Programmatic Monitoring and Adaptive Management (MAM) Updates

CPRA
Coastal Protection and Restoration Authority of Louisiana

August 16, 2023

committed to **our coast**

Adaptive Management *CPRA Definition*

Adaptive Management:

is a **structured process for making decisions** over time through active learning;

enables adjustments to be made in projects and in programs as new information becomes available;

embraces the **scientific approach** that involves:

- Identifying explicit goals and objectives
- Developing and implementing management actions
- Assessing the system's response to the actions
- Using that knowledge to make management decisions across all projects and programs throughout all stages of development.

Integrated Adaptive Management

Applies to **Projects** and **Programs**

Builds on previous efforts

Informed by other programs/efforts

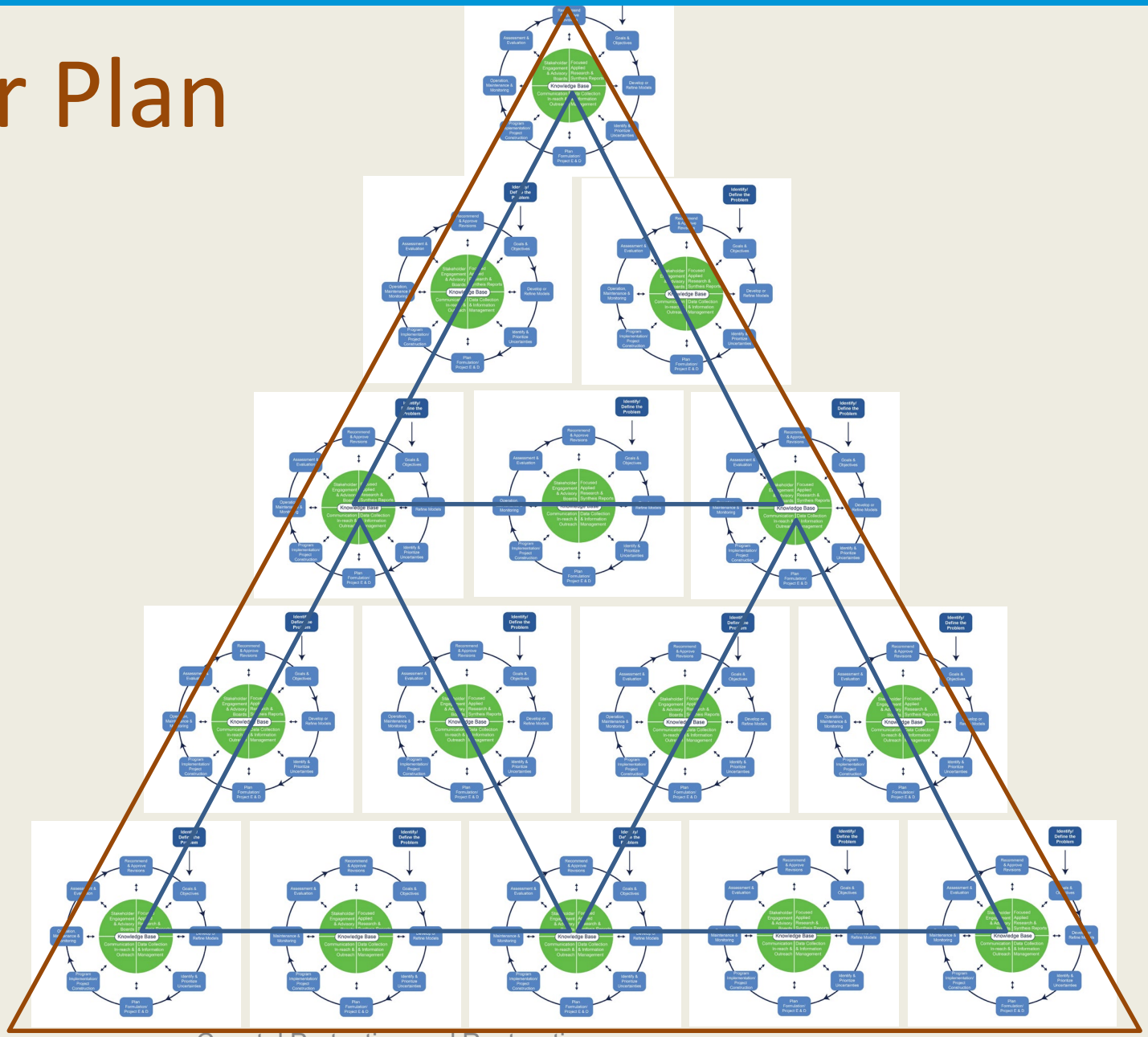
Connections between boxes and **with Knowledge Base** are critical communication pathways and multi-directional

Supports a number of funding **programs** (NRDA, RESTORE, NFWF, CWPPRA, GOMESA)

Master Plan

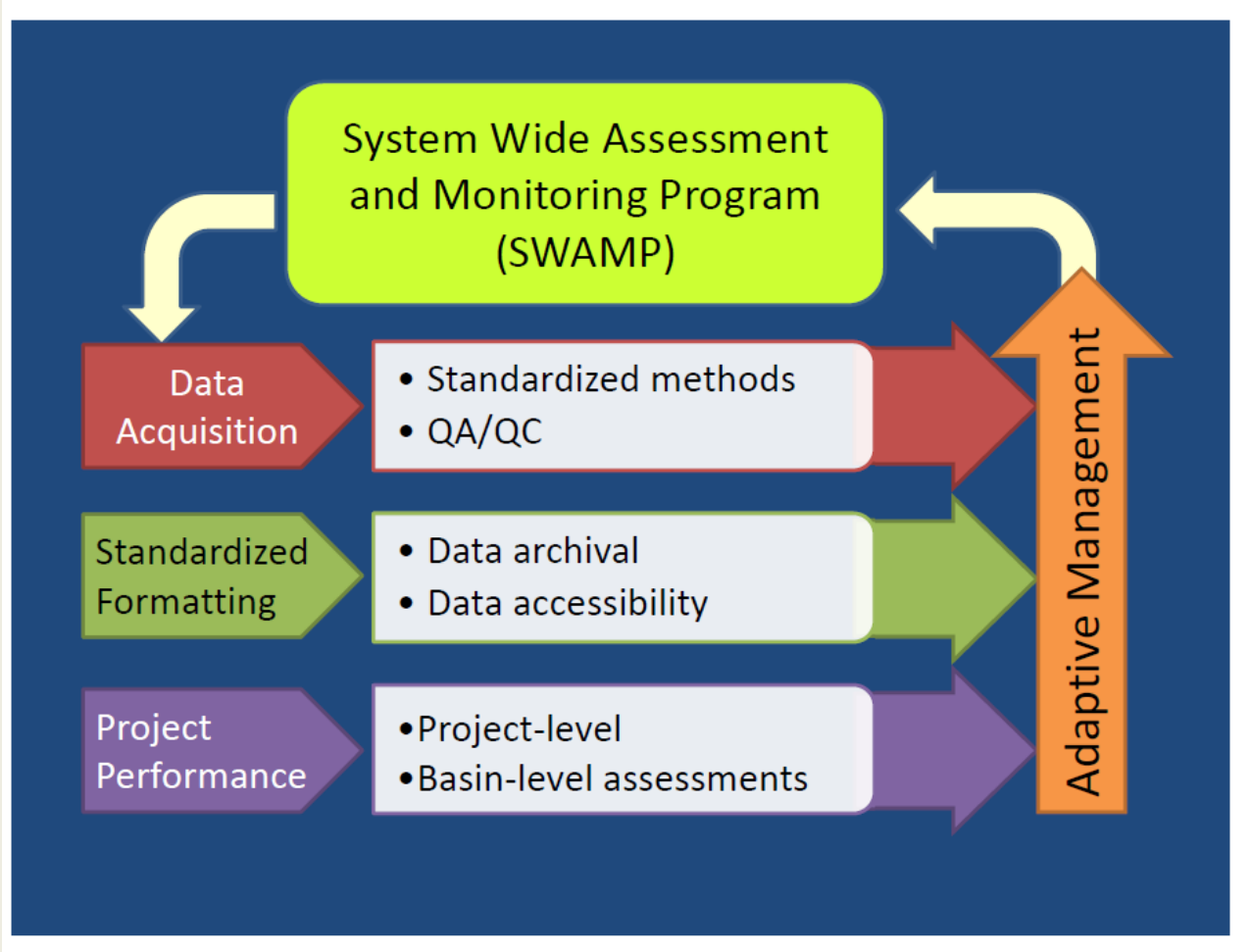
Programs

Projects -



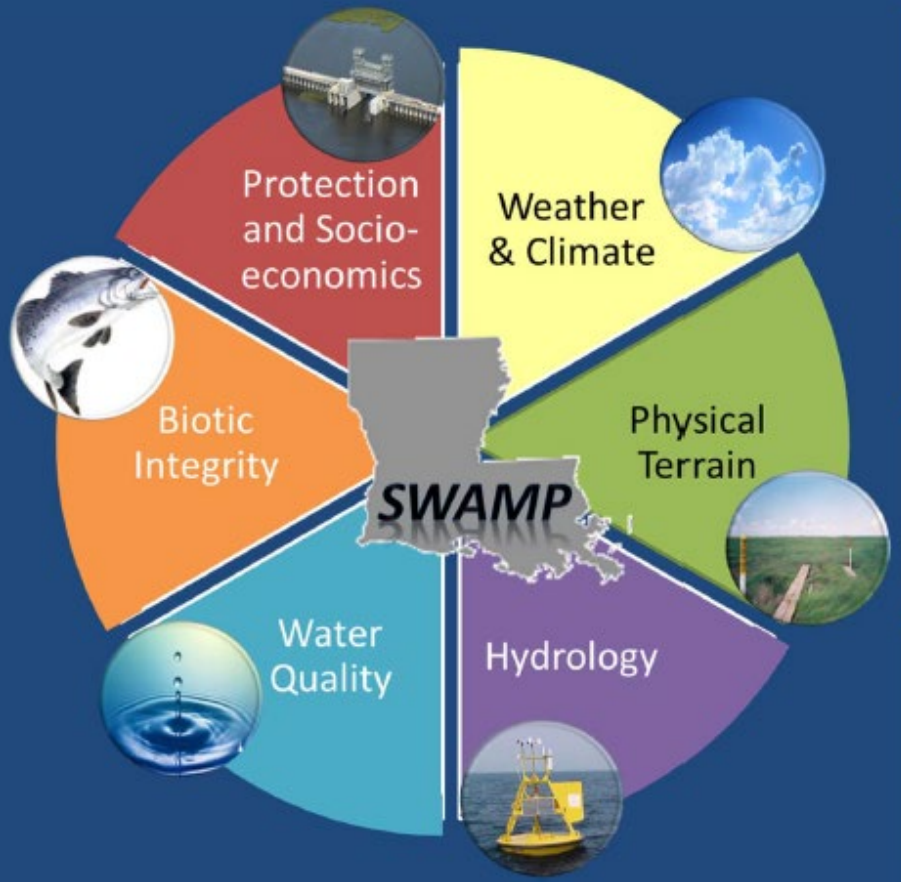
System-Wide Assessment And Monitoring Program (SWAMP)

CPRA Adaptive Management Implementation Tool *(Baseline Data & Monitoring)*



System Wide Assessment & Monitoring Program (SWAMP)

