



MODELS INSTRUMENTAL IN COASTAL LOUISIANA PLANNING EFFORTS

Integrated Compartment Model & Basin-wide Delft

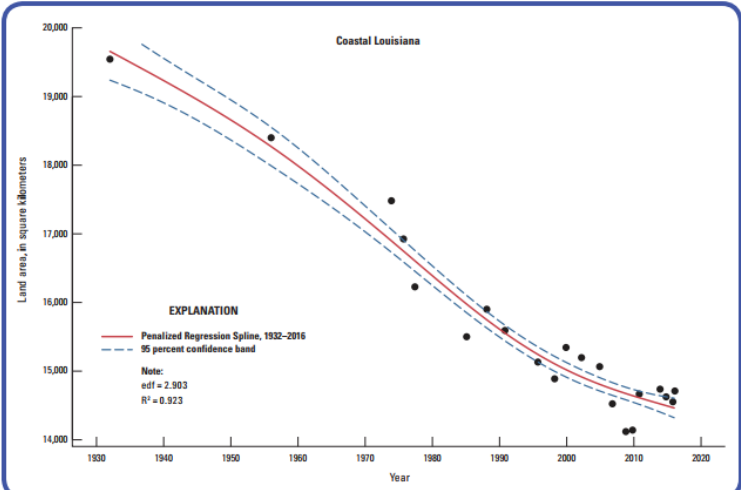
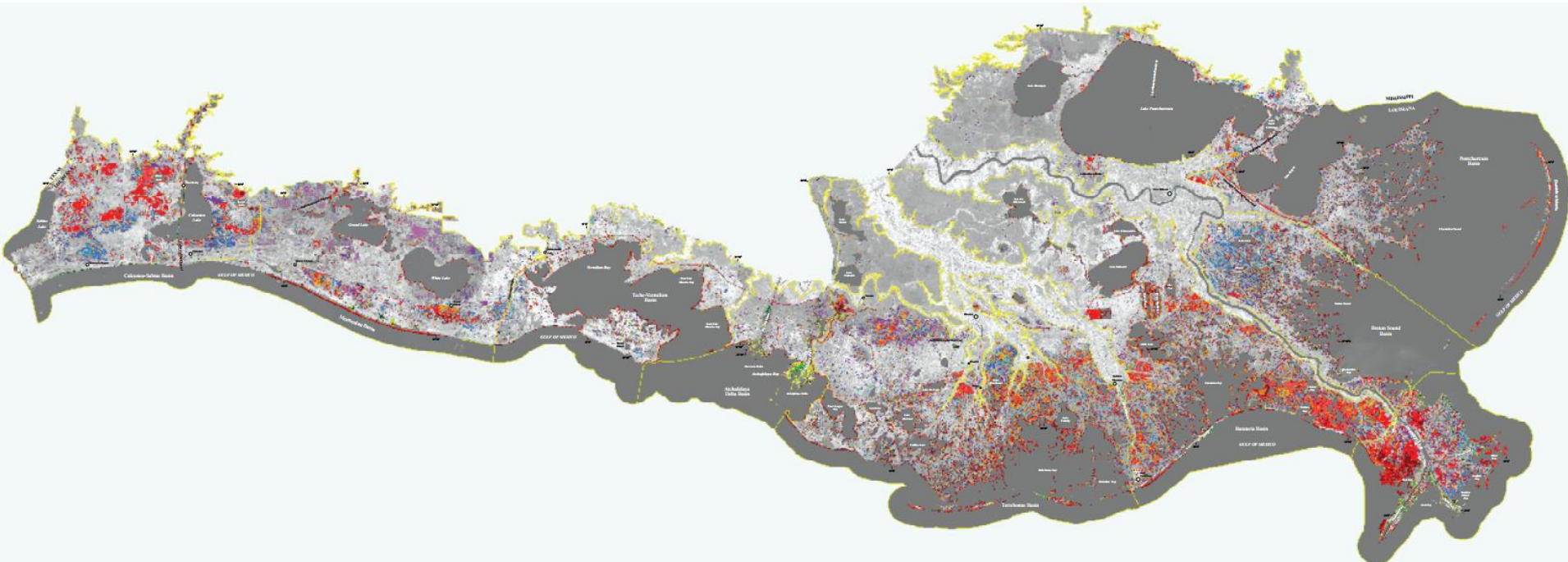
Eric D. White, PE
Research Engineer
October 2, 2017



THE WATER INSTITUTE
OF THE GULF®



HISTORIC WETLAND LOSS IN COASTAL LOUISIANA



Estimated land loss from 1932 – 2016:
~ 4833 km² (1866 mi²)

Equivalent to 25% of 1932 wetland area



2017 COASTAL MASTER PLAN

MASTER PLAN MODELING TEAM

CPRA Lead

Mandy Green
Angelina Freeman
David Lindquist

PM-TAC Team

Courtney Harris (VIMS)
John Callaway (USFCA)
Mike Waldon
Scott Hagen (LSU)
Wim Kimmerer (SFSU)

Water Institute Lead

Denise Reed
+Ehab Meselhe

Modeling Staff

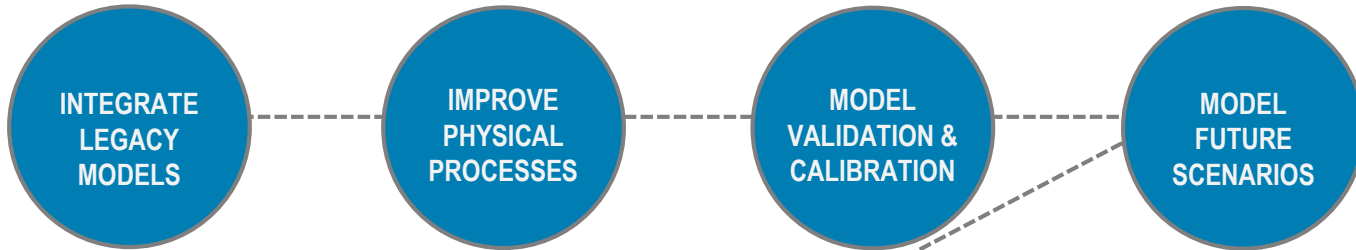
+Brady Couvillion (USGS)
+Zhifei Dong (CB&I)
+Scott Duke-Sylvester (ULL)
+Jenneke Visser (ULL)
+Alex McCorquodale (UNO)
+Eric White (WI)
Ann Hijuelos (WI)
Yushi Wang (WI)
Joao Pereira (WI)
Alaina Grace (WI)
Scott Hemmerling (WI)
Leland Moss (WI)
Stokka Brown (M&N)
Jonathan Wang (M&N)
Kevin Hannigan (M&N)
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Jenni Schindler (CHF)
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Vadim Alymov (CECI)
Michael Poff (CECI)
Craig Conzelmann (USGS)
Hardin Waddle (USGS)
Kevin Suir (USGS)
+ David Johnson (RAND)
Kenneth Kuhn (RAND)
+ Jordan Fischbach (RAND)
Gordon Thomson (CB&I)
Hugh Roberts (Arcadis)
Zach Cobell (Arcadis)
John Atkinson (Arcadis)
Haihong Zhao (Arcadis)
Kim de Mutsert (GMU)
Kristy Lewis (GMU)



