AMBUR-HVA: A New Hazard Vulnerability Assessment Tool for Regional Coastal Resiliency Planning

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What is HVA?

Hazard Vulnerability Assessment Tool

A geospatial tool that allows coastal managers, planners, and researchers to better understand our vulnerabilities to coastal hazards

- *Hazards included*
- *Who built the tool*
- *Process of using it*

What is this tool..

- Incorporates 4 datasets into a vulnerability ranking of 1 -5.
  1. Storm surge (SLOSH)
  2. Shoreline Change (erosion/accretion)
  3. Flooding (FEMA Q3/DFIRM)
  4. Social /economic vulnerability (SoVI®)
- Stand-alone, FREE
- Does require some GIS skills
- Does require that you gather/create GIS layers
- ArcGIS compatible products

Four component datasets

Shoreline Change Rate (+/-)

Shoreline Change Rate Calculation

AMBUR

(Analyzing Moving Boundaries Using R)

- Open Source
- Desktop-based
- Handles curving shorelines of estuarine environment

R install command:
install.packages("ambur", repos="http://R-Forge.R-project.org")

Four component datasets

FOUR Primary HVA Tools

Coastal Vulnerability Analysis

AMBUR-HVA

-Shoreline Change Tool
-Inundation Tool
-Social Vulnerability Scaling Tool
-Composite HVA Tools

R install command:
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Why is this useful?

1. More informed planning
   - ID areas for alternative shoreline stabilization
     - Buffers, setbacks, living shorelines
   - Guide development siting
2. Pre-disaster planning
   - Emergency routes
   - Predict areas likely to be most susceptible to hazards
3. Redevelopment planning
   - Predict areas likely to need assistance with recovery
4. Community Rating System (CRS)
5. Identify areas best suited for restoration/rehabilitation
   - Shellfish
   - Wetlands
   - Alternative shoreline stabilization

For Whom is it useful?

1. Coastal Managers
2. State Emergency Managers
3. Researchers
4. Local Municipalities
5. GIS Users

Who created the tool?

OVERVIEW
- Governor's South Atlantic Alliance (GSAA).
- Alliance was created in 2009 when the 4 state (NC, SC, GA, FL) Governors signed a regional partnership agreement.
- Federal partners include NOAA, EPA, DOI
- Current project funded from a NOAA grant in 2012.

HVA PROJECT
- Technical partners from all 4 states.

AMBUR-HVA Targeted Geospatial Inputs

Governors' South Atlantic Alliance
North Carolina • South Carolina • Georgia • Florida

Layer	Description
Historical shorelines	Detailed shoreline positions and classifications that also include locations of shoreline armoring/stabilization. Shorelines are analyzed in AMBUR-SCA to generate shoreline change data.
AMBUR transects*	Shoreline change data generated from AMBUR-SCA . Contains erosion rates, morphologic classifications, variability of movements and other metrics (need to use v. 1.1.14).
SLOSH*	Estimates storm surge heights resulting from historical, hypothetical or predicted hurricanes (USACE or NWS polygon grids)
FEMA Q3/DFIRM*	Areas potentially impacted by flooding
SoVI*	Social vulnerability index that assists with determining populations at risk to environmental hazards

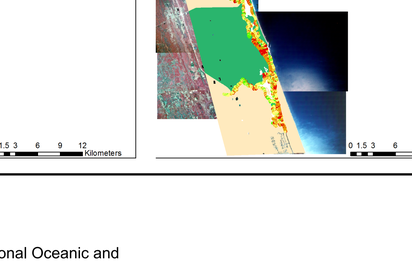
*For direct use in AMBUR-HVA v.0.91 beta tool for shorelines and inland areas.

Jekyll Island Workflow in AMBUR

classify shorelines
construct transects & calculate distances & rates of change

digitize historical shorelines

Export shoreline analysis statistics for the transects extending across the envelope of change



What are the products ?

Inputs

- Four components
  - Storm surge layer (SLOSH)
  - Shoreline Change Rate (+/-) layer
    - Digitized shorelines
    - Historic and current imagery
  - Flood map layer
  - SoVI® layer

Final HVA Products

- Composite layer (all four datasets) ranked 1 - 5
- Individual layers (Each ranked 1 – 5)
  - Shoreline Change (3 components)
    - Rate, Temporal, and Spatial variation
  - Inundation (Flood and Storm Surge)
  - Inundation + SoVI®

Tool Highlights

Governors' South Atlantic Alliance
North Carolina • South Carolina • Georgia • Florida