Natural System & Human System



SWAMP Parameters

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

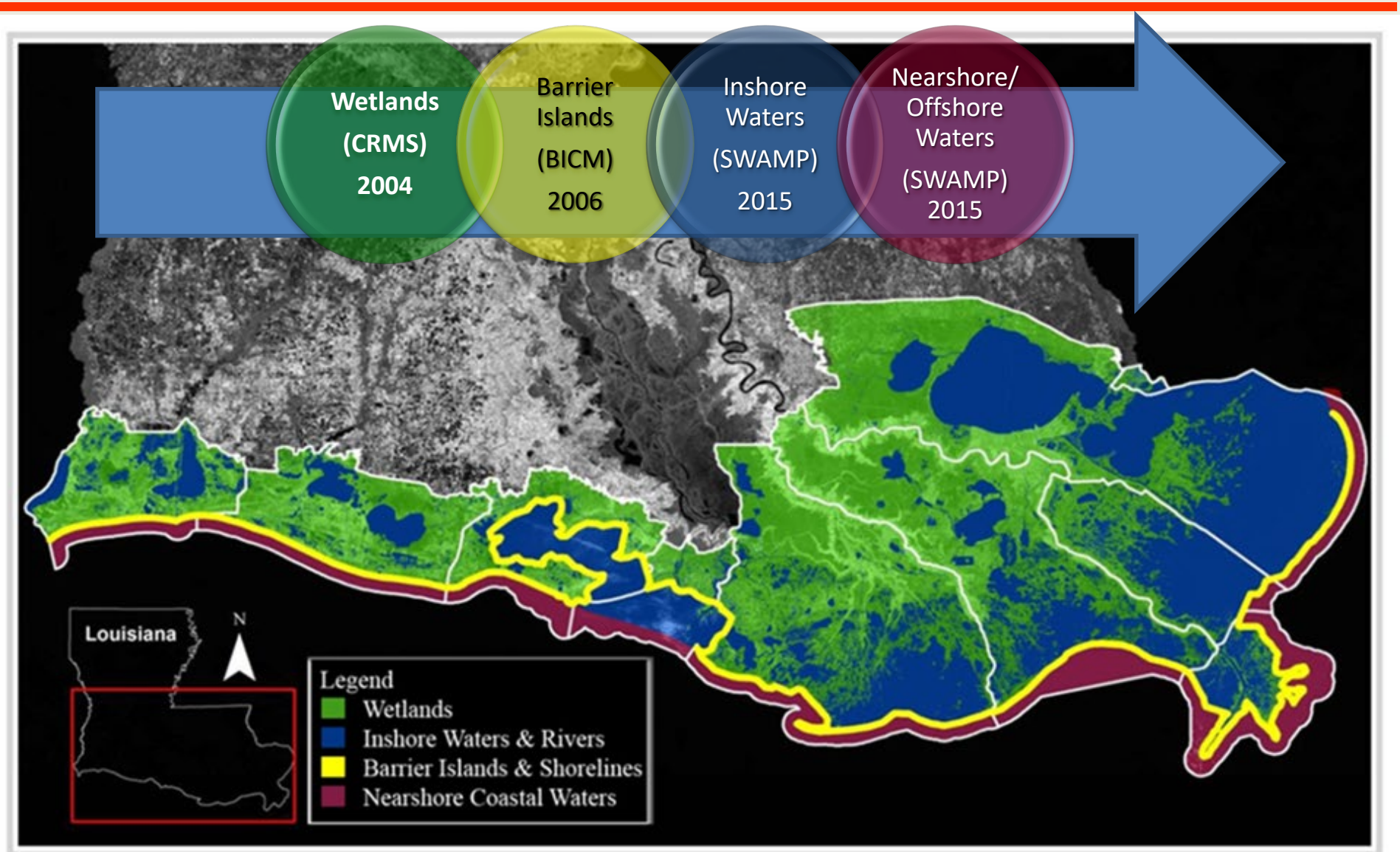
Biotic Integrity
- Wetland Biomass
- Nekton
- Oysters
- Soil Condition
- Veg Composition

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

System Wide Assessment & Monitoring Program (SWAMP) –

Coast-wide Reference Monitoring System (CRMS)

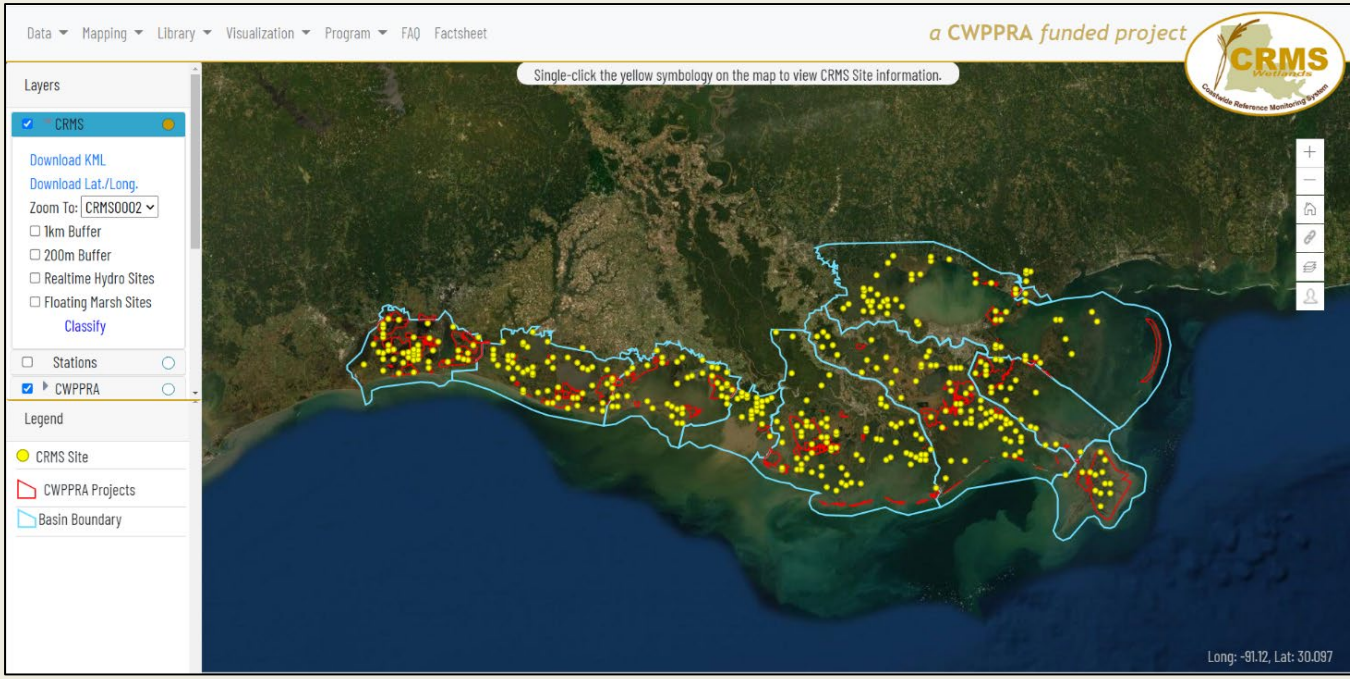
Barrier Island Comprehensive Monitoring (BICM) Program



Physical Terrain

- **389 Active monitoring sites across coastal Louisiana**

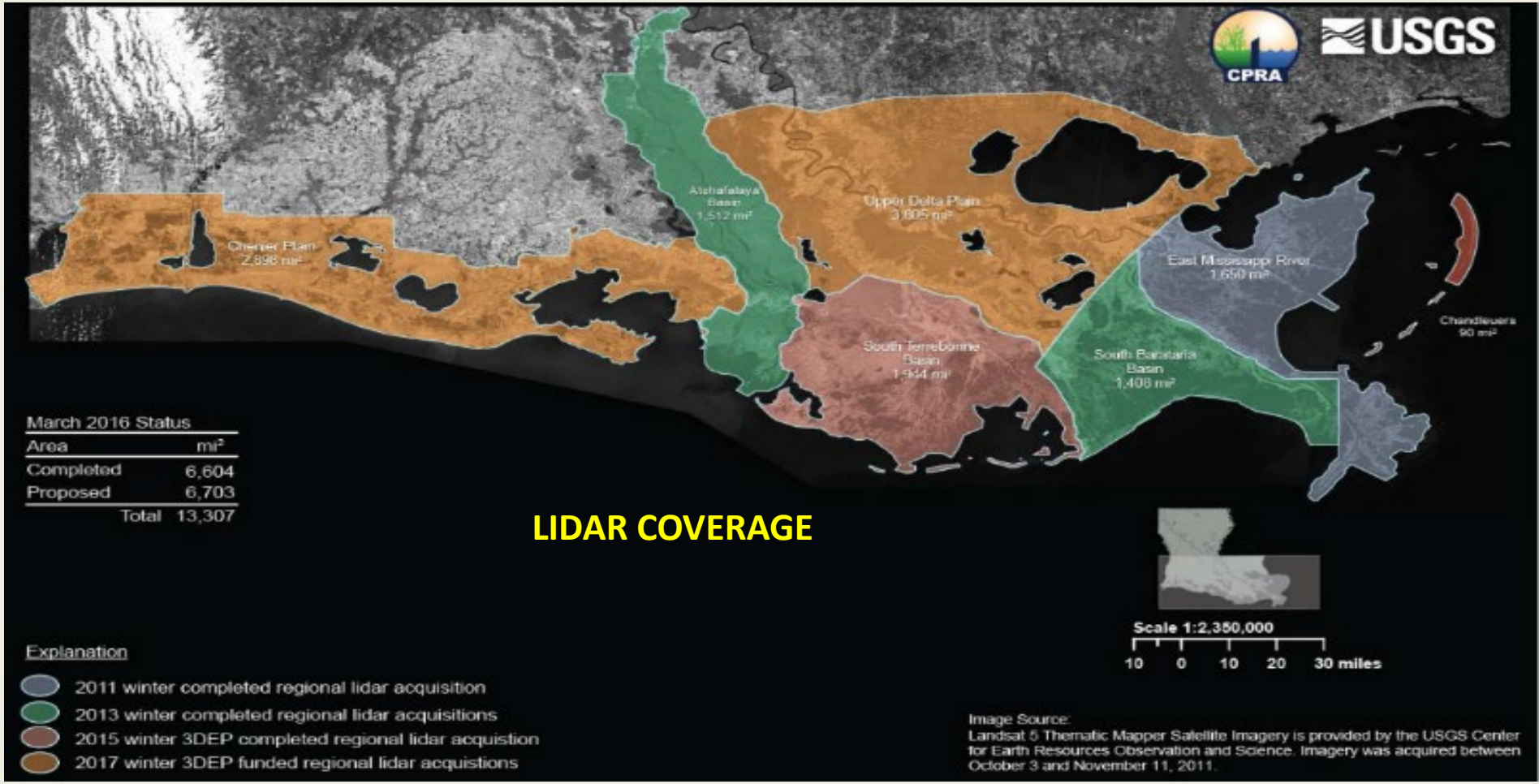
- Measures:
  - Water Level
  - Salinity
  - Vegetation
  - Elevation
  - Vertical Accretion
  - Surface Elevation Change
  - Soil Characteristics
  - Land Change



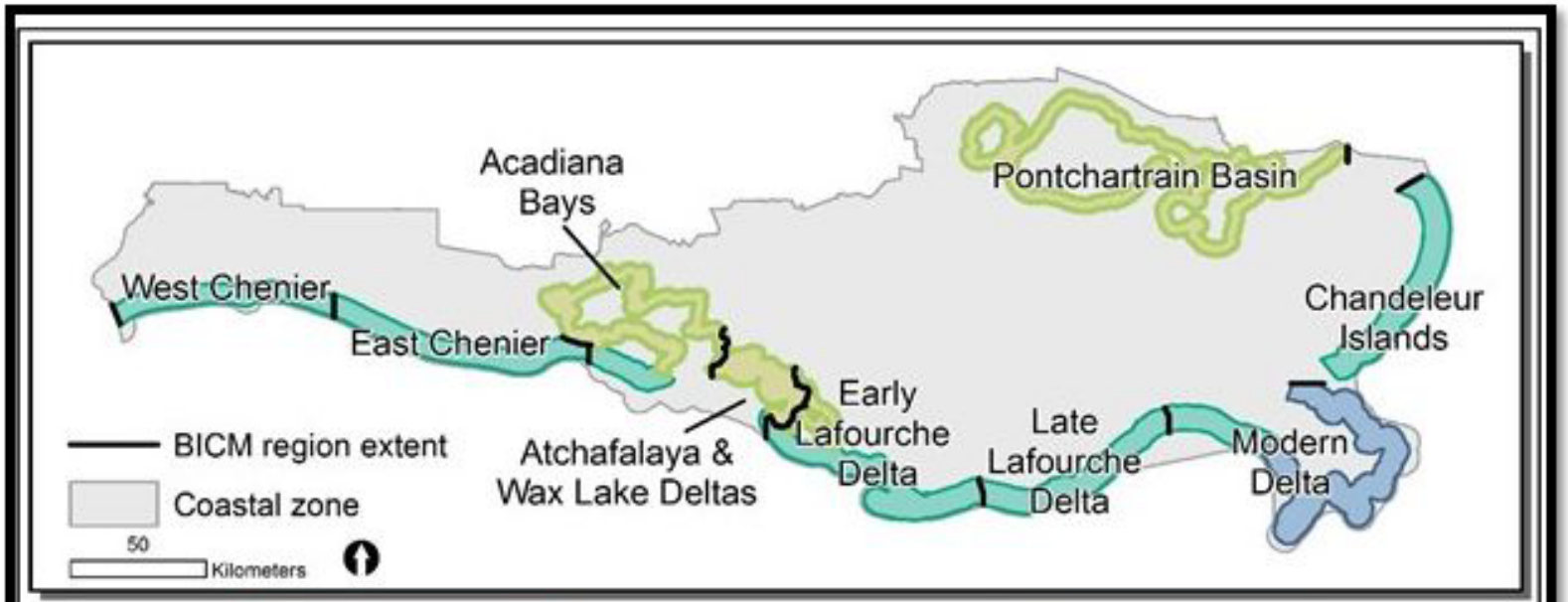
- Publically available dataset with continuous data since 2006