2017 COASTAL MASTER PLAN

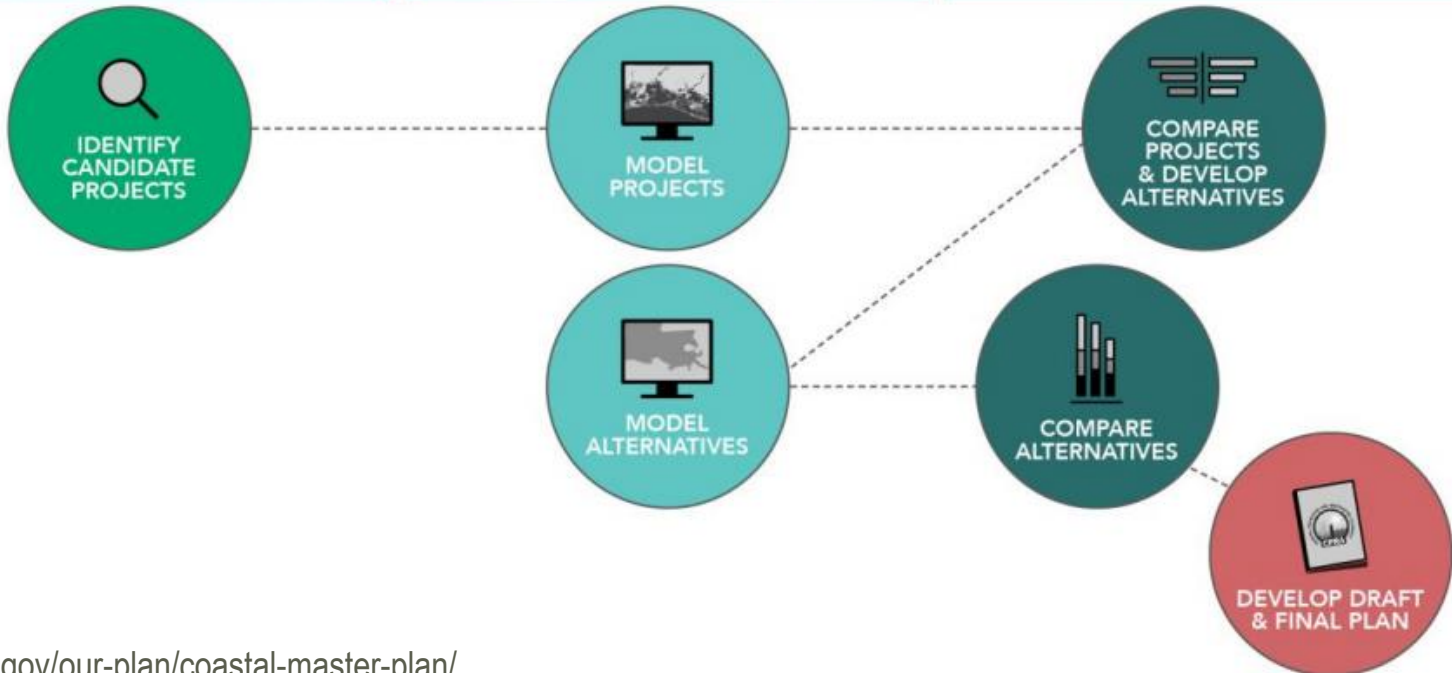
MODEL IMPROVEMENT PLAN



COASTAL PROJECTS

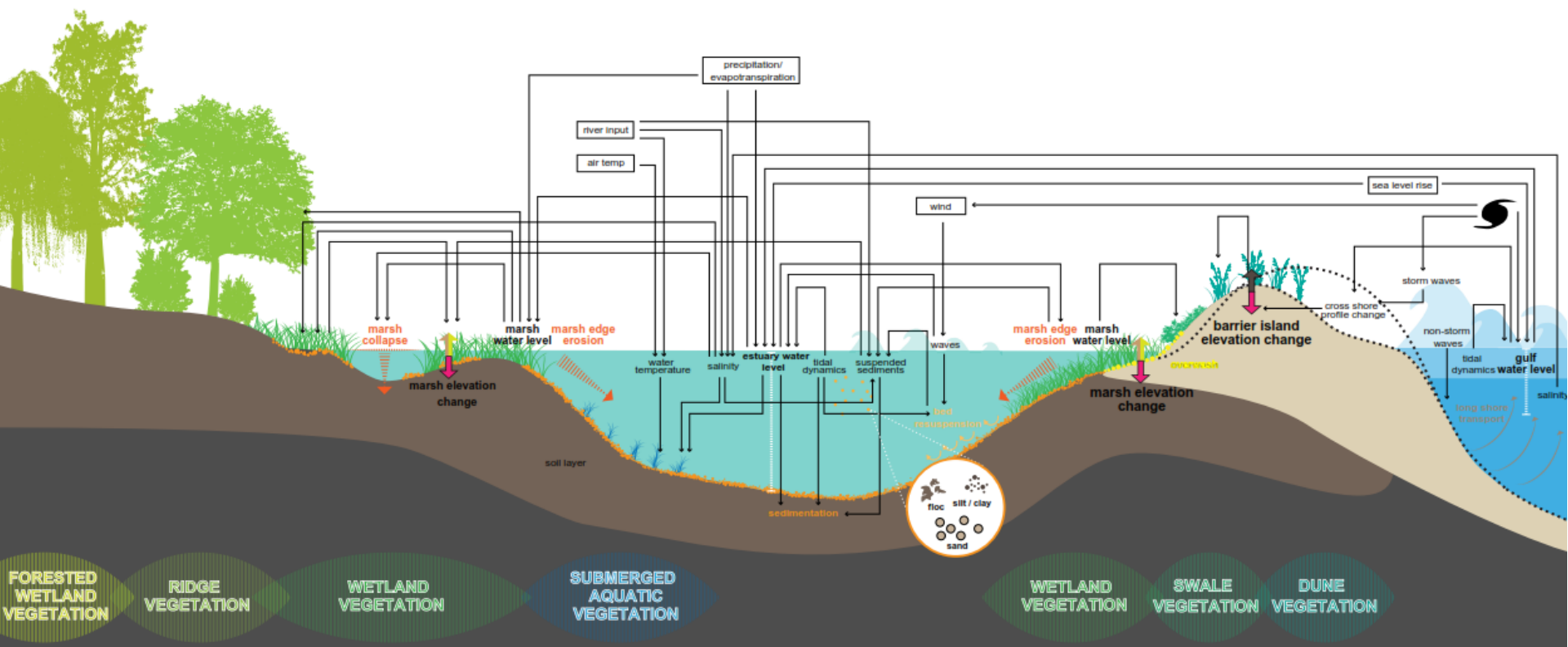
PREDICTIVE MODELS

PLANNING TOOL



coastal.la.gov/our-plan/coastal-master-plan/

OUTREACH & ENGAGEMENT

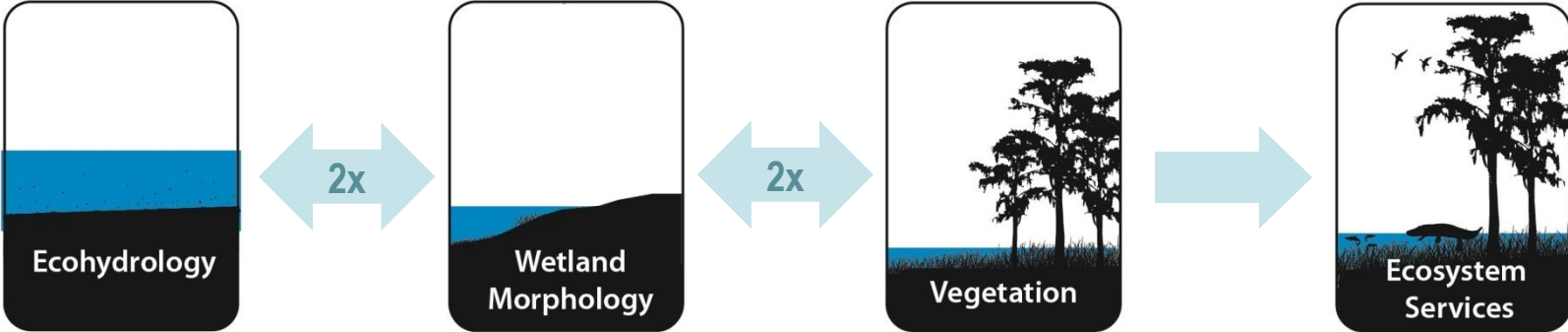


ICM: INTEGRATED COMPARTMENT MODEL

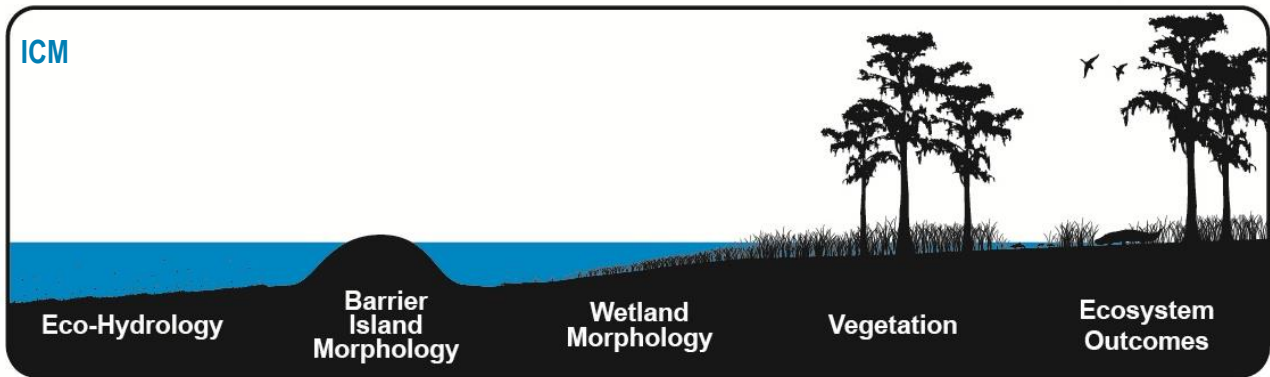


