags in front of rocks
- ‘Hard’ living shoreline
Oak and Maritime Hammock/Shell midden

Existing vegetation: oak, red cedar, sabal palm, sea oxeye daisy, other halophytic species

MHW

Existing patchy vegetation: black mangrove, sea oxeye daisy, grasses

Mangrove Planting Zone: 1 mangrove/2 ft.

Smooth Cordgrass Planting Zone: 1 plug/2 ft

Oyster Shell Bags

 Restoration Area: Intertidal Zone (~9 ft)

20’ 5’
Existing patchy vegetation: black mangrove, sea oxeye daisy, grasses.

Mangrove Planting Zone: 1 mangrove/2 ft.

Smooth Cordgrass Planting Zone: 1 plug/2 ft.

Vegetation: black mangrove, sea oxeye daisy, grasses

Oyster Shell Bags

Restoration Area: Intertidal Zone (~9 ft)

Oak and Maritime Hammock/Shell midden

Existing vegetation: oak, red cedar, sabal palm, sea oxeye daisy, other halophytic species
Existing patchy vegetation: black mangrove, sea oxeye daisy, grasses

Mangrove Planting Zone: 1 mangrove/2 ft.

Smooth Cordgrass Planting Zone: 1 plug/2 ft

Oyster Shell Bags

Restoration Area: Intertidal Zone (~9 ft)

Maritime Hammock/Shell midden

cedar, sabal palm, sea oxeye daisy, other halophytic species

Oak and Maritime Hammock/Shell midden

Existing vegetation: oak, red cedar, sabal palm, sea oxeye daisy, other halophytic species

20’ 5’
Existing patchy vegetation: black mangrove, sea oxeye daisy, grasses

Mangrove Planting Zone: 1 mangrove/2 ft.

Smooth Cordgrass Planting Zone: 1 plug/2 ft

Oyster Shell Bags

Restoration Area: Intertidal Zone (~9 ft)

Maritime Hammock/Shell midden

Existing vegetation: oak, red cedar, sabal palm, sea oxeye daisy, other halophytic species
- 3100 linear feet of stabilization
- Methods utilized in multiple sites within the region
- Mangroves, *Spartina alterniflora*, oysters
- Involvement from UCF students and MDC volunteers
- BACIPS monitoring design

<p>| FL Fish and Wildlife Conservation Commission | $41,769 |
| Indian River Lagoon NEP | $49,741 |
| University of Central FL | $26,450 |
| <strong>Total project cost</strong> | <strong>$117,960</strong> |
| Project Size | 0.75 acre |</p>
<table>
<thead>
<tr>
<th></th>
<th>Phase 1</th>
<th>Phase 2</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>March 2018</td>
<td>500’</td>
<td></td>
<td></td>
</tr>
<tr>
<td>July 2018</td>
<td></td>
<td>500’</td>
<td></td>
</tr>
<tr>
<td>Spartina</td>
<td>300</td>
<td>120</td>
<td>420</td>
</tr>
<tr>
<td>Mangroves</td>
<td>97</td>
<td>63</td>
<td>160</td>
</tr>
</tbody>
</table>
Mean Erosion

<table>
<thead>
<tr>
<th></th>
<th>Phase 1 (Stabilization in March 2018)</th>
<th>Phase 2 (Stabilized in July 2018)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-month Post</td>
<td>[Bar chart data]</td>
<td>[Bar chart data]</td>
</tr>
<tr>
<td>7 months Post</td>
<td>[Bar chart data]</td>
<td>[Bar chart data]</td>
</tr>
<tr>
<td>1-month Post</td>
<td>[Bar chart data]</td>
<td></td>
</tr>
<tr>
<td>3-month Post</td>
<td>[Bar chart data]</td>
<td></td>
</tr>
</tbody>
</table>

**Meters**

-0.9, -0.8, -0.7, -0.6, -0.5, -0.4, -0.3, -0.2, -0.1, 0
### Mean Erosion

<table>
<thead>
<tr>
<th>Phase 1 (Stabilization in March 2018)</th>
<th>Phase 2 (Stabilized in July 2018)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-month Post</td>
<td>1-month Post</td>
</tr>
<tr>
<td>7 months Post</td>
<td>3-month Post</td>
</tr>
</tbody>
</table>

### Mean Percent Cover of Vegetation (Starting = 9.5%)

<table>
<thead>
<tr>
<th>Phase 1 (Stabilization in March 2018)</th>
<th>Phase 2 (Stabilized in July 2018)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-month Post</td>
<td>1-month Post</td>
</tr>
<tr>
<td>7 months Post</td>
<td>3-month Post</td>
</tr>
<tr>
<td>Tomoka Data Summary</td>
<td>Mean Percent Cover of Vegetation</td>
</tr>
<tr>
<td>---------------------</td>
<td>----------------------------------</td>
</tr>
<tr>
<td></td>
<td>9.5</td>
</tr>
<tr>
<td>Phase 1 (Stabilization in March 2018)</td>
<td>9.9</td>
</tr>
<tr>
<td></td>
<td>34.5</td>
</tr>
<tr>
<td>Phase 2 (Stabilized in July 2018)</td>
<td>41.4</td>
</tr>
<tr>
<td></td>
<td>36.8</td>
</tr>
</tbody>
</table>
Next Steps

• 500’ complete, 2600’ remaining
• Complete by October 2019
• Adaptive management
• Share successes/lessons learned with regional partners
What can *Living Shorelines* do for you?

- Erosion control (property loss)
- Habitat enhancement
- Maintains coastal processes
- Beautify shorelines
- Improve water quality
- Naturally adapt to climate change
  - Marshes and oyster reefs can grow faster than SLR
- Buffer from storm surge
- Recreational opportunities
- Increased biodiversity
- Reduce storm water flow into receiving waters

Photo: Jeffrey Zipay
Photo: Marinediscoverycenter.org
Photo: Palm Beach County
Cellulose oyster bags – biodegradable wood fiber

August 6, 2018
<table>
<thead>
<tr>
<th>Tomoka Data Summary</th>
<th>Mean Percent Cover of Vegetation</th>
<th>% Survival of Mangroves</th>
<th>% Survival of Spartina</th>
<th>Spartina Density (# of shoots per m²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phase 1 (Stabilization in March 2018)</td>
<td>9.5</td>
<td>9.9</td>
<td>90</td>
<td>N/A - unable to tell clumps apart</td>
</tr>
<tr>
<td>Phase 2 (Stabilized in July 2018)</td>
<td>34.5</td>
<td>94</td>
<td>96</td>
<td>41</td>
</tr>
<tr>
<td></td>
<td>36.8</td>
<td>90</td>
<td>92 clumps apart</td>
<td>38</td>
</tr>
</tbody>
</table>