- Funded by CWPPRA and NRDA

Physical Terrain



Physical Terrain – Collection Efforts

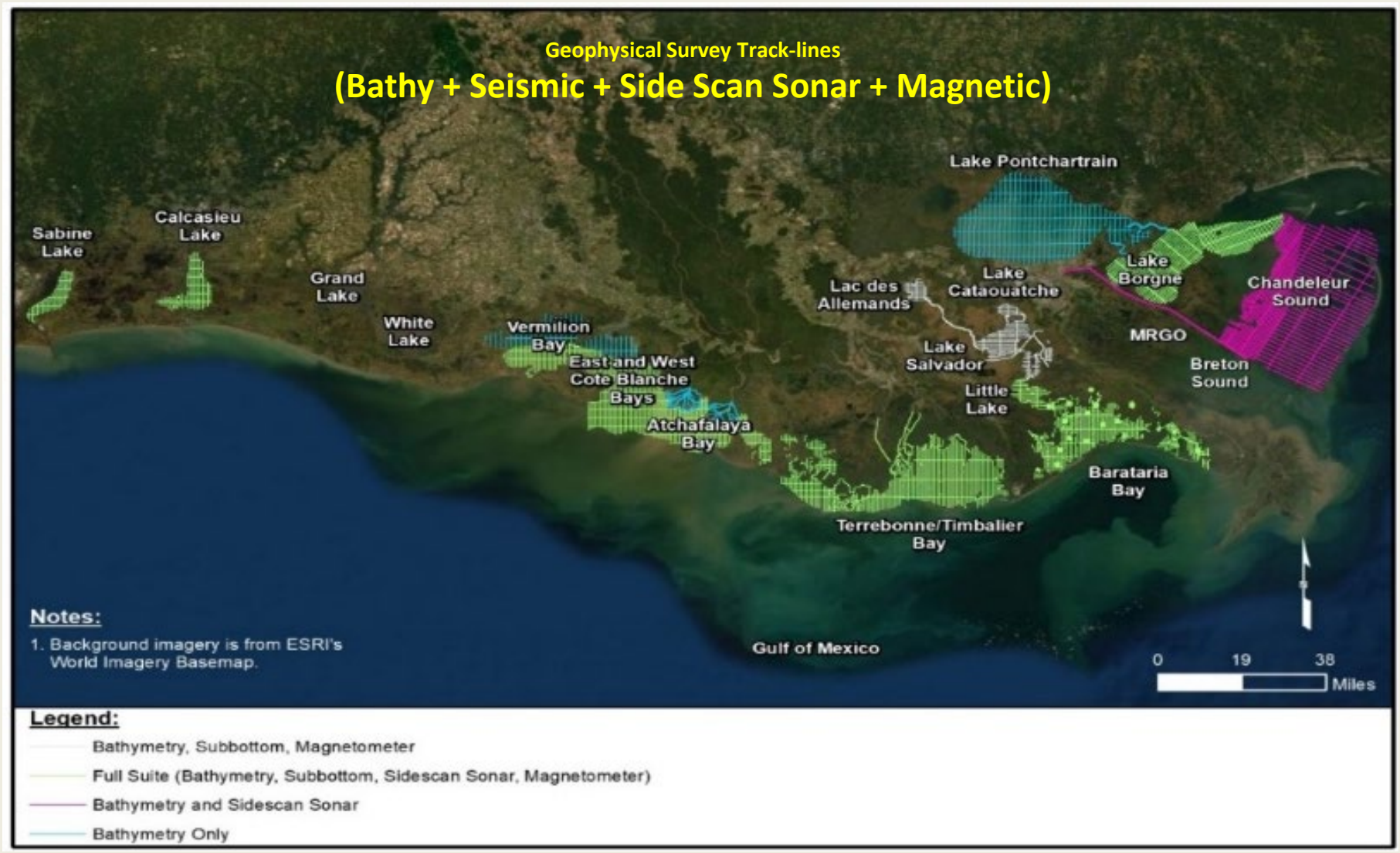


Shoreline Assessment,
Shoreline Position,
Bathymetric Surveys,
Topographic Surveys,
Habitat Mapping,
& Sediment Characterization