ICM: MODEL INTEGRATION

2012 MASTER PLAN LANDSCAPE MODELS



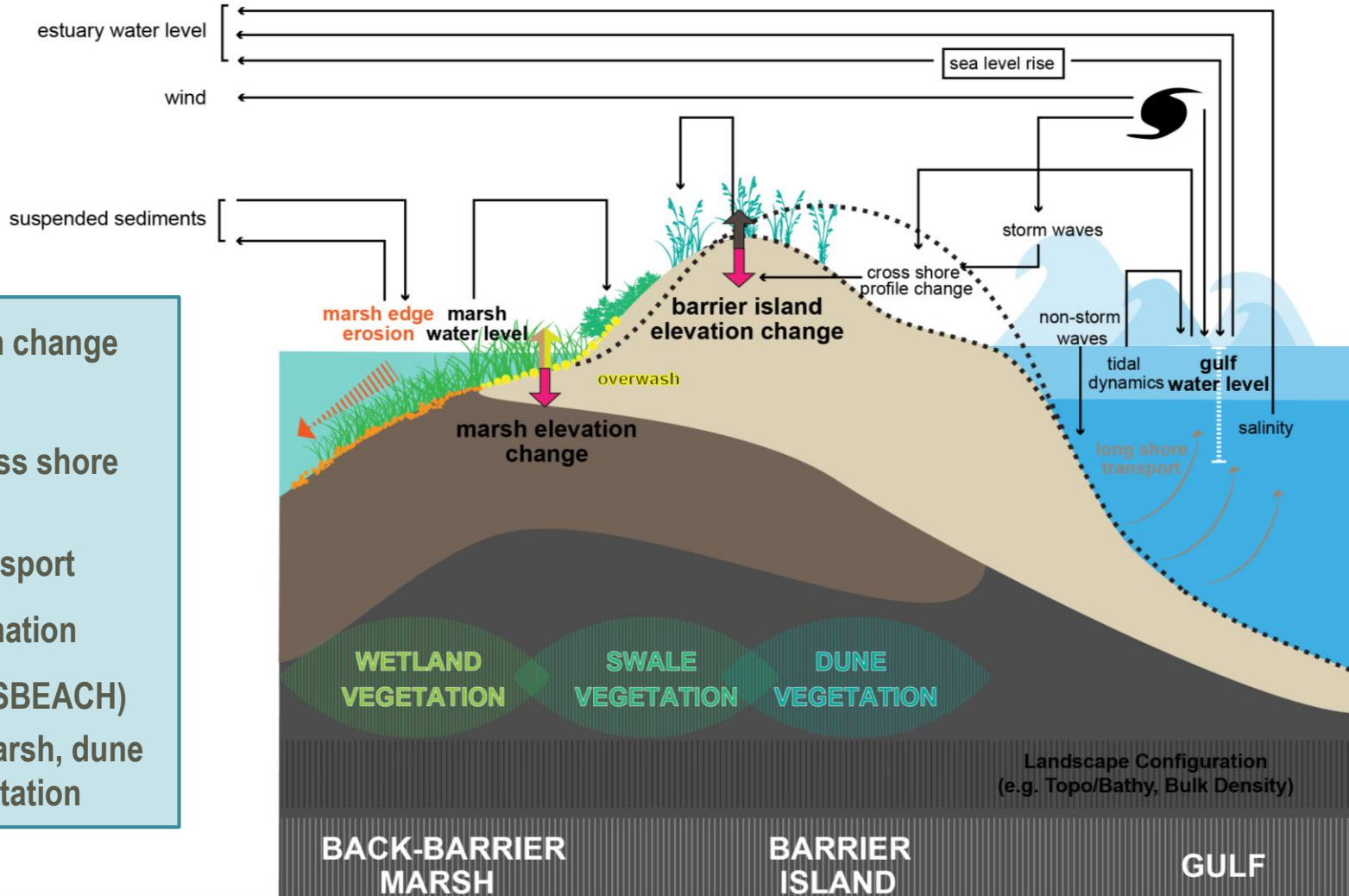
2017 MASTER PLAN LANDSCAPE MODEL



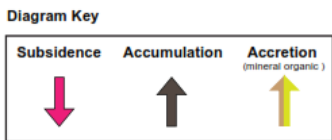
2012 & 2017 RISK ASSESSMENT



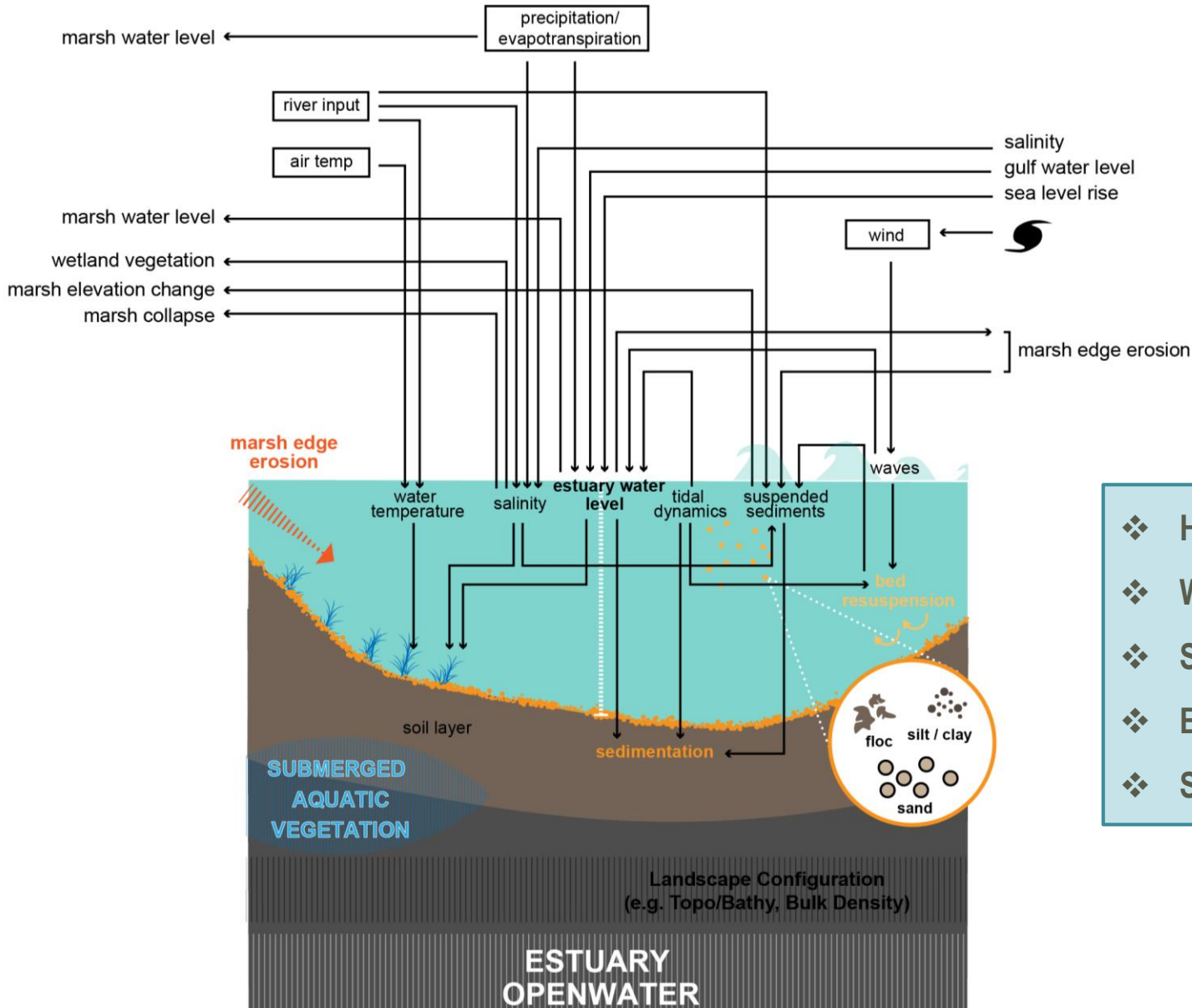
ICM: BARRIER ISLAND PROCESSES



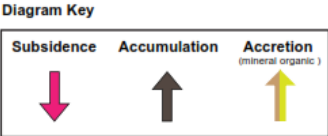
- ❖ Island elevation change
