The System Wide Assessment and Monitoring Program “SWAMP”

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Coastal Protection and Restoration Authority

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Need for coastwide monitoring

109 Projects
Changing Data Needs

- Support Master Plan tools
- Resolve Uncertainties
- Actively and adaptively manage projects and programs
- Evaluate effectiveness of projects and collective effects
- Evaluate socio-economics
- Evaluate risk reduction
Where We Started

- Coastwide Reference Monitoring System (CRMS) (2005-present)
- Barrier Island Comprehensive Monitoring Program (BICM) (2006-present)
- Other agencies & entities…

Coastal Protection and Restoration Authority of Louisiana
System-Wide Assessment and Monitoring Program (SWAMP)

- Vision is for integrated protection and restoration monitoring (cutting edge and robust)

- Data network will support Master Plan models and other tools, program performance metrics (measure success/change in human and natural systems)

- Include opportunities for leveraging and partnership among a variety of agencies (building on existing monitoring programs)
SWAMP Acknowledgements

- The Water Institute of the Gulf, Leads
  - Ann Hijuelos – Natural System
  - Scott Hemmerling – Human System

- SWAMP Team Members
  - The Water Institute of the Gulf: Mead Allison, Tim Carruthers, Katelyn Costanza, Ehab Meselhe, Leland Moss, Joao Pereira, Denise Reed, Dallon Weathers, and Brendan Yuill
  - External SMEs: Mark Hester (ULL), Bryan Piazza (TNC), Erick Swenson (LSU), Troy Blanchard (LSU), Rex Caffey (LSU), Mary Christman (MCC Statistical)
SWAMP Development

1. Develop a **framework** that:
   - Identifies the key parameters necessary for understanding the overall coastal system (natural and built) and supporting the coastal protection and restoration program.

2. Develop an **inventory** of ongoing/active monitoring efforts.
SWAMP Development

• What data do we need to address CPRA’s objectives

- Landscapes: Land Area
  - Satellite Imagery
  - Aerial Photography

- Biol. Integrity: Vegetation Community
  - Vegetation Survey
  - CRMS Veg Data
  - Remote Data (NDVI, etc.)

- Socio-economics: Ecosystem Dependency
  - Census Data
  - Community Surveys
  - Tourism and Recreational Data

- Community Resources: Protection Level
  - Miles of Levees
  - Height of Levees
  - Protected Acres
  - Homes Above BFE
  - Severe or repetitive loss

Data Needs
- Satellite
- Aerial
- Veg Survey
- CRMS Veg
- NDVI
- Census Data
- Levee Surveys
- Home Surveys
Data Users

- Physical Terrain
  - Bathymetry
  - Surface Elevation
  - Land Area

- Weather & Climate
  - Evapotranspiration
  - Precipitation
  - Wind

- Hydrology
  - Current Velocity
  - Water Level
  - Waves

- Water Quality
  - Chl a
  - DO
  - Nutrients
  - Salinity
  - Turbidity
  - TSS

- Biotic Integrity
  - Wetland Biomass
  - Nekton
  - Oysters
  - Soil Condition
  - Veg Composition

- Protection & Socioeconomics
  - Population Demographics
  - Housing and Community Characteristics
  - Economy & Employment
  - Ecosystem Dependency
  - Protection of Residential Properties
  - Protection of Critical Infrastructure & Services
SWAMP Development

Planning 2013
- Framework
- Data Inventory
- Performance Measures

Design 2014/15/16
- Power Analysis
- Sample Size Determination
- Statistical Design
- Coastwide, BA, PO, BS, MRD

Implementation 2015/16/17
- Linking/Leveraging with Existing Programs
- Developing/Refining Data Standards, SOPs, QA/QC, Data Management
SWAMP Natural System
Barataria Pilot

• **Biotic Integrity**
  – Nekton community composition
  – Oyster biomass
  – Soil condition
  – Wetland vegetation biomass
  – Vegetative community composition