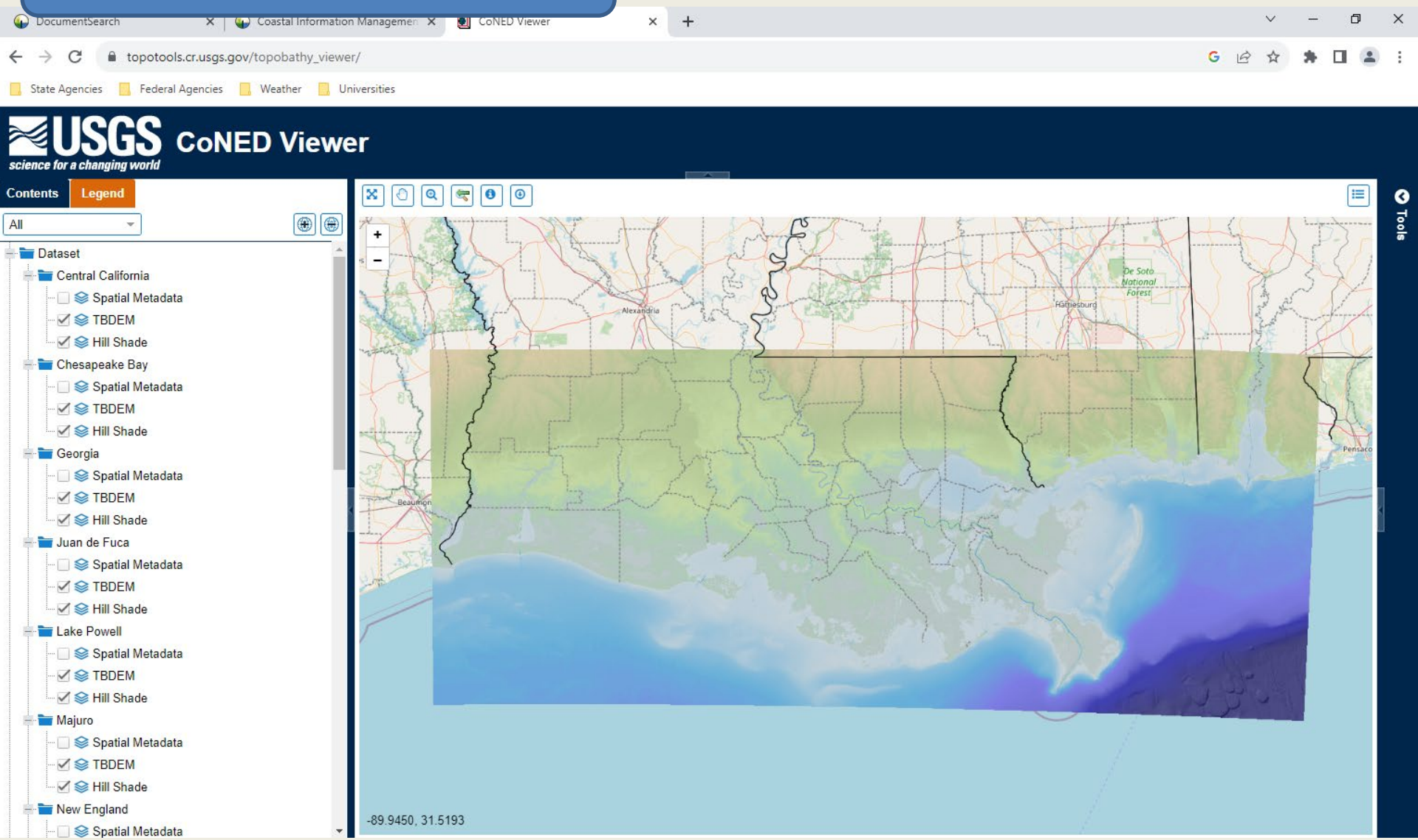
BICM - Bathymetry

1880's
1930's
2006/07
2015-17
2022-23 – Ongoing

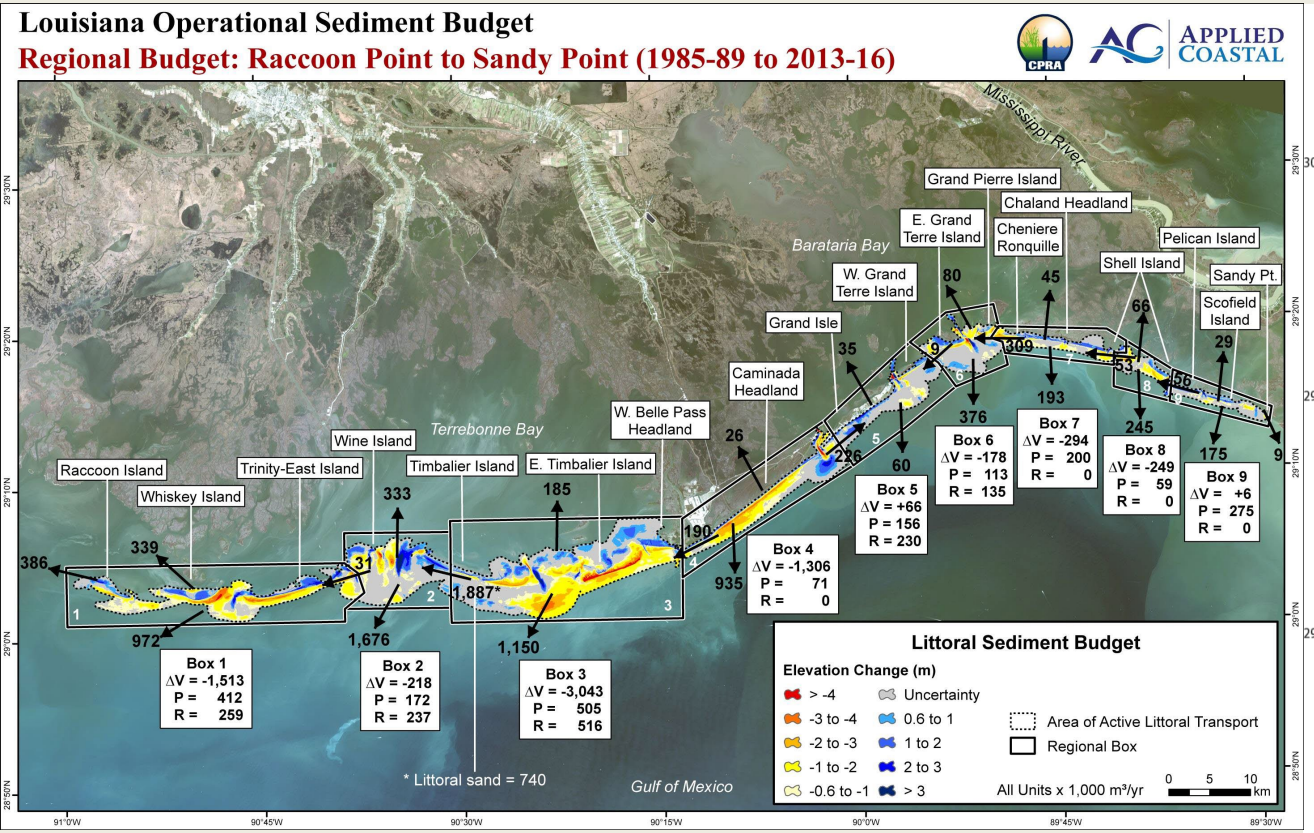
Physical Terrain

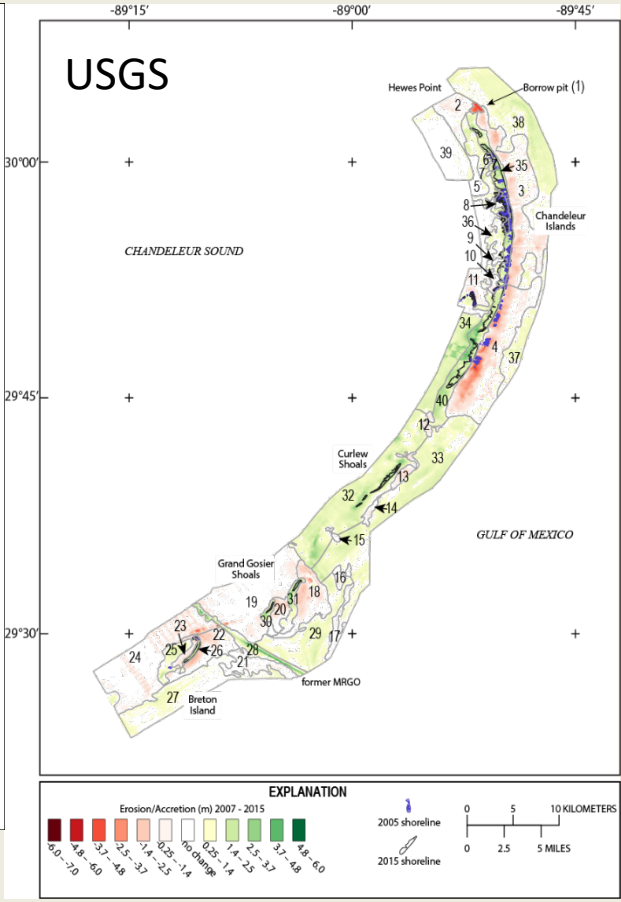


Physical Terrain



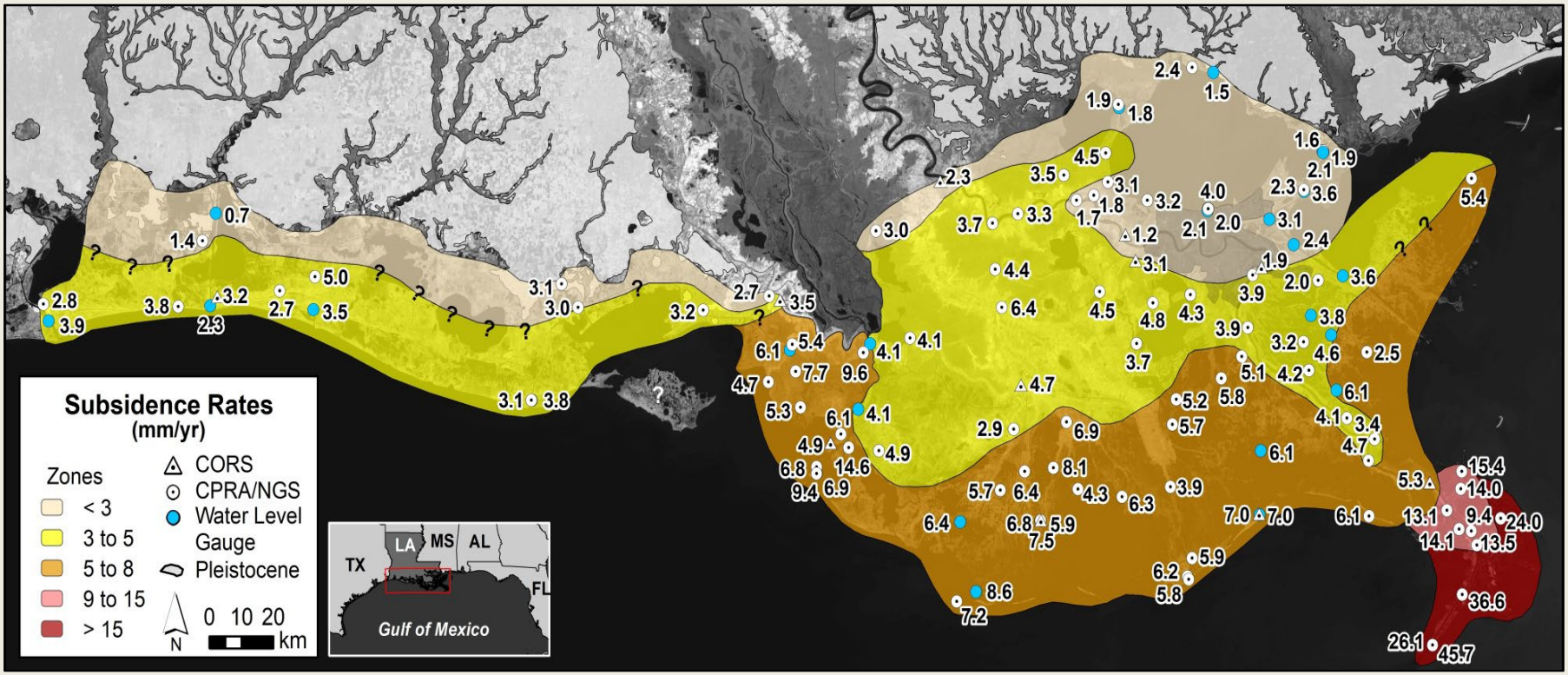
Operational Sediment Budget Development





Physical Terrain

Map of Subsidence Rates for Coastal Louisiana



Hydrology

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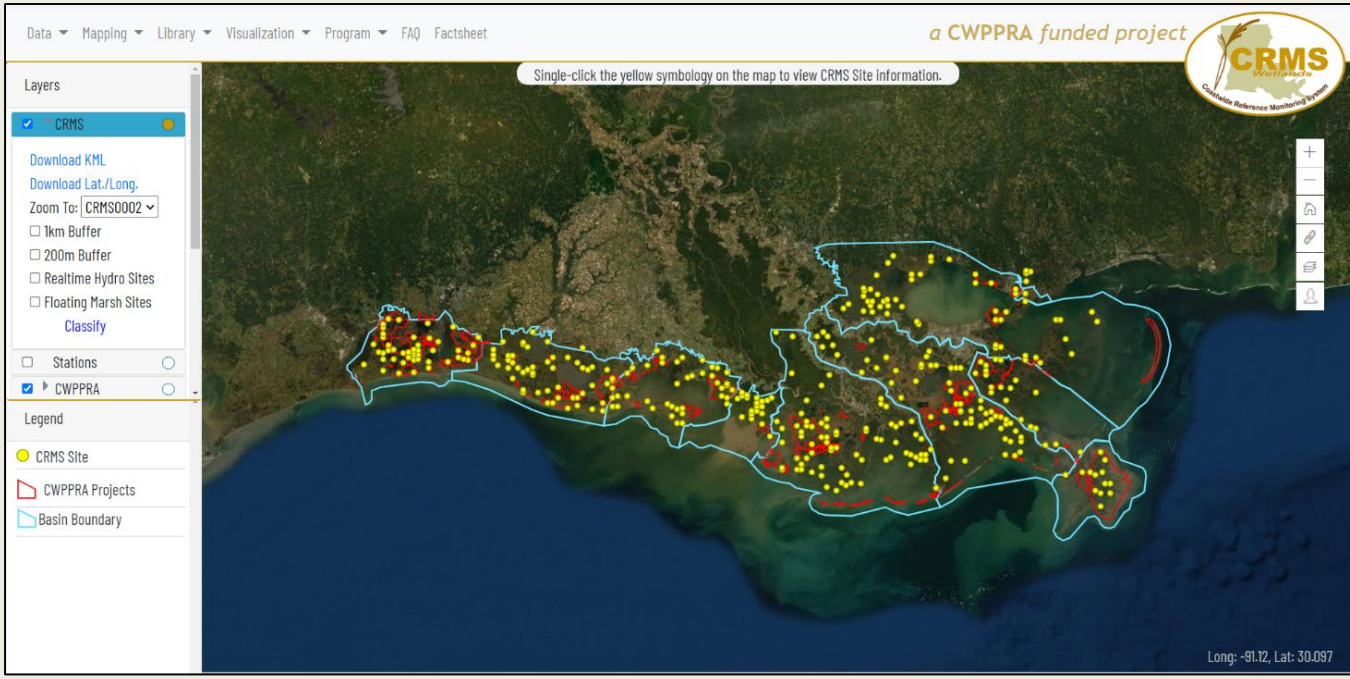

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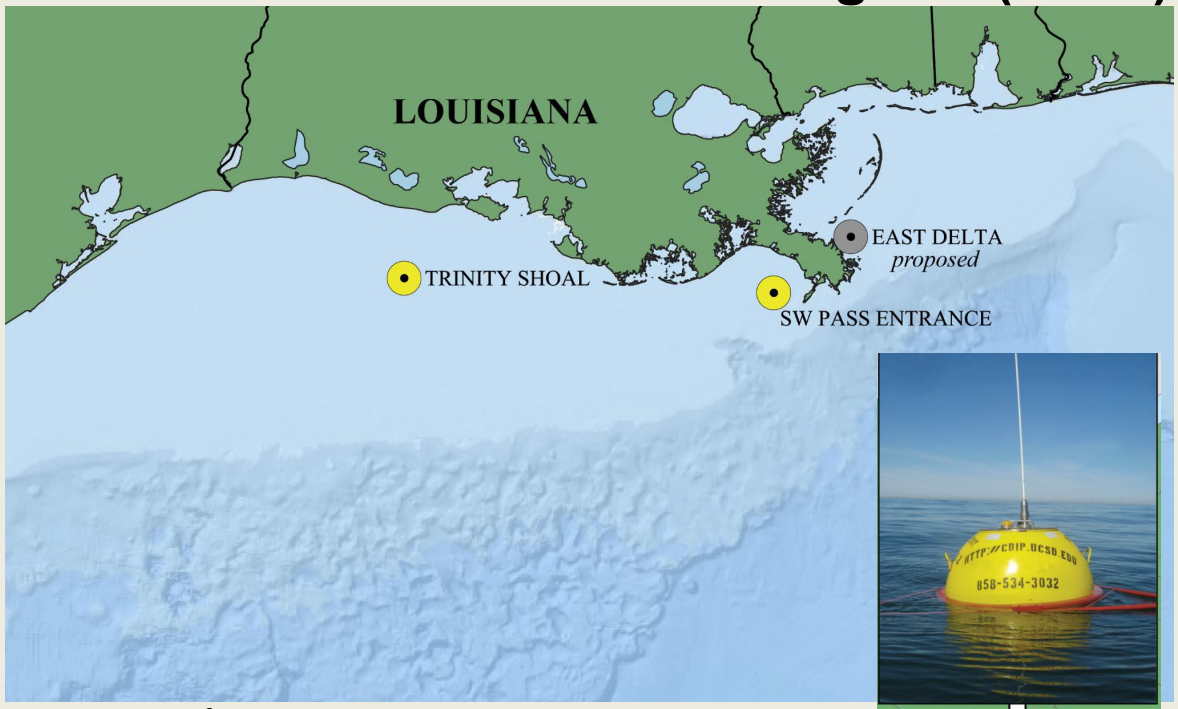
Hydrology

Wave and Current Monitoring in Louisiana
Coastal Data Information Program (CDIP)



DATA ACQUISITION

- Wave height, period, direction, sea surface temperature
- Available as directional spectra, parameters, time series of displacements, with myriad detailed metata.
- Newest generation of buoys includes sensors for surface current speed and direction, and air temperature.

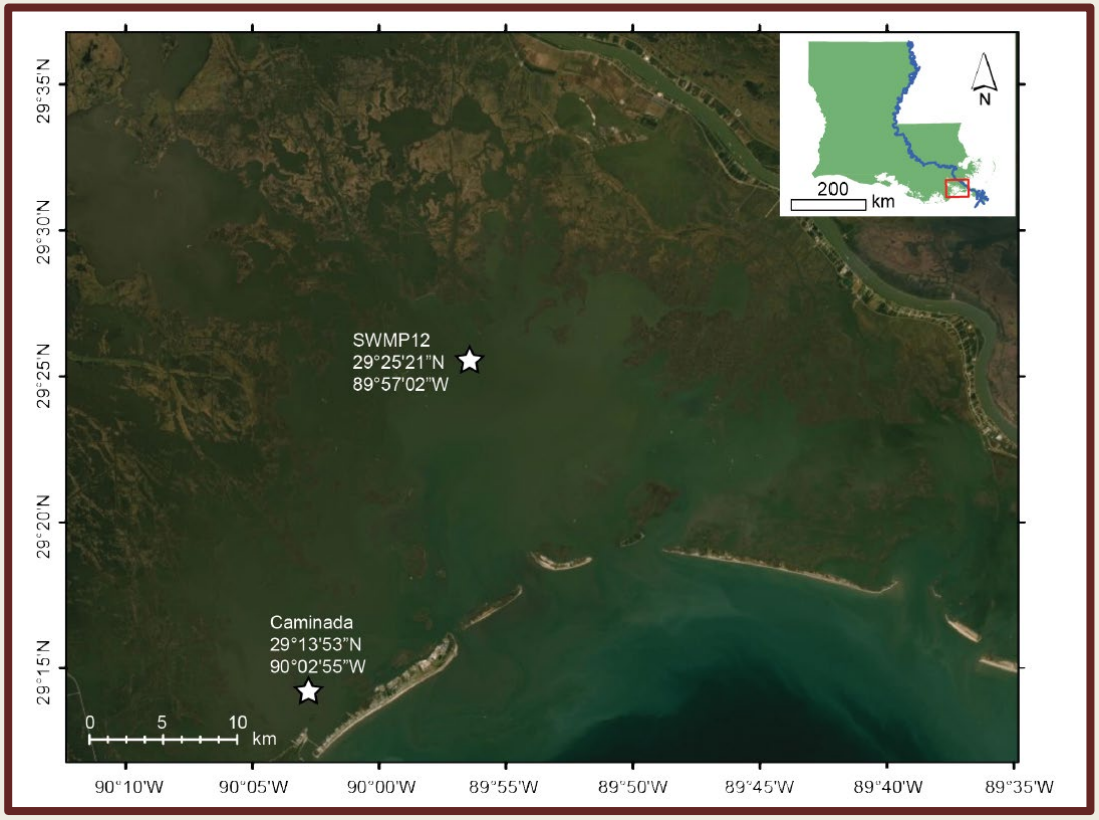
DATA DISSEMINATION

- Buoys report data every 30 minutes via Iridium (> 99% reliable).
- All CDIP buoy data, real time and archived, are available via fully compliant NetCDF (THREDDS, ERDDAP).
- Following QC, data disseminated in near real time to NOAA/NDBC, and onward to NWS, NOAA PORTS, IOOS RA data portals, etc.