- ❖ Breaching
- ❖ Overwash / cross shore profile change
- ❖ Longshore transport
- ❖ Wave transformation
- ❖ Storm effects (SBEACH)
- ❖ Back-barrier marsh, dune and swale vegetation



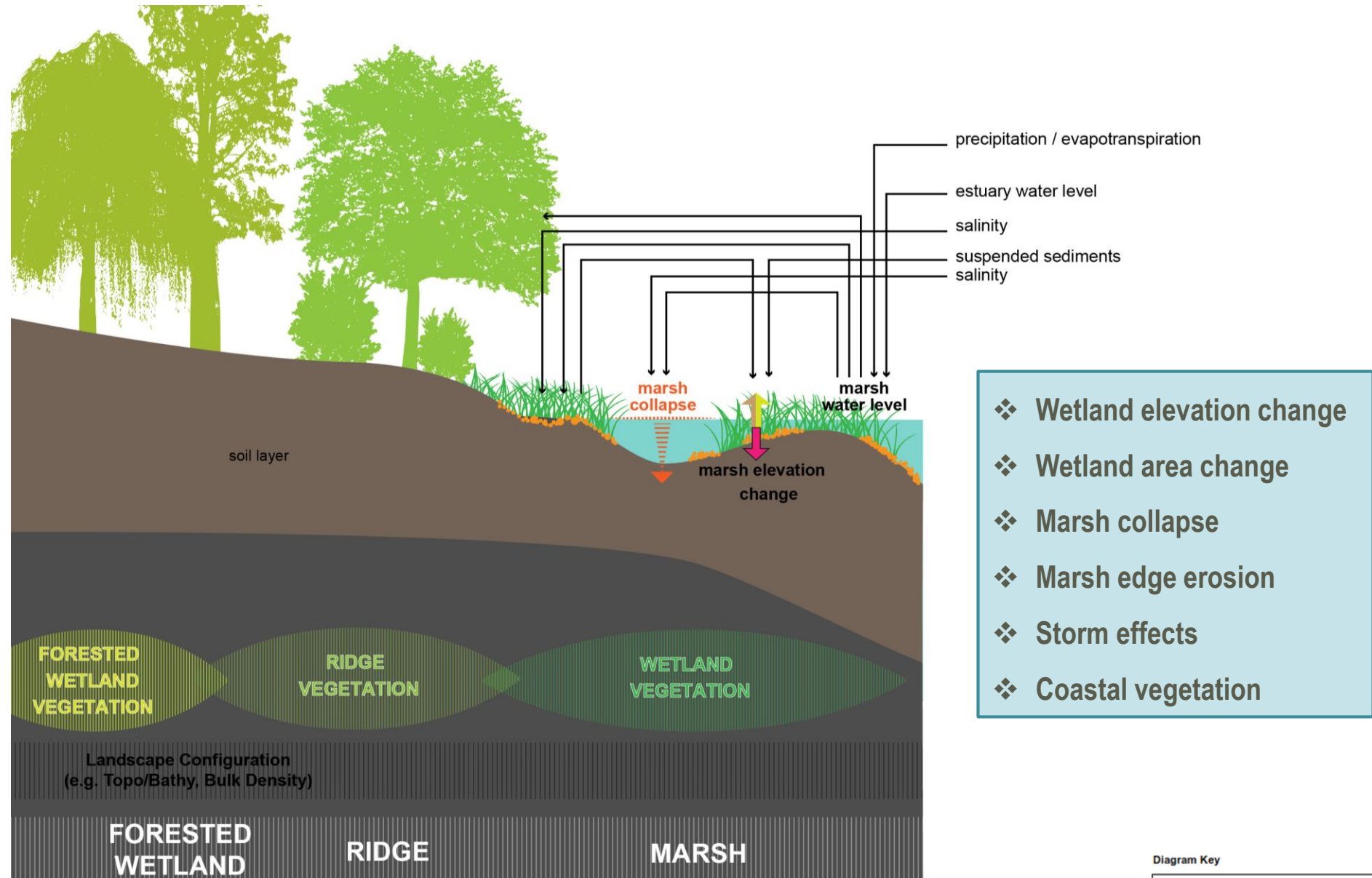
ICM: ESTUARY & OPEN WATER PROCESSES



- ❖ Hydrodynamics
- ❖ Water quality
- ❖ Sedimentation
- ❖ Bed resuspension
- ❖ Sediment distribution