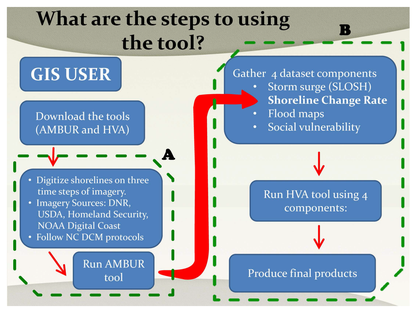
AMBUR-HVA 0.91

- Over 10,000 km of shorelines for calibration
- 58,178 transect locations for calibration
- Data from 4 States encompassing varying coastal geologic/geomorphic settings
- 4 primary data layers (shoreline, inland inundation/flooding, & social vulnerability components)
- Nearly 1000 lines of code
- GUI that simplifies analysis
- Built and refined from input from both coastal scientists and managers
- Intended to be scientifically defensible

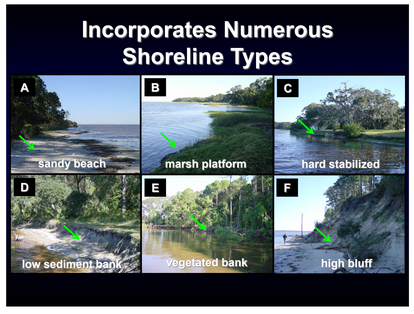
Vulnerabilities to WHAT?

- STORM SURGE
- EROSION
- FLOODING
- ECONOMIC and SOCIAL (SoVI®)

What are the steps to using the tool?



Incorporates Numerous Shoreline Types



Data layer rankings for HVA index calculations in AMBUR-HVA

Governors' South Atlantic Alliance
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Inundation/Flooding & Social Vulnerability				Shoreline Change Rates (SCR)			
Parameter Ranking	SLOSH Category	Flood Zone Category	SoVI scores	Parameter Ranking	SCR (m/yr)	Parameter Ranking	SCR Temporal Variability	SCR Spatial Variability
5 (highest)	1	V, VE, Open Water	> 6.77	5 (highest)	< –1	High	> 0.5	> 0.16
4	2	A, AE, AH	4.06 to 6.77	4	–0.2 to –1			
3	3	B	-1.37 to 4.06	3	–0.2 to 0.2	Medium	0.2 to 0.5	0.074 to 0.16
2	4	C, X, X500	-4.09 to -1.37	2	0.2 to 1			
1 (lowest)	5	D, 0.2 PCT ANNUAL CHANCE FLOOD HAZARD	< –4.09	1 (lowest)	> 1	Low	< 0.2	< 0.074

SLOSH = Sea, Lake and Overland Surges from Hurricanes
SoVI = Social Vulnerability Index

Future Tool Development

AMBUR-HVA Targeted Geospatial Inputs (current and future potential development)

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AMBUR transects*	Shoreline change data generated from initial AMBUR analysis. Contains erosion rates, morphologic classifications, variability of movements, and other metrics.
SLOSH*	Estimates storm surge heights resulting from historical, hypothetical, or predicted hurricanes
FEMA Q3/DFIRM*	Areas potentially impacted by flooding
SoVI*	Social vulnerability index that assists with determining populations at risk to environmental hazards
ASCE 7-98 wind zones	Areas potentially impacted to hurricane force winds
digital elevation model (LiDAR)*	Elevations and slope of areas adjacent to shorelines
Fetch	Wind/wave exposure.
National Wetlands Inventory	Detailed classifications of wetland types adjacent to shorelines. Assists with determining specific habitat loss/vulnerability.
Environmental Sensitivity Index*	Coastal resources at risk to oil spills. Contains detailed geomorphologic classifications of areas adjacent to shorelines in addition to the sensitivity index.
Parcels	Areas that help to determine built environment.
Building Footprints	Areas that help to determine built environment.

Net Shoreline Change

Absolute Shoreline Change

Shoreline Change + Inundation Risk

Shoreline Change + Social Vulnerability

Combined Hazard Vulnerability

Further Information

Link to the download for the HVA and AMBUR tools
- *HVA: http://r-forge.r-project.org/R/?group_id=476*
- *AMBUR: http://r-forge.r-project.org/R/?group_id=476*
- *Tool documentation: http://ambur.r-forge.r-project.org/*

Links to the four dataset components
- *Storm surge (SLOSH): http://slosh.nws.noaa.gov*
- *Shoreline change: Your output from the AMBUR software is used.*
- *FEMA Flood Maps: https://msc.fema.gov/webapp/wcs/stores/servlet/FemaWelcomeView?storeId=10001&catalogId=10001&langId=-1*
- *Social Vulnerability Index: http://www.csc.noaa.gov/digitalcoast/*

Links to GSAA
- *Home page: http://www.southatlanticalliance.org/*
- *Data portal: http://www.gsaaportal.org/*

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