Hydrology

SWAMP – Inshore Wave & Current measurements

Acoustic Wave and Current (AWAC) Profiler Deployments in Barataria Bay



Water Quality

Fundamental Objective: Document changes in key water quality variables in estuarine open water bodies from the Gulf of Mexico boundary to upland endpoints that are sensitive to system drivers and are critical for understanding system dynamics.

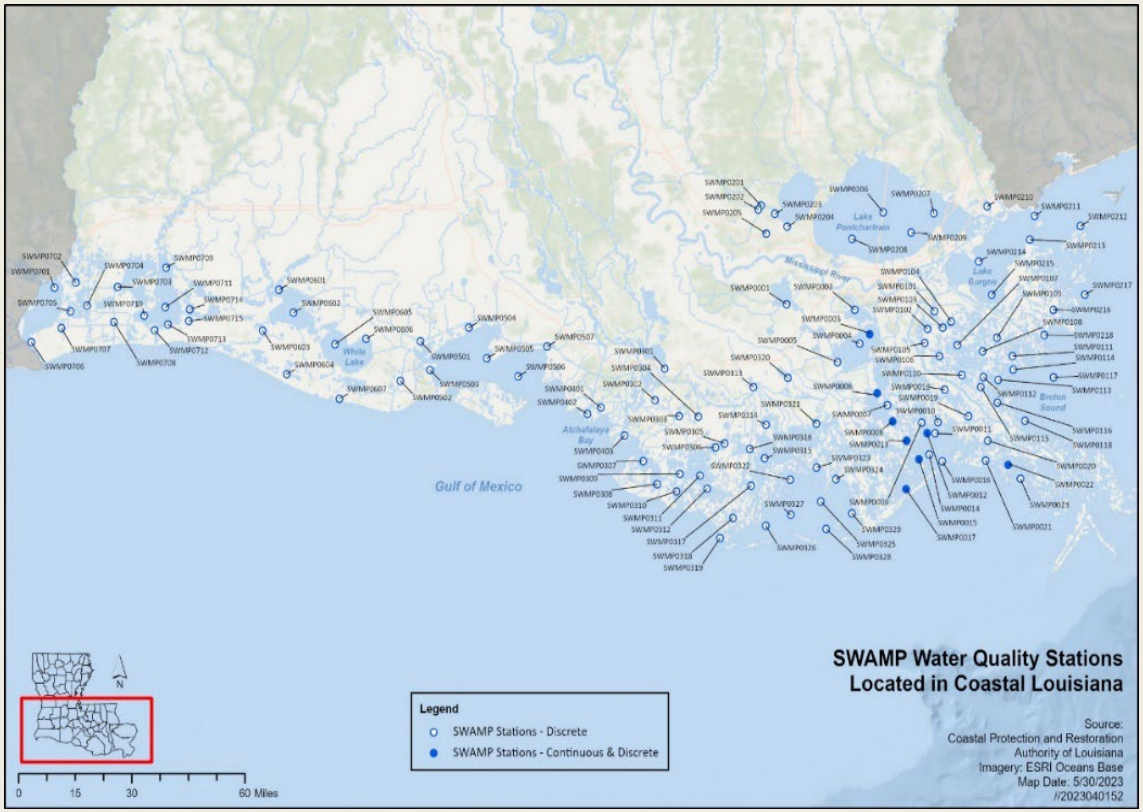
Implementation:

120 stations sampled monthly

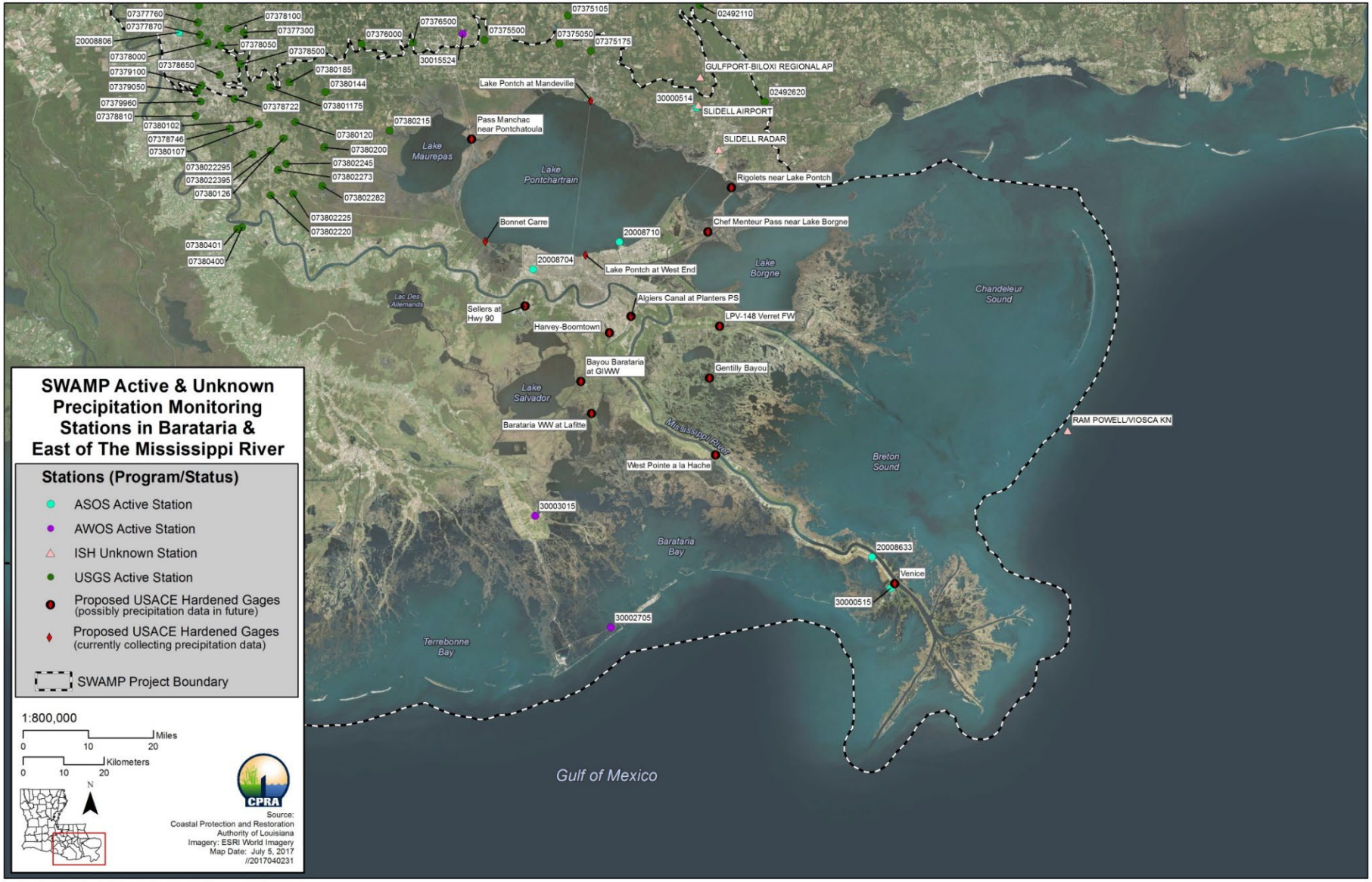
In-situ Measurements: Depth, water temp, specific conductance, salinity, DO, pH

Water Quality (Laboratory Analysis) : Turbidity, Chlorophyll a, TN, TKN, NO_2, NO_3, NH_4,TP, orthophosphate, silica, TSS, VSS

Station Data Availability:
Barataria: Nov 2015 – Present
Breton/Pont: Sept 2017 – Present
Terrebonne, Atchafalaya, Teche/Vermillion, Mermentau, Calcasieu/Sabine: Oct 2020 – Present



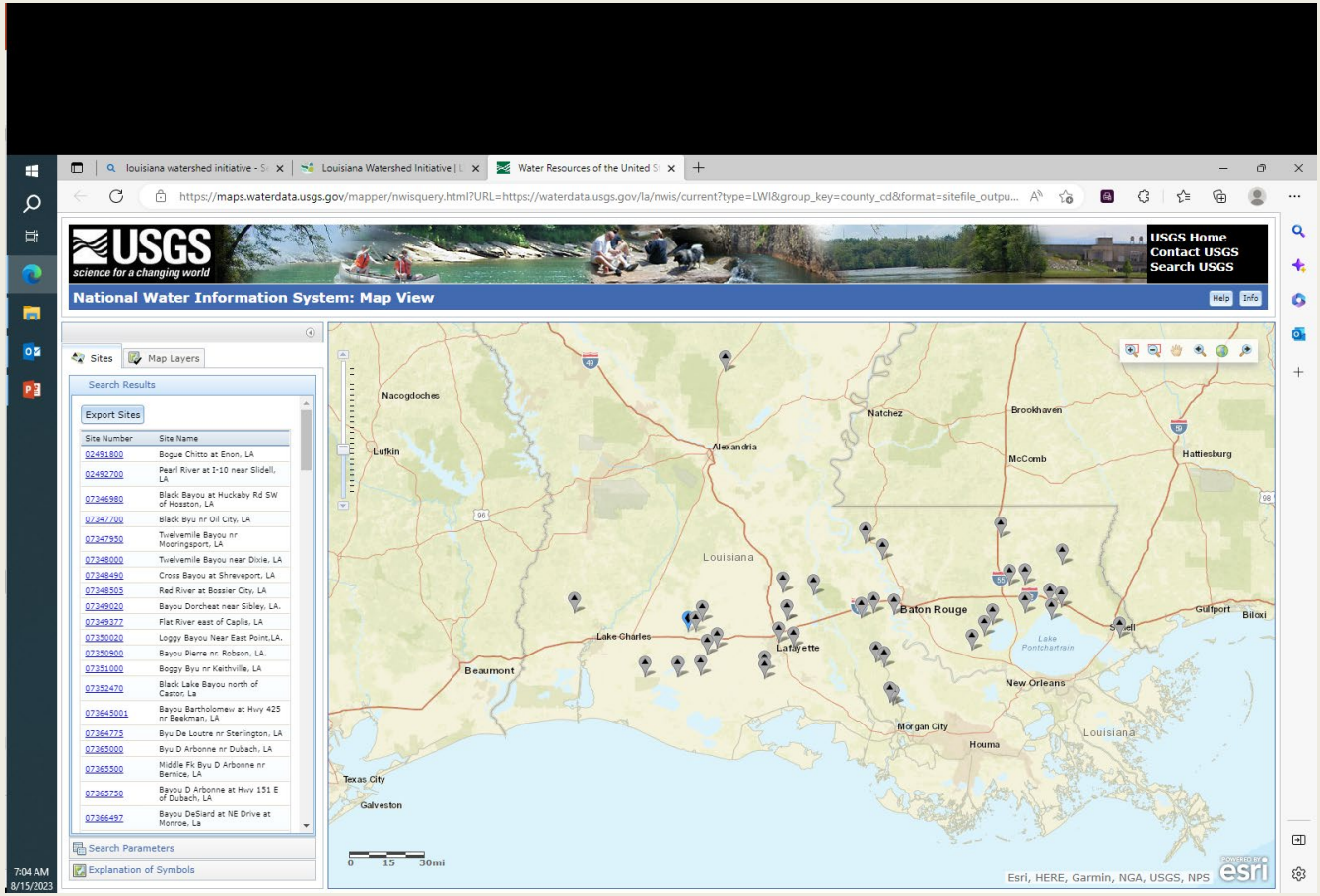
Weather and Climate



Weather and Climate

Louisiana Watershed Initiative

Once deployed, the network will provide enhanced statewide coverage for monitoring riverine and rainfall information in real time and support the development and use of watershed models.