ICM: WETLAND PROCESSES & VEGETATION

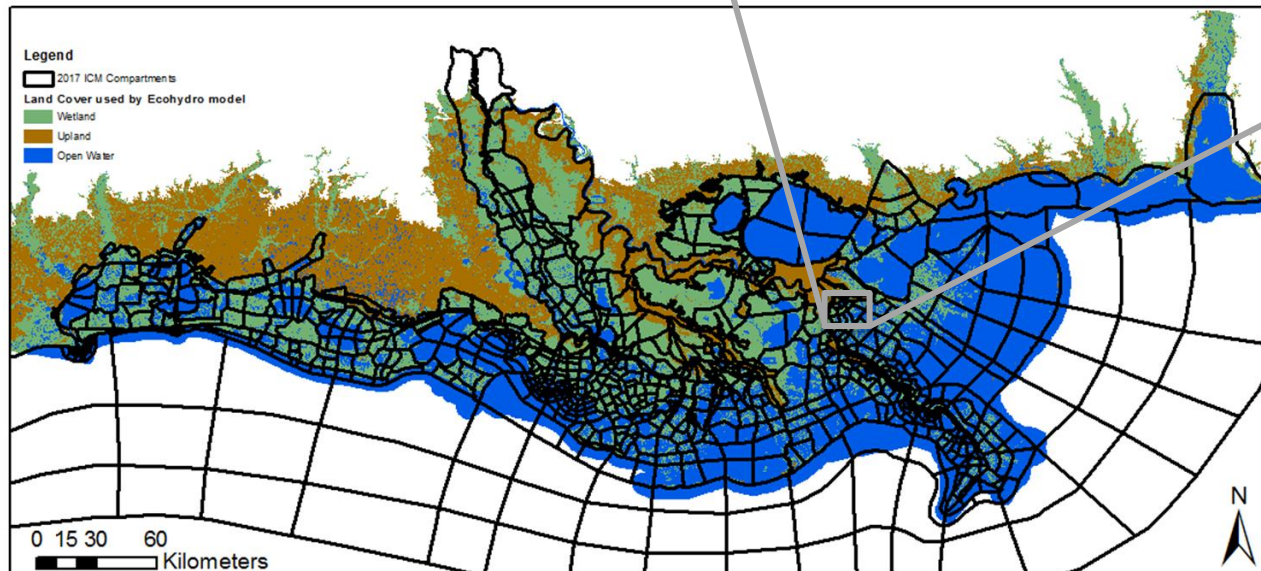
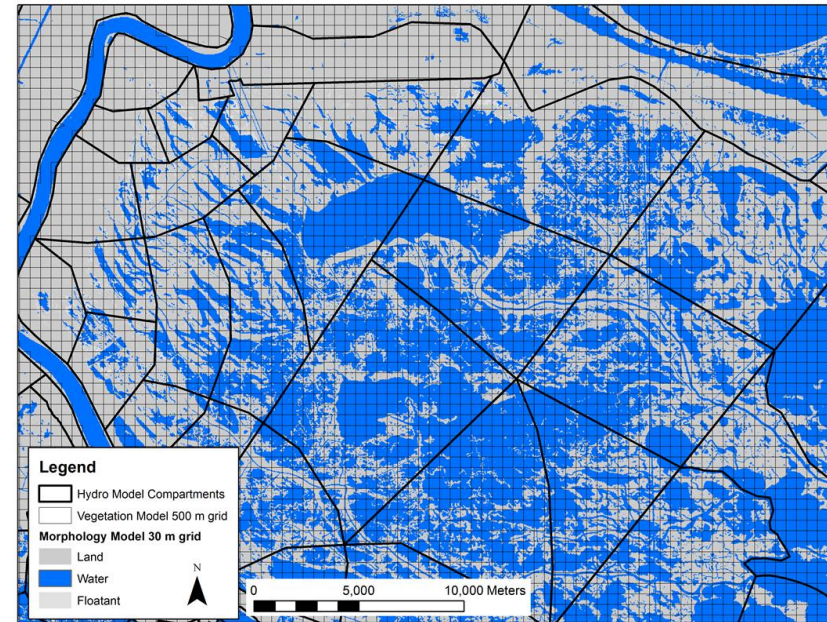
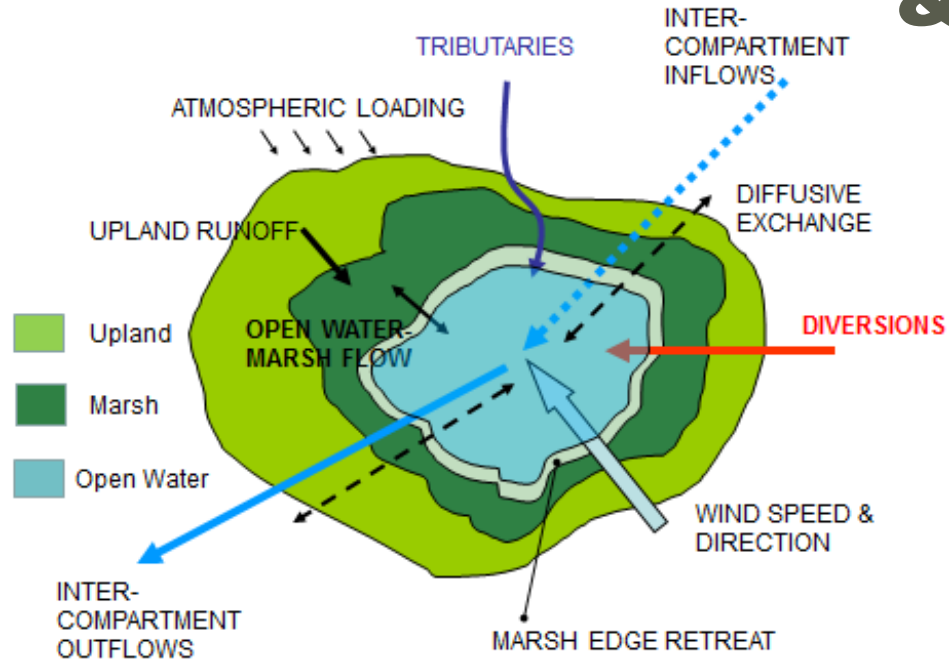


- ❖ Wetland elevation change
- ❖ Wetland area change
- ❖ Marsh collapse
- ❖ Marsh edge erosion
- ❖ Storm effects
- ❖ Coastal vegetation

Diagram Key



ICM: COMPARTMENT CONCEPTUALIZATION & SPATIAL RESOLUTION



ICM: ECOSYSTEM OUTCOMES & DECISION METRICS

PLANNING TOOL

DECISION DRIVERS



REDUCING FLOOD RISK



BUILDING/ MAINTAINING LAND

CONSTRAINTS



SEDIMENT



FUNDING

METRICS

COMMUNITY METRICS



AGRICULTURAL COMMUNITIES



FLOOD PROTECTION OF STRATEGIC ASSETS



OIL & GAS COMMUNITIES



SOCIAL VULNERABILITY



FLOOD PROTECTION OF HISTORIC PROPERTIES



NAVIGATION



TRADITIONAL FISHING COMMUNITIES

ENVIRONMENTAL METRICS



ALLIGATOR



CRAWFISH



SALTWATER FISH



USE OF NATURAL PROCESSES



BLUE CRAB



FRESHWATER FISH



SHRIMP



WATERFOWL



BROWN PELICAN

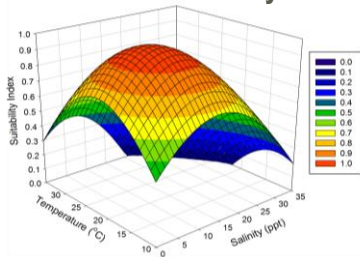


OYSTERS



SUSTAINABILITY OF LAND

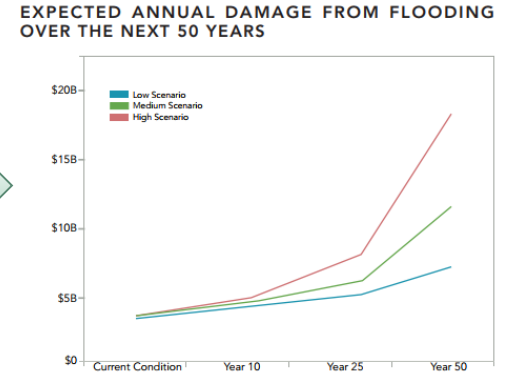
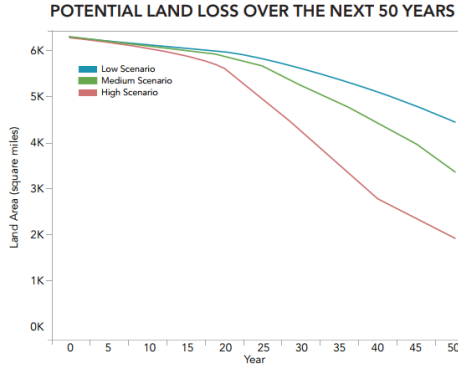
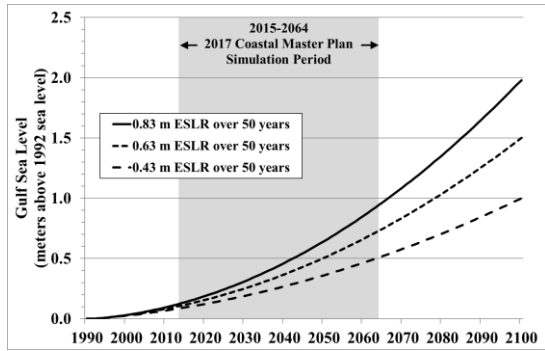
HSIs: Habitat Suitability Indices