• **Water Quality**
  – Chlorophyll a
  – Dissolved Oxygen
  – Nutrient constituents (N, P, Silica)
  – Salinity
  – Turbidity
  – Suspended sediment concentration

• **Weather and Climate**
  – Potential Evapotranspiration
  – Precipitation
  – Wind

• **Hydrology**
  – Current velocity
  – Water level
  – Waves

• **Physical Terrain**
  – Surface elevation
  – Bathymetry
  – Land area
Biotic Integrity

Nekton community composition (↑stations)

Oyster biomass (↑freq, ↑coverage)

Soil condition

Wetland vegetation biomass

Vegetative community composition
Fisheries Independent Sampling
- Square Meter
- Gill Net
- Seine
- Trawl
- New Trawl Sites

Biotic Integrity
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SWAMP Natural System
Barataria Pilot

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• Physical Terrain
  – Surface elevation
  – Bathymetry
  – Land area
Continuous Water Quality

Water Quality
- Chlorophyll a
- Dissolved Oxygen
- Nutrient constituents (N, P, Silica)
- **Salinity**
- Turbidity
- Suspended sediment concentration
Continuous Water Quality

- Chlorophyll a
- Dissolved Oxygen
- Nutrient constituents (N, P, Silica)
- Salinity
- Turbidity
- Suspended sediment concentration

Water Quality

USGS (Sal, Temp, Water Level)
Continuous Water Quality

Water Quality

- Chlorophyll a
- Dissolved Oxygen
- Nutrient constituents (N, P, Silica)
- Salinity
- Turbidity
- Suspended sediment concentration

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, i-cubed, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community.
Discrete Water Quality

- Chlorophyll a
- Dissolved Oxygen
- Nutrient constituents (N, P, Silica)
- Salinity
- Turbidity
- Suspended sediment concentration

*Water Quality*

*Boat-Based Monthly Sampling*
Water Quality

- Chlorophyll a
- Dissolved Oxygen
- Nutrient constituents (N, P, Silica)
- Salinity
- Turbidity
- Suspended sediment concentration

USGS (Sal, Temp, Water Level)
- Add Chl, DO, Turb
- New Stations
- Boat-Based
- Monthly Stations (plus TSS, TN, TP)
SWAMP Natural System
Barataria Pilot

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• Weather and Climate
  – Potential Evapotranspiration
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• Hydrology
  – Current velocity
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• Physical Terrain
  – Surface elevation
  – Bathymetry
  – Land area
SWAMP
Side Scan Sonar

High Density/ High Confidence

High

Low Density/ High Confidence

Low

Low Density/ Low Confidence

Low

High Density/ Low Confidence

High
SWAMP Physical Terrain

March 2015 Status

<table>
<thead>
<tr>
<th>Area</th>
<th>mi²</th>
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<tr>
<td>Completed</td>
<td>6,604</td>
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<tr>
<td>Proposed</td>
<td>6,703</td>
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<tr>
<td>Total</td>
<td>13,307</td>
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Explanation

- 2011 winter completed regional lidar acquisitions
- 2013 winter completed regional lidar acquisitions
- 2015 winter 3DEP completed regional lidar acquisition
- 2015 fall to 2016 winter 3DEP proposed regional lidar acquisition
- 2016 winter to 2017 winter 3DEP proposed regional lidar acquisition

Physical Terrain

Surface elevation

Bathymetry

Land area

Scale: 1:2,350,000

Image Source:
LandSat 5 Thematic Mapper Satellite Imagery is provided by the USGS Center for Earth Resources Observation and Science. Imagery was acquired between October 3 and November 11, 2011.
Questions?
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Protection Data
Protection and Socio-economics
Biotic Integrity
Oceanic

Restoration Data
Weather & Climate
Physical Terrain
Hydrology
Water Quality

Oceanic
Atmospheric