Biotic Resources

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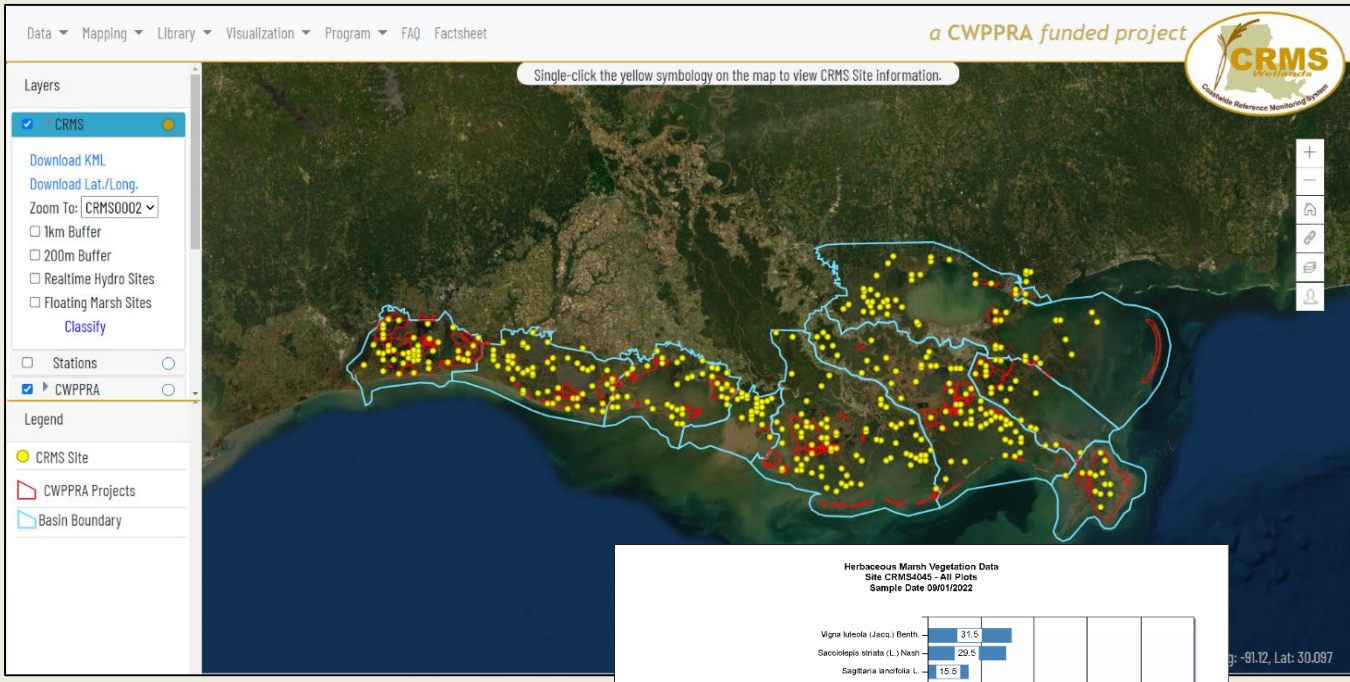
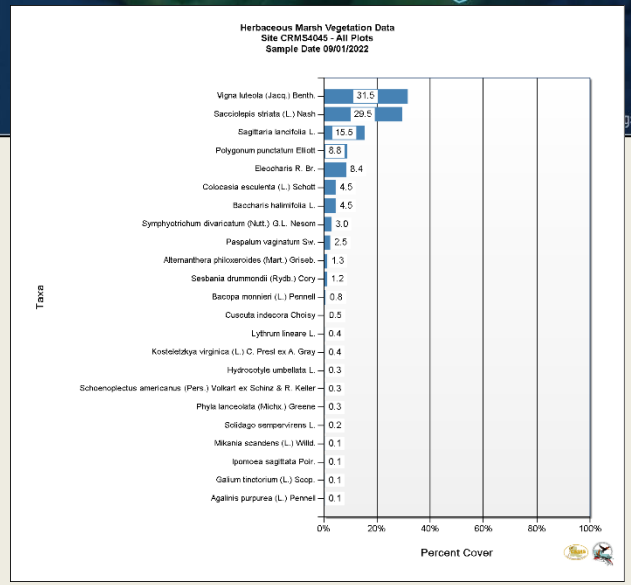
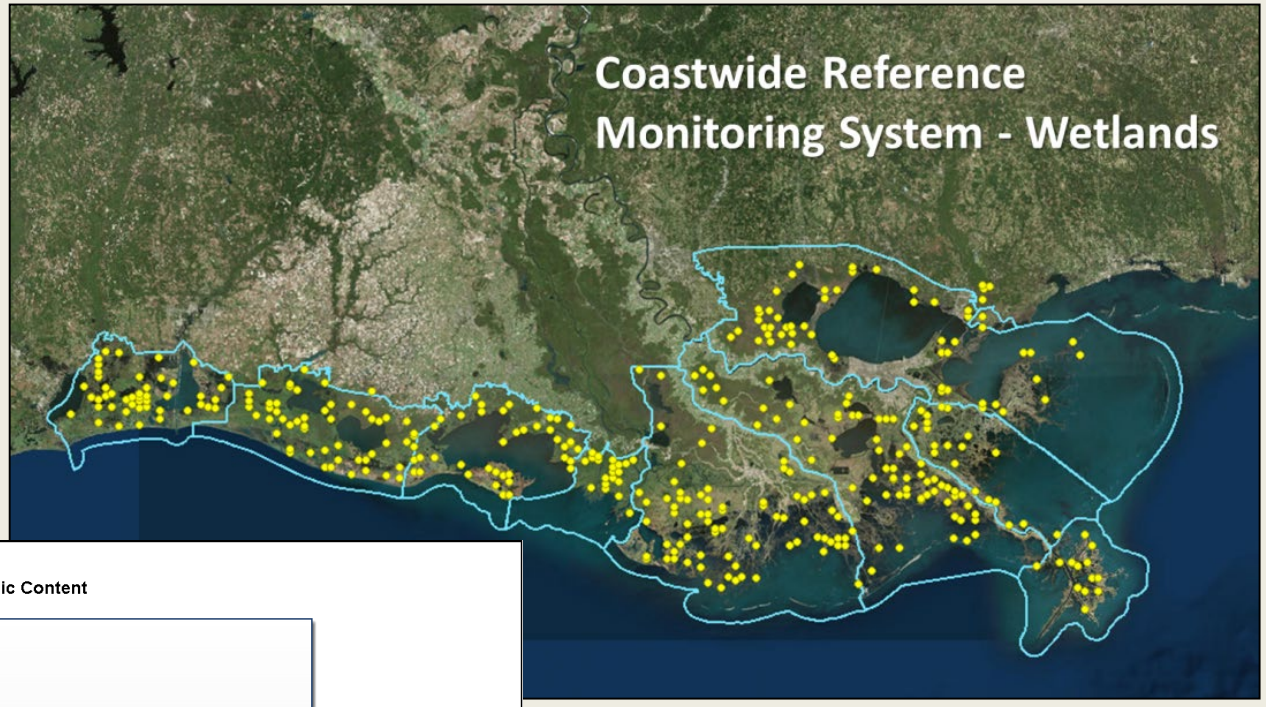


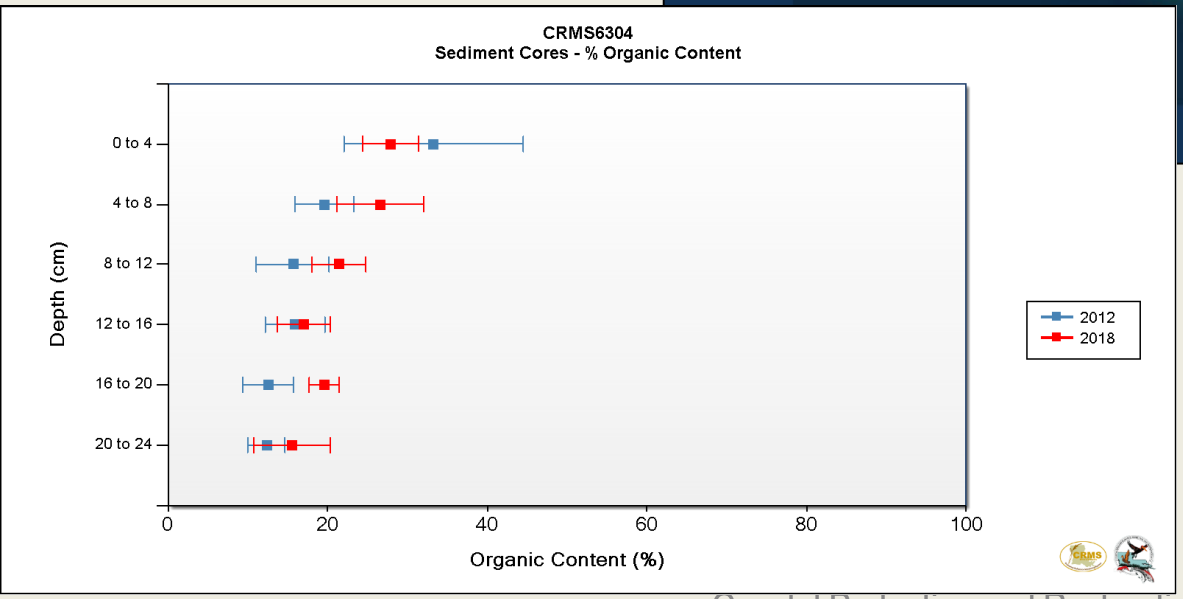


Biotic Resources

Above & Below Ground Biomass

- Subset of nearly 40% of all CRMS sites
- Stratified random design within each basin*

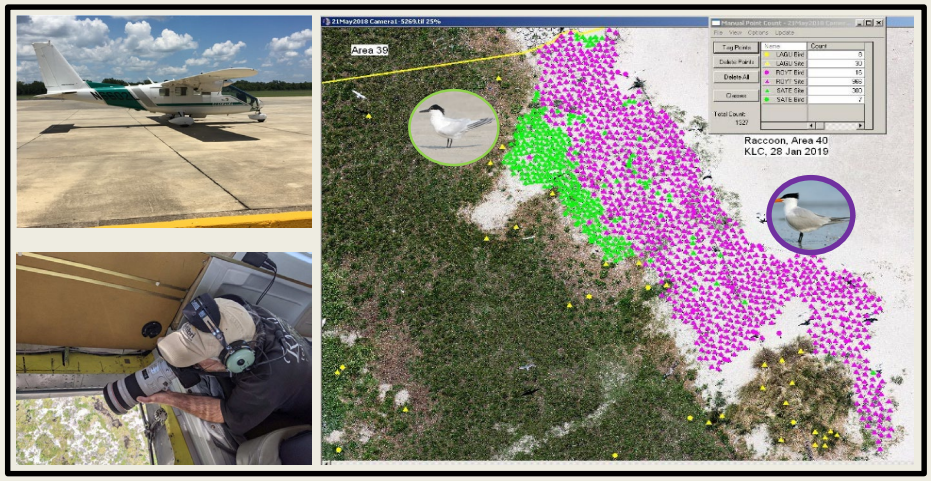


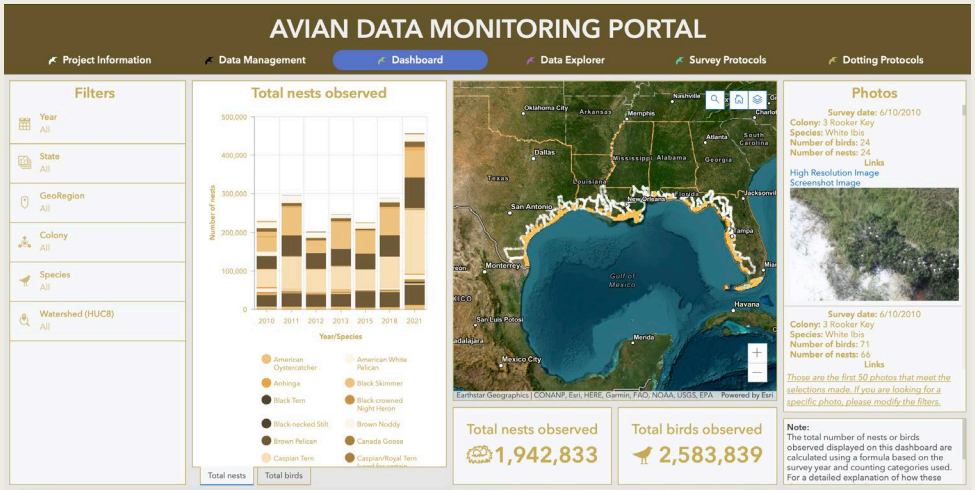


*excludes forested wetlands

Biotic Resources

Colonial Waterbirds (CWB)