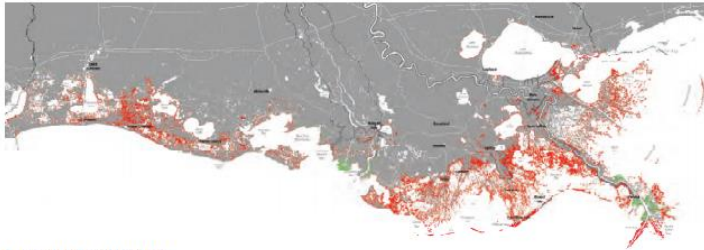
EwE: Ecopath with Ecosim and Ecospace food web model



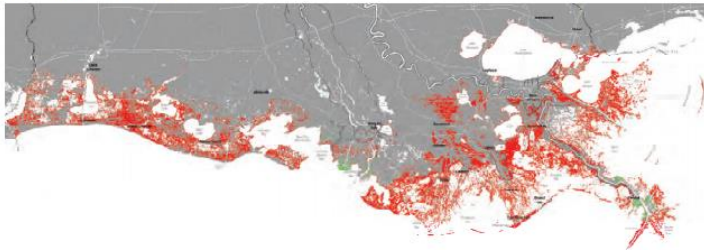
PROJECTED FUTURE CONDITIONS



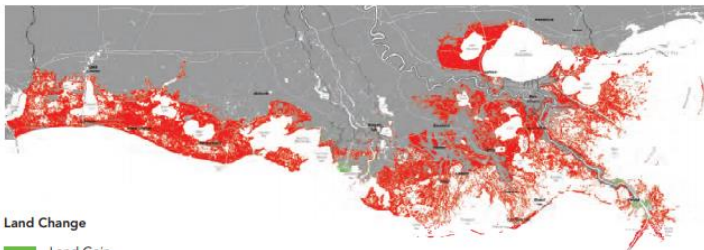
LOW SCENARIO



MEDIUM SCENARIO



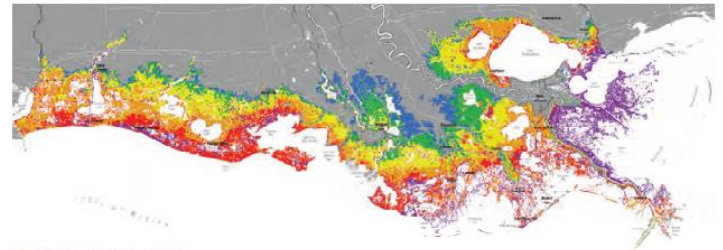
HIGH SCENARIO



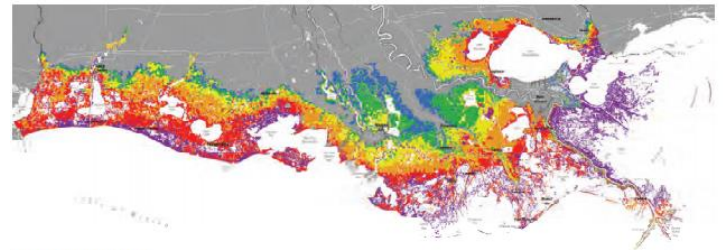
Land Change

- Land Gain
- Land Loss

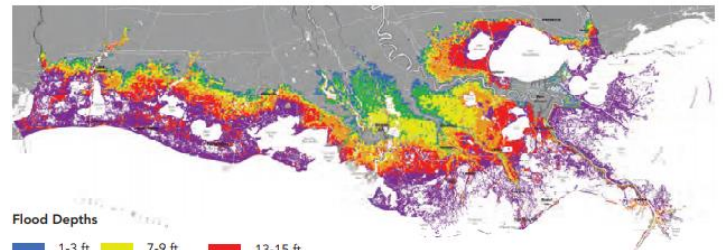
LOW SCENARIO



MEDIUM SCENARIO



HIGH SCENARIO



Flood Depths

- 1-3 ft
- 4-6 ft
- 7-9 ft
- 10-12 ft
- 13-15 ft
- Over 15 ft





BASIN-WIDE DELFT3D MODELING



PROJECT TEAM

The Water Institute of the Gulf

Natural Systems Modeling and Monitoring

- Model setup, calibration, validation and production runs

Physical Processes and Sediment Systems

- Data collection for model calibration and validation
- QA/QC model output

Coastal Ecology

- Data collection for model calibration and validation
- QA/QC model output

People, Resources & Technology

- Calculation and preparation of land change maps

Collaborators

University of Louisiana-Lafayette

- Development and integration of vegetation model

Louisiana State University

- Geotechnical data collection and laboratory analysis

Deltares

- Support of model setup, calibration and validation activities



PROPOSED SEDIMENT DIVERSIONS



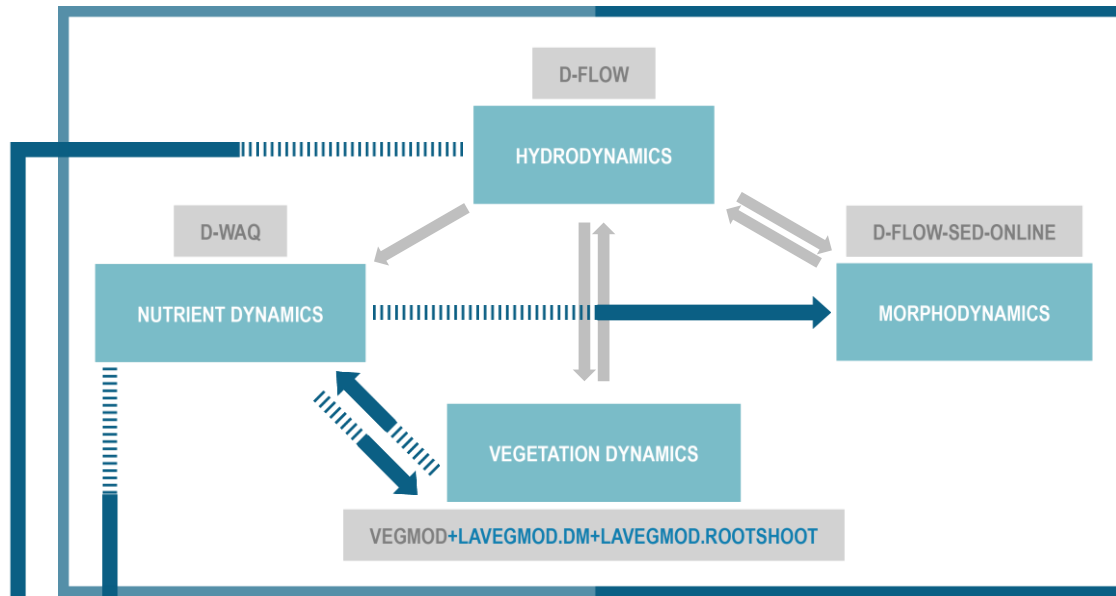
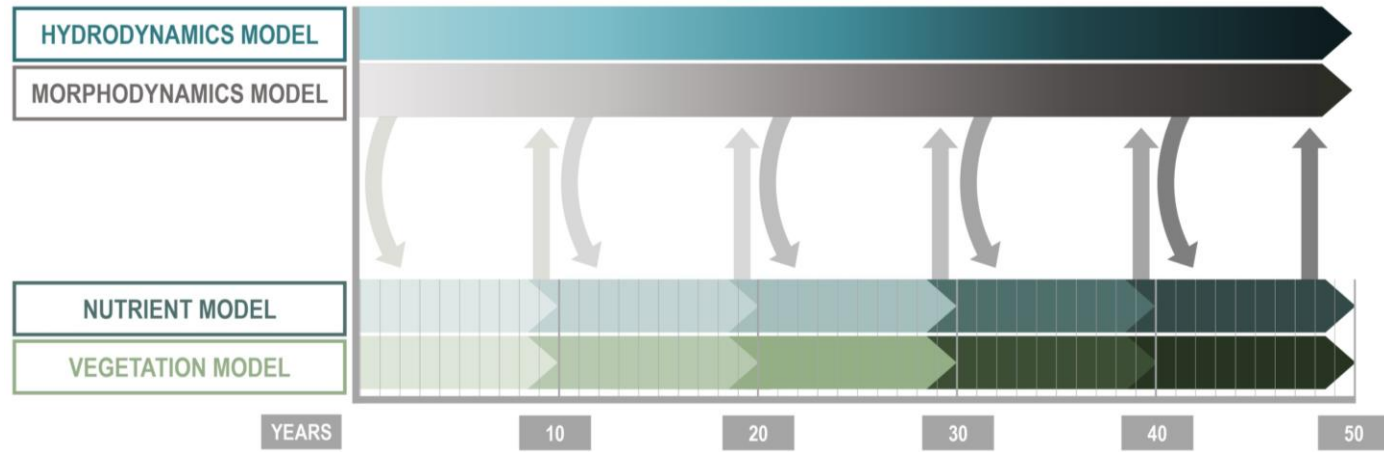
PROJECT GOAL

