Drawing the Map of Submerged Aquatic Vegetation in the Northern Gulf of Mexico: Distribution Patterns Across Marsh Vegetation Zones

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Restore America’s Estuaries Conference, New Orleans, Louisiana
December 14, 2016
Submerged Aquatic Vegetation (SAV)

- Commonly found in shallow waters of all salinities in Northern Gulf of Mexico (NGOM)

Patterns of abundance and distribution across marsh regimes are unknown
Quantification of SAV and seed resources

- SAV foraging values for wildlife species are specific to coastal marsh zones are largely developed from expert opinion in absence of quantifiable data.

![FRESH BASELINE (DATA)](image1) ![INTERMEDIATE 100%](image2) ![BRACKISH 50%](image3) ![SALINE 10%](image4)
SAV Distribution and Abundance

Where?

Why?
Study Area & Methods

Mobile Bay, Alabama to Nueces River, Texas

Data collected: species, percent cover, depth, salinity, turbidity, temperature, pH, triplicate cores (seeds and biomass)
• SAV was present at ~45% of all sites over 3 years.
  – Significantly different between saline (25% presence) and fresh, intermediate and brackish (50% presence) zones.
SAV Patterns of Distribution: Predicting Likelihood of Occurrence

Key drivers and available data

- Salinity
- Light
- Exposure

Predicting presence across unsampled areas
Species distribution or Niche modeling

- Species distribution or niche models relate occurrence data to information about the environmental or spatial characteristics
  - Prediction over un-sampled areas
  - Linking field-based habitat studies to environmental data (GIS layers) with generalized linear models (GLM)

A niche is the role and position of a species in its environment; where an organism can survive and reproduce
Spatial Layer and Environmental Data Generation

- **Coast-wide Reference Monitoring System (CRMS)**
- **Seasonal hydrology data**
  - **Spring:** February 15 - May 14
    - Temperature increasing to 25°C
  - **Summer:** May 15 - September 14
    - Temperature ≥ to 25°C
  - **Fall:** September 15 - November 14
    - Temperature decreasing to 5°C
  - **Winter:** November - February 14
    - Temperature ≤ to 15°C
Spatial Layer and Environmental Data Generation

- Seasonal salinity
  - Mean
Spatial Layer and Environmental Data Generation

- Seasonal salinity
  - Variance

Winter 2014-2015 Interpolated Salinity Variability
(offshore not valid)
Spatial Layer and Environmental Data Generation

- Reflectance
  - Water clarity (Light, Turbidity) = Reflectance
  - Reflectance of B3 (Red, 630-690nm) from LANDSAT imagery
  - Correlates well with turbidity in other areas (Mekong Delta, Tampa Bay)
Spatial Layer and Environmental Data Generation

- Exposure Index
  - Fetch
    - Omni-directional maximum fetch calculated in GIS
    - Re-scaled from 1-100
  - Wave Power
    - In progress
    - Wind Rose and Directionality
SAV-Likelihood Occurrence Model

- Coast-wide:
  - Winter Mean Salinity (-)
  - Winter Salinity Variance (+)
    - FAV
  - Spring Salinity Variance (-)
  - Reflectance (-)
SAV-Likelihood Occurrence Model

- Coast-wide Full Model (all variables included)
  - Preliminary results
  - Over-predict in Brackish
  - Under-predict in Wax Lake, Atchafalaya, Chandeleurs
SAV-Likelihood Occurrence Model

• **Fresh Marsh**
  - Fall Mean Salinity (-)
  - Winter Salinity Variance (+)
    - FAV
  - Spring Salinity Variance (-)
  - Summer Salinity Variance (+)
    - FAV
  - Reflectance (-)

• **Floating Aquatic Vegetation (FAV)**
  - Not a layer yet so only analyzed in R
SAV-Likelihood Occurrence Model

• Intermediate Marsh
  – Spring Salinity Variance (-)
  – Reflectance (-)
• Similar to Fresh
• FAV effect
SAV-Likelihood Occurrence Model

- Brackish Marsh
  - Exposure (-)
  - Winter Salinity Variance (-)

- Orientation incorporation will improve model performance
SAV-Likelihood Occurrence Model

• Saline
  – Exposure (-)
  – Reflectance (-)
  – Summer Mean Salinity (-)

• Orientation incorporation will improve model performance
Model improvements/considerations

Landscape-scale estimate of SAV likelihood of occurrence expressed as probabilities

Floating Aquatic Vegetation

Depth

Wave Power

Regions/Basins

Species specific
Implications and conclusion

• Probability of SAV occurrence models are more accurate when regionally/zonally specific
• Field data and ecological knowledge are essential to calibrating SAV model
• Aquatic habitat response to environmental drivers is different than emergent habitat
  – More rapid
  – Shallow aquatic habitat types (F, I, B, S) may improve model performance
• Questions:
  – How do changes in SAV distribution impact associated fauna?
  – How will SAV distributions change as salinities and coastal conditions are altered with sea-level rise?
Acknowledgements

For support and funding this project many thanks go to:

- The Department of the Interior, USFWS & USGS
- USGS South Central Climate Science Center
- Gulf Coast Joint Venture
- Gulf Coast Prairies LCC
- Gulf Coast Plains and Ozarks LCC
- FWS Science Support Partnership: Southwest Region 2, Southeast Region 4
- All the landowners for access
- Our amazing student workers
- The kindness of strangers