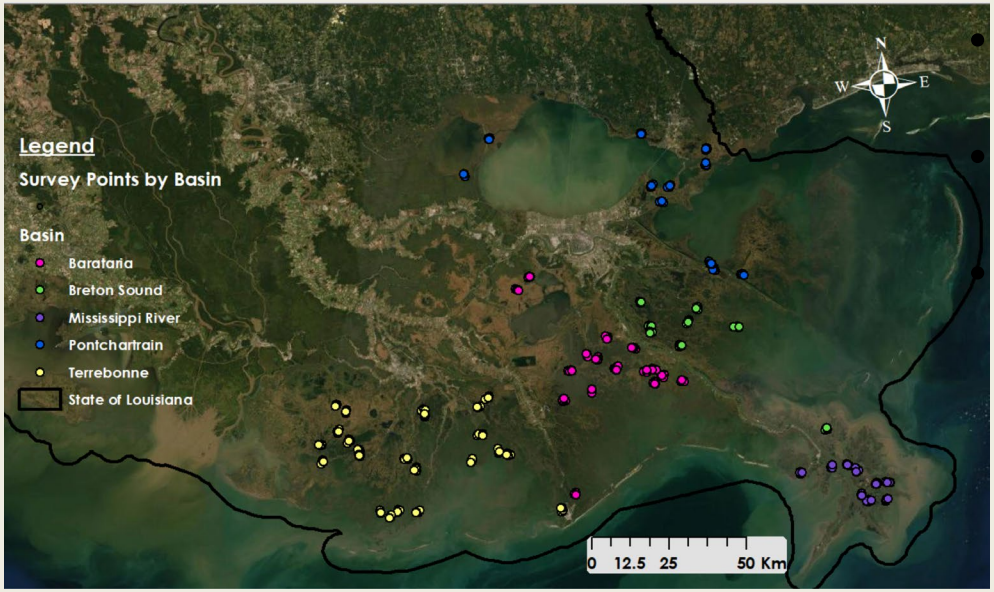




- MAM Activity encompasses 2010-2023
- Newly Approved MAIP (2024-29)
- Inform future **project selection, design and construction;**
- Document **individual** and **coastwide** CWB **performance;**
- Document CWB **habitat utilization** over time;
- Inform need and effectiveness of **adaptive management strategies;**
- Facilitate Trustees' ability to **easily convey restoration benefits** to resource stakeholders **emphasizing the general public.**

Biotic Resources

Secretive Marsh Birds



Native and Restored Coastal Marshes

Co-located with designated CRMS sites

Completion: December 2024

- Determine population estimates of breeding SMBs in select basins of the Louisiana coastal zone;
- Determine multi-scale habitat relationships of SMBs in select basins of the Louisiana coastal zone;
- Informed restoration and management decisions will require addressing informational needs.

Biotic Resources

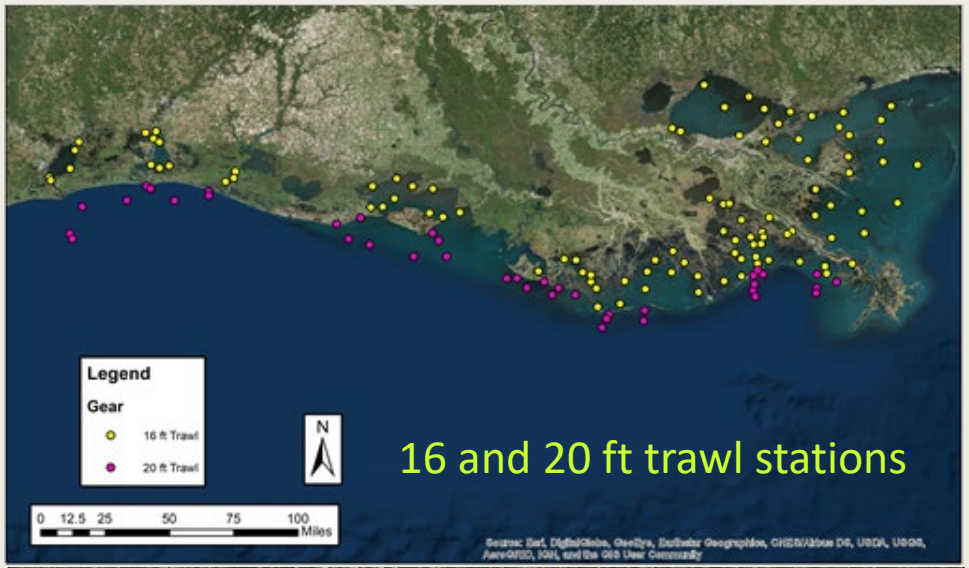
Fisheries Independent Monitoring Plan includes:

- Supplement existing LDWF monitoring

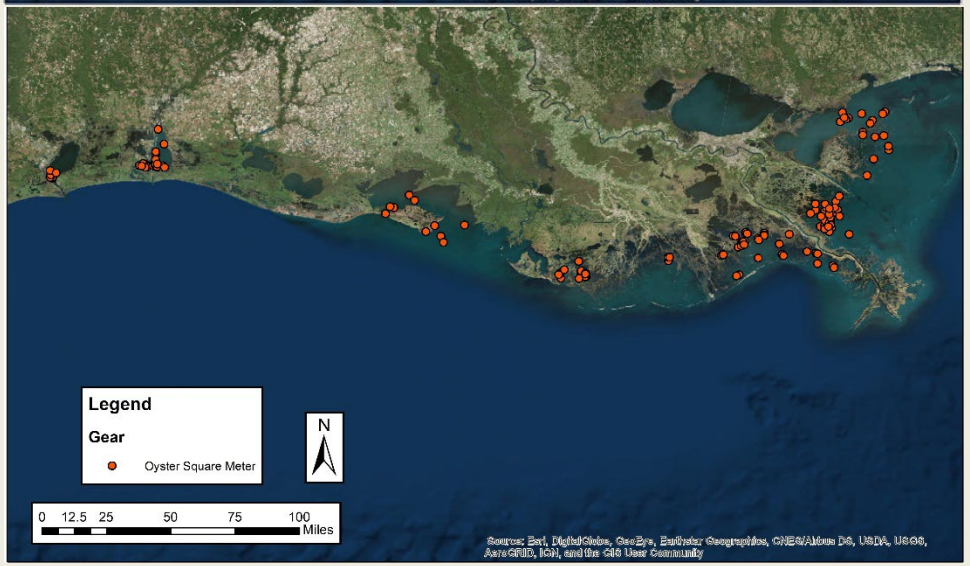
- 16’ trawl sampling
  - 70 existing/10 new Barataria Basin Sites
- Oyster Dredge sampling at 3 new sites (11 events per year).
- Oyster M^2

  Spring, Summer, and Fall sampling at 25 new sites in Barataria Basin

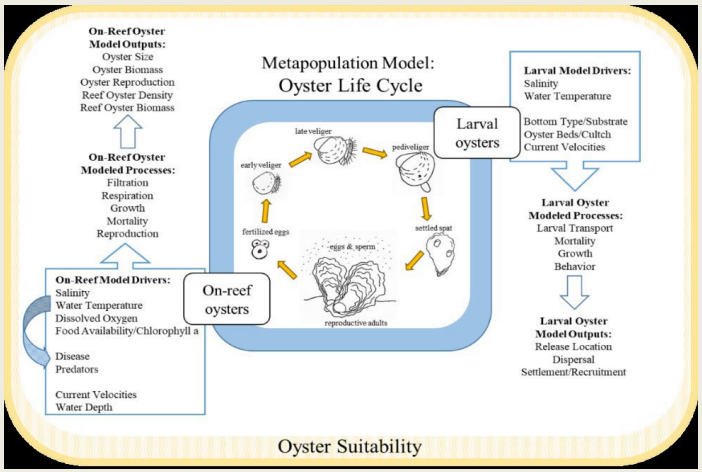
  Supplemental Spring and Fall sampling at existing sites in Barataria (9) and Pontchartrain Basins (42) in addition to the Summer sampling event conducted by LDWF
- 72 seine stations across the coast (1/month)
- COMPLETE - Monthly Electrofishing samples paired with 12 seine samples in Barataria Basin
- 2 gill net samples in the western portion of the state (18/year)

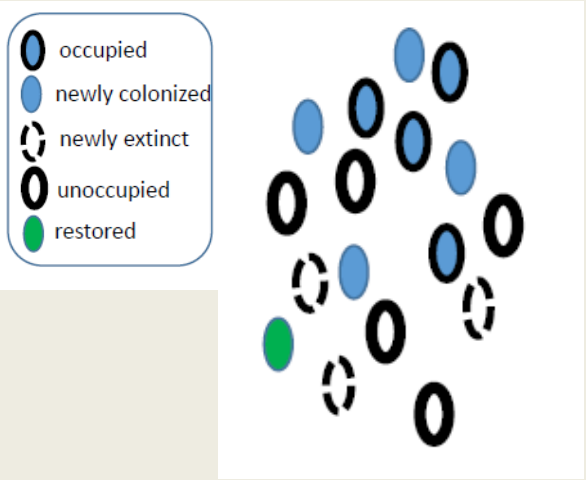


16 and 20 ft trawl stations



Conceptual Oyster Metapopulation Model





- Coupled modeling framework under development is comprised of:
  - a hydrodynamic/water quality (Hydro/WQ) model
  - an oyster larval transport model
  - an oyster reef individual-based model (IBM)
- Hydro/WQ model generates outputs that are input to the larval transport model, which simulates oyster larval settlement from releases over space and time
- Hydro/WQ and larval transport models provide inputs to the oyster reef IBM that simulates oyster growth, survival, reproduction, and shell maintenance of oyster spat (settlement) to adult life stages
- Model outputs will support LDWF in evaluating locations for oyster reef construction and enhancement and will be used to quantify relative changes in oyster recruitment and production under management scenarios and future foreseeable conditions.

Additional MAM Activities

- Sea Turtle Habitat Use and Abundance
- Monitoring Approaches to Dolphin Restoration
- Quantifying Changes in Wetland Areas
- Characterizing Barrier Island Resiliency
- Lower Trophic Level Monitoring
- CIMS/DIVER System Interoperability
- Barrier Island System Management (BISM)
- Regional Geology and Sediment Management (RGSM)
- Borrow Area Monitoring & Management (BAMM)
- ETC….

Data Mgmt

Foundational Data Monitoring Programs

System Wide Assessment & Monitoring Program (SWAMP)

Natural & Human Systems

Physical Terrain	Bathymetry, topography, surface elevation, land area
Water Quality	DO, nutrients, salinity, turbidity, TSS, Chl a
Climate	Evapotranspiration, precipitation, wind
Hydrology	Current velocity, water level, waves
Biotic	Wetland biomass, nekton, oysters, soil condition, veg comp
Protection	Population demographics, housing & community, economy & employment, critical infrastructure

Coastwide Reference Monitoring System (CRMS)

392 active sites collecting data

Vegetation	Cover and species comp, relative abundance, dominance, richness, height, NDVI
Hydrology	Water depth, flood frequency and duration, salinity, temperature
Soils	Bulk density, % organic, water content, sediment elevation/accretion, subsidence
Landscape	Land/water ratio

Barrier Island Comprehensive Monitoring Program (BICM)

Louisiana shoreline analysis

Shoreline Position & Assessment	1880's, 1920's-30's, 1980's, 1998, 2004, 2005, 2008, 2012, 2015
Habitat Mapping & Landloss	1980's, 1996, 2002, 2004, 2005, 2008, 2015
Topographic Surveys	1997, 2001, 2002, 2006, 2015-2017
Bathymetric Surveys	1880's, 1930's, 1980's, 2006/2007, 2015-2017
Sediment Characterization	2008, 2015-2017
Subsidence	2015 – 2019
Veg Sampling	

Fisheries Independent Monitoring Plan (FIMP)

Biological & Physical characteristics

Trawls	Bottom trawls, biological fish sampling, environmental
Seines/Nets	Seines, gill nets, trammel nets, sampling
Oyster/Mollusk	Oyster sampling, square-meter, dredge
Electrofishing	Electrofishing technique used

Data Mgmt

Coastal Information Management System

Robust system of inter-connected, web accessible, geospatial and tabular databases

Central repository for LA coastal protection and restoration data

Map Viewer (visualization, GIS, custom applications)

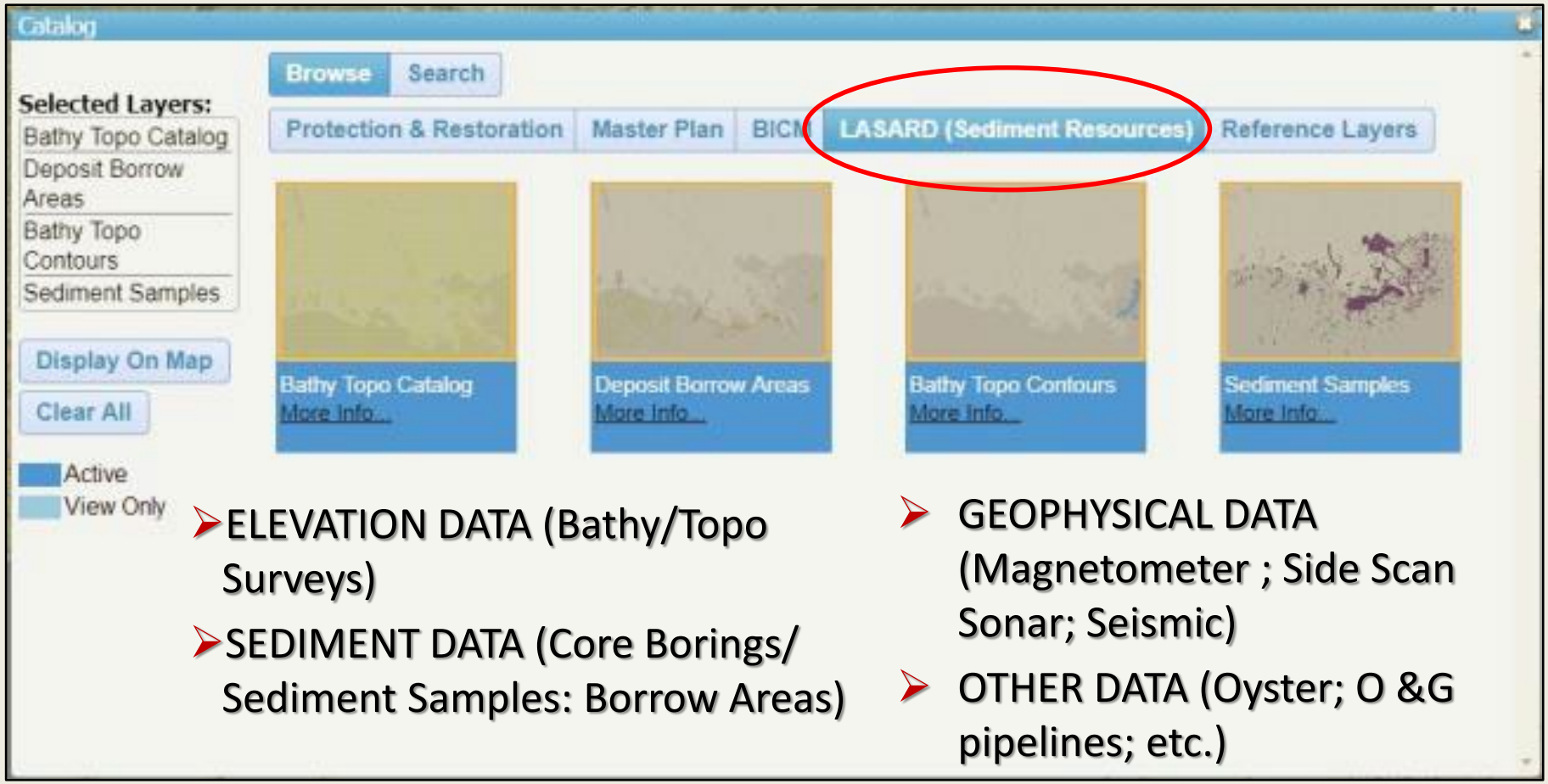
Data Download (monitoring data i.e., CRMS, SWAMP, FIMP, etc…)

Document Library (reports, studies, photos, etc…)

cims.coastal.louisiana.gov

CIMS - Map Viewers: Main

Louisiana Sand/Sediment Resources Database (LASARD)



- ELEVATION DATA (Bathy/Topo Surveys)
- SEDIMENT DATA (Core Borings/ Sediment Samples: Borrow Areas)
- GEOPHYSICAL DATA (Magnetometer ; Side Scan Sonar; Seismic)
- OTHER DATA (Oyster; O &G pipelines; etc.)

Data Mgmt

Lessons Learned Database

- Background
  - NRDA Funded
  - One recommended priority action within Louisiana Adaptive Management Status and Improvement Report
  - Develop and implement an interactive Lessons Learned Database - ensure historical and future lessons are captured for inclusion in and improvement of ongoing and future restoration projects
- Initiated- Jan 2023
- Current status- finalizing database structure, location, and broad functionality
- Next steps
  - Develop front-end (database contributors) and back-end (database viewers) user interfaces
  - Testing and revising
  - Final approvals
  - Public release of final Lessons Learned Database
  - Ongoing updates and management of database
- Timeline for completion- Late Calendar Year 2024

Synthesis/Assessment

System-wide Assessment and Monitoring Program

- Physical Terrain
- Hydrology
- Water Quality
- Weather/Climate
- Biotic Resources

- Synthesis – What do the data indicate
  - Land Loss Rates
  - Subsidence Rates
  - Relative Sea Level Rise Rates
  - Salinity Changes
  - Habitat Changes
  - ETC…
- Integrate among various Datasets
  - CRMS RSET/Accreation integrated with updated SWAMP Subsidence Rates
  - Etc…

Synthesis/Assessment

System-wide Assessment and Monitoring Program

- Physical Terrain
- Hydrology
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- Assessment – What did the Projects/Programs Accomplish (Natural Ecosystem Focus)
  - Land Change Trends vs CMP Predictions?
    - Basin Land Change vs CRMS Site Land Change
      - » Do CRMS Sites Reflect Basin Trends
        - Drivers at CRMS Sites correlated to Land Loss Rates
          - Project site Variables vs CRMS Site variables
            - CRMS vs Project Flora/Faunal Responses to System Drivers

Synthesis/Assessment

Barataria Basin Program Performance Assessment (BBPPA)

- The PPA is designed to provide insight on ecosystem change and program effects, using metrics of system change to **specify how the program is contributing to the CMP objectives** and to demonstrate how data can be used to track progress toward meeting those objectives.

- Planned **using a tiered approach** to understanding system drivers (e.g., relative sea level rise (RSLR), climatic influences, salinity, subsidence, tropical events, oil spills, etc.), land loss dynamics, and the interaction of various system drivers – in affecting the identified land changes

- Attempt to assess system drivers, land area changes, **and other system responses** (e.g., vegetation class distribution, vegetation composition, vegetation richness, nekton composition and abundance, etc.) such that the different characteristics of the system can be examined separately as well as collectively.

- The PPA, while initially focused exclusively on Barataria Basin, is being developed so that the framework and **workflow can serve as a template** for other basins.

Synthesis/Assessment

BBPPA – Metrics (partial)

Drivers

Driver	Data Sets	Notes
Tropical events – track, central pressure, etc.	Obtain from Master Plan team; supplement with data available from NOAA	Inventory those tropical events that have had an effect on Barataria; identify what types of effects were documented at the time of the event
Mississippi River discharge	Obtain from Mid-Barataria Diversion (MBSD) or Master Plan teams; supplement with data from stations above (Tarbert Landing) to bring to present day	
Precipitation	Obtain from MBSD or Master Plan teams	
Relative sea level rise	Obtain from NOAA tide gage (i.e., Grand Isle)	
Subsidence	Interpret existing work (e.g., Byrnes, Master Plan, CORS stations, etc.)	

Geomorphology and Hydrology Metrics

Metric	Data Sets	Notes
Marsh edge erosion	Obtain USGS data from Master Plan team	
Tidal prism estimates	Selected CRMS water level data	Derived from fluctuations in water level and basin area
Salinity	USACE, USGS, Water Quality Portal data	Trends over time; variability

Flora Metrics

Metric	Data Sets	Notes
Land use / vegetation community change	USGS land use/land cover (2001-2019; 30m)	GIS analysis: summarize time series by region
Vegetation community change	Project vegetation plots – marsh creation and other projects	Determine community type for each plot and describe vegetation changes over time for each region
Species cover change basal area (forested)	Project vegetation plots – marsh creation and other projects	Summarize cover time series by region

Tie metrics to synthesis activities

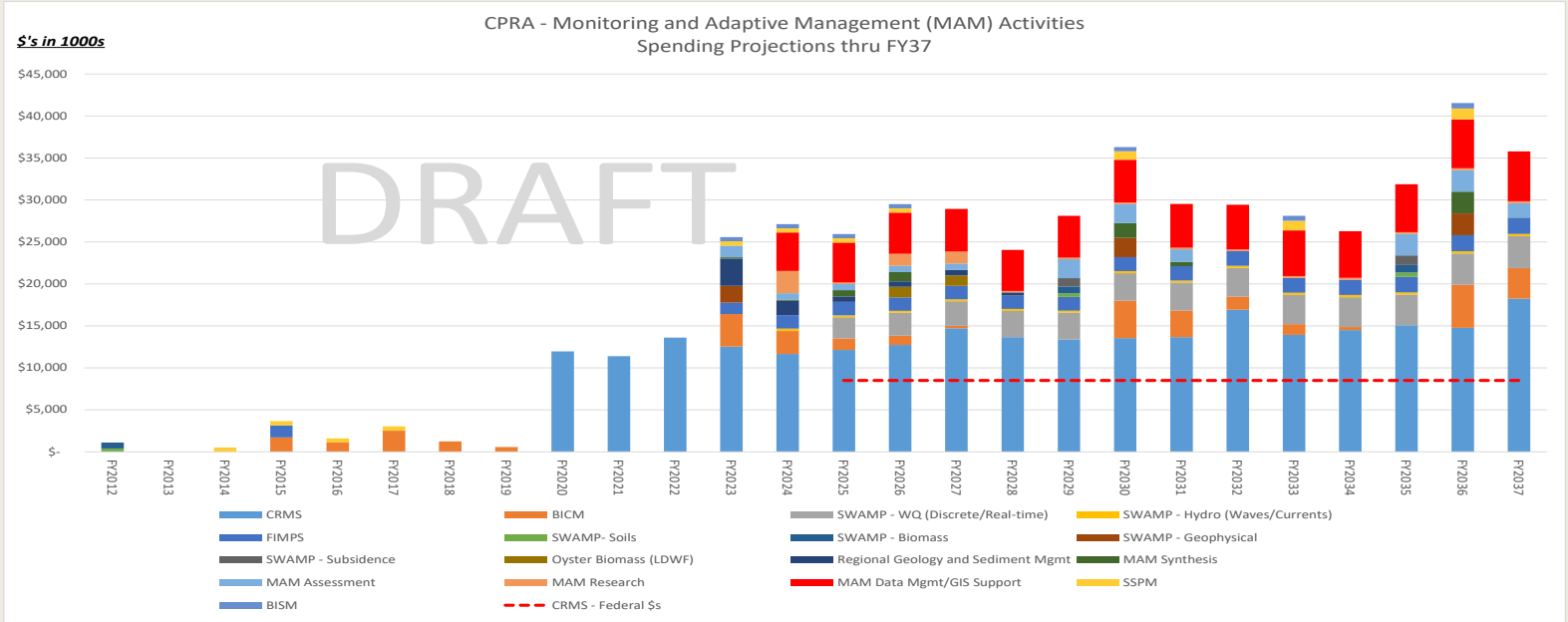
Build consensus on Drivers/Responses importance

Define analysis approaches

Seek input from other Programs/Outside Entities

Adaptive Mgmt

- Defining Objectives-
  - Monitoring
  - Assessment
- Critical Assessment of Needs
- Timing (Master Plan Cycle Decisions)
- Integration of AM Process
  - Lessons Learned
  - Data Management
  - Synthesis/Assessment



COASTAL PROTECTION AND RESTORATION AUTHORITY

CPRA

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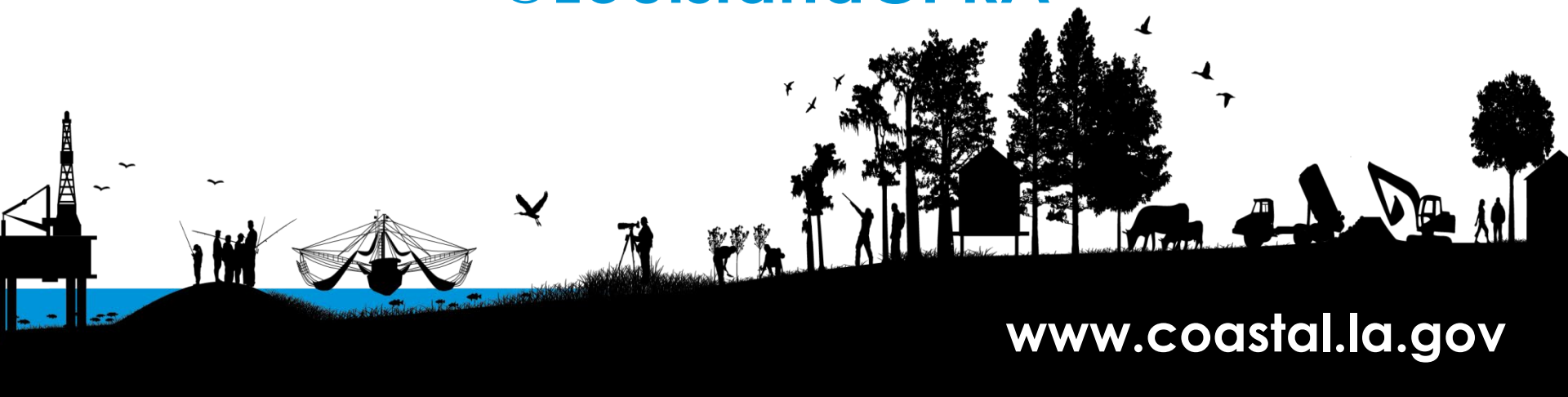

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