Produce a calibrated and validated model capable of simulating:

- Land change processes that occur during the creation of a new delta and wetland areas
- Nutrient effects to the wetland vegetation, soil, and the phytoplankton of Breton Sound and Barataria Basin



BASIN-WIDE DELFT3D MODEL FRAMEWORK

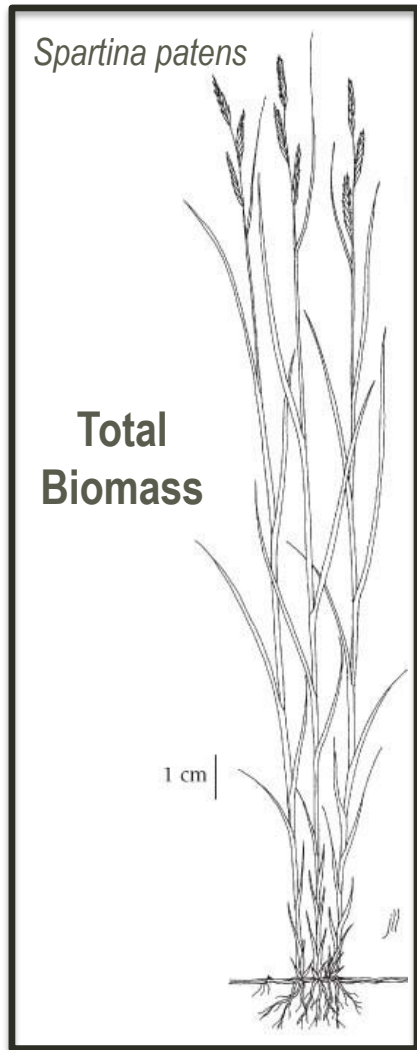


FOOD WEBS

EWE & CASM

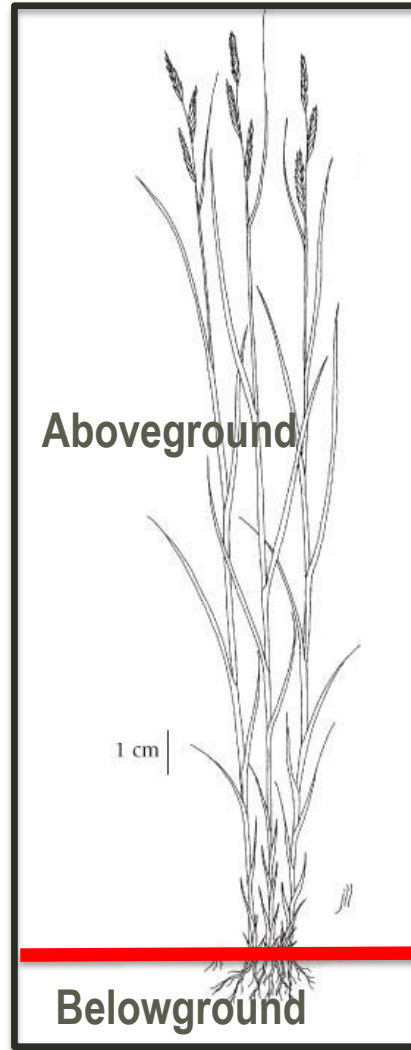


VEGETATION DYNAMICS: ORGANIC MATTER ACCUMULATION



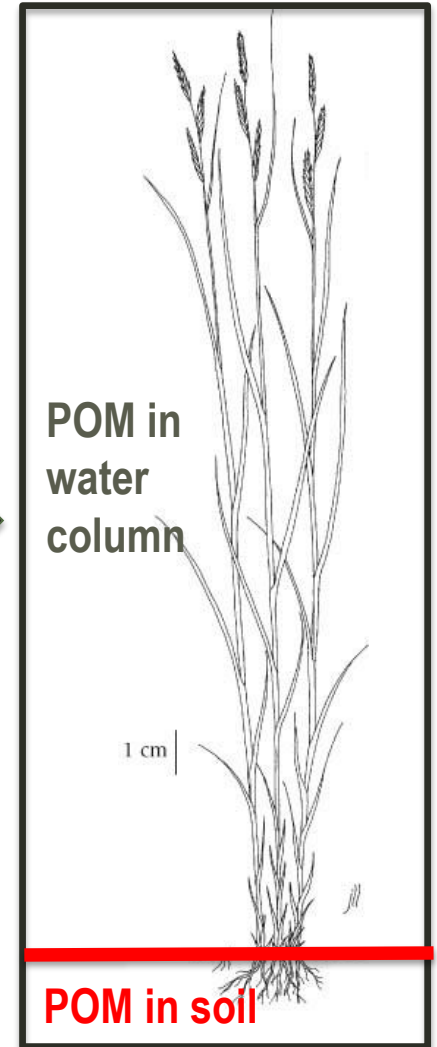
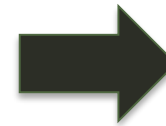
(VEGMOD)

Biomass
Allocation



(LaVegMod.RootShoot)

Mortality

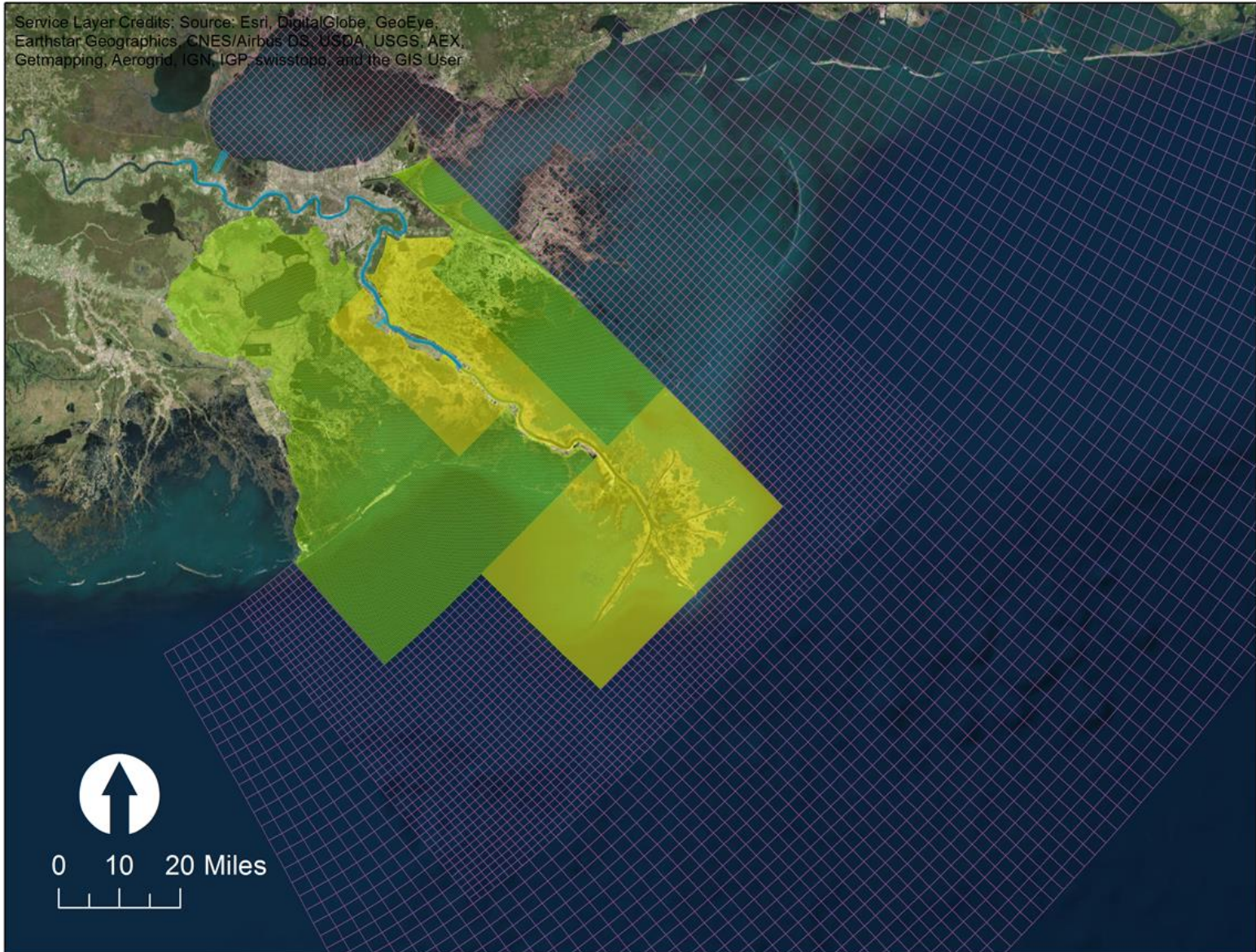


(VEGMOD)



BASIN-WIDE DELFT3D MODEL DOMAIN

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User

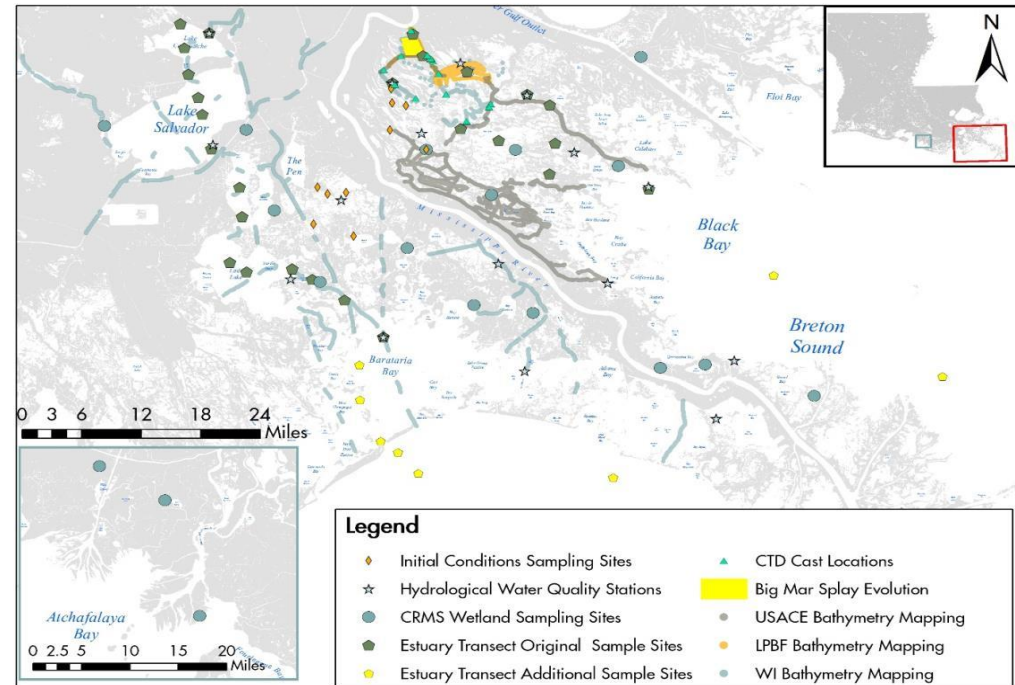


0 10 20 Miles



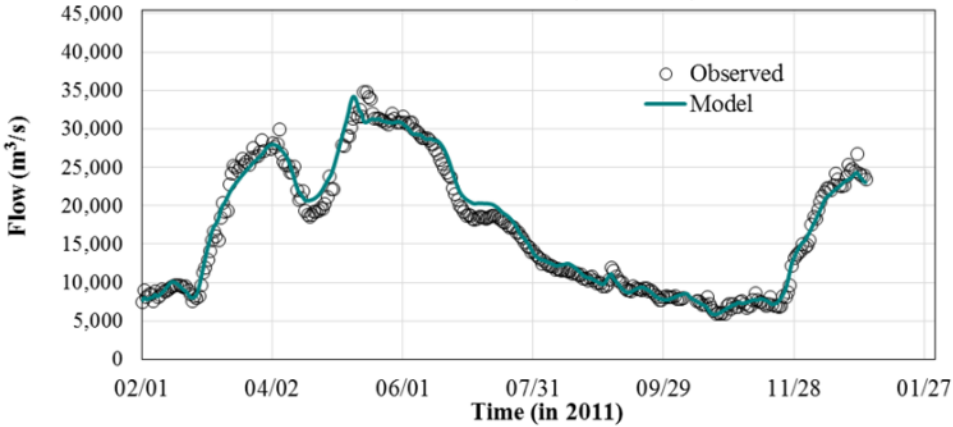
SUPPLEMENT EXISTING DATA WITH TARGETED COLLECTION

- **Model Setup**
 - Update bathymetry to build grids
 - Utilize locally observed values within model (e.g., soil properties, water quality, meteorology, ocean forcing, etc.)
- **Calibration and Validation**
 - Key parameters to tune model performance
- **Improved Understanding of Processes**
 - Compare model outputs to observed basin behavior, ensuring dynamics are captured by the model design

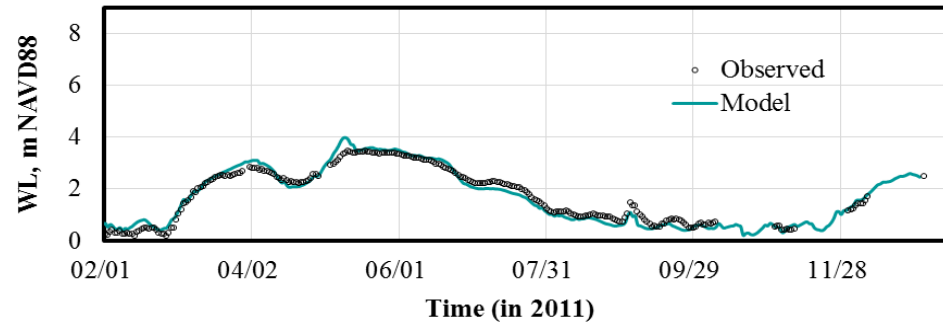


RIVER HYDRODYNAMICS: CALIBRATION & VALIDATION

