Modeling Sea Level Rise Impacts on Coastal Wetlands at Several Gulf of Mexico Estuaries

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Nature Conservancy
Topics to be Covered

- Why model SLR impacts on GOM estuaries?
- Tool selection (why use SLAMM?)
- Project sites and program strategy
- Sample results at one site
- How understanding coastal wetland migration informs adaptations to sea level rise.
- How are we engaging the community in our work?
IPCC predicts sea level to rise by 18-59 cm by 2100, not taking into account the melting of the polar ice caps. More recent analyses suggest that global sea level could rise by about 1.4 meters by 2100 and perhaps substantially higher.\(^1\)

- US Gulf Coast highly vulnerable: >20,000 km\(^2\) is below 1.5 m in elevation.

- Future SLR will substantially alter GOM coastal ecosystems, dependent species and human communities.

- GOM is a TNC and EPA priority area with several priority sites identified.

Several EPA NEP Sites in GOM

\(^1\)Rahmstorf et al. 2007; CCSP, 2008; Overpeck et al. 2006, Mitrovica et al. 2009; \(^2\)Titus, & Richman, 2001
Model Used: Sea Level Affecting Marshes Model (SLAMM)

- Relatively easy to use;
- In wide use by federal agencies, academics and NGOs;
- Simulates dominant processes involved in wetland conversions and shoreline modifications during SLR: inundation, erosion, overwash, saturation.
- As with all models input data is very important and outputs need to be assessed with a critical eye.

SLAMM available at [http://warrenpinnacle.com](http://warrenpinnacle.com)
Project sites & program strategy

• Develop information on potential future condition of coastal ecosystems and vulnerable species at ecologically sensitive sites across GOM; and
• Work with partners to identify and implement site appropriate adaptation strategies.

EPA funded sites:
• TX, Corpus Christi Bay
• AL, Mobile Bay
• FL, Pensacola Bay, Southern Big Bend, Tampa Bay
SLAMM Hindcast: Waccasassa Bay, Florida


http://www.springerlink.com/content/0k87r6367494212g/

Outgrowth of the January 2010 Symposium on Sea Level Rise in Florida sponsored by the Florida Institute for Conservation Science
Waccasassa Bay, FL Study
Extensive saltmarsh dominated coastal ecosystem fronting coastal forest (AKA swamp)

Add’tl co-investigator for this study: Frances “Jack” Putz, Univ. of Florida
Input parameters used for the SLAMM Hindcast

Land cover photo date: 1983/1984
DEM date: 1983/1984
Direction offshore [N, S, E, W]: W/S
Historic trend in sea level rise (mm/year): 1.8
NAVD correction [mean tide level–NAVD88 ] (m): −0.0495/ −0.0452
Great diurnal tide range (m): 1.158
Salt elevation (m above MTL): 0.814197
Marsh, swamp and tide flat erosion rate (horizontal m/year): 0.23
Saltmarsh, brackish marsh & tidal fw marsh accretion rates (mm/year): 7.2
Beach sedimentation rate (mm/year): 7.2
Used elevation pre-processor [true, false]: False
Results of SLAMM hindcast 1984-2008

- Coastal Forest, -32% (-3134 ha);
- Trans. saltmarsh, +2670 ha;
- Saltmarsh, +12% (+1100 ha).
- Observed SLR 1.80mm/yr.
Results of SLAMM hindcast at field sites 1984-2008

SLAMM analysis found same patterns of transition as field studies
Apalachicola Bay SLAMM Forecast

Study Funded by Florida Dept. of Environmental Protection, Coastal Partnership Initiative
Created a subsite to accommodate the high flow area in the vicinity of Apalachicola River.
## Apalachicola SLAMM Simulation, 2006 - 2100

<table>
<thead>
<tr>
<th>SLAMM Input Parameters</th>
<th>Global</th>
<th>Subsite</th>
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<tbody>
<tr>
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<td>DEM Date</td>
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<td>Historic trend in SLR (mm/yr)</td>
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<td>NAVD correction [MTL - NAVD88 (m)]</td>
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<td>Great diurnal tide range (m)</td>
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<td>Beach sedimentation rate (mm/yr)</td>
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LiDAR Source:
Florida Division of Emergency Management (FDEM) Coastal LiDAR Project

DEM Source:
NOAA Coastal Services Center’s Digital Coast

Horz. Accuracy:
3.8 feet

Vertical Accuracy:
0.6 feet

Legend
DEM meters, NAVD88 Value
High : 19.8624
Low : -1.01967

World Imagery

Elevation only valid over land areas
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<thead>
<tr>
<th>Date</th>
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<th>% Change</th>
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Results
1 Meter SLR by Year
2100

Initial Condition

SLAMM Categories
- Developed Dry Land
- Undeveloped Dry Land
- Swamp
- Cypress Swamp
- Inland Fresh Marsh
- Tidal Fresh Marsh
- Trans. Salt Marsh
- Regularly Flooded Marsh
- Mangrove
- Estuarine Beach
- Tidal Flat
- Ocean Beach
- Ocean Flat
- Rocky Intertidal
- Inland Open Water
- Riverine Tidal
- Estuarine Open Water
- Tidal Creek
- Open Ocean
- Irreg. Flooded Marsh
- Inland Shore
- Tidal Swamp
- Blank
- Vegetated Tidal Flat
- Backshore
Results
1 Meter SLR by Year
2100

Time Zero,
2006

SLAMM Categories
- Developed Dry Land
- Undeveloped Dry Land
- Swamp
- Cypress Swamp
- Inland Fresh Marsh
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- Backshore
Swamp converting to tidal swamp near Lake Wimico
Swamp and tidal swamp converting to tidal FW marsh at river mouth and Lake Wimico
Results
1 Meter SLR by Year
2100

Tidal FW Marsh moving into swamp & tidal FW marsh converts to brackish marsh at river mouth and lake.
Brackish marsh moves up river and brackish marsh near river mouth becomes tide flat.
How are we engaging the community in our work?

• Stakeholder meetings at each modeled estuary to educate about likely future scenarios:
  – Impacts on coastal habitats and a few vulnerable species as well as human communities.

• Develop site relevant adaptation strategies.
Stakeholder Workshop Schedule

Pensacola Bay – June 16, 2011
Southern Big Bend – tbd
Tampa Bay - tbd
Mobile Bay - tbd
Corpus Christ Bay - tbd

Approximately 1 modeling effort completed and 1 workshop every 3 months
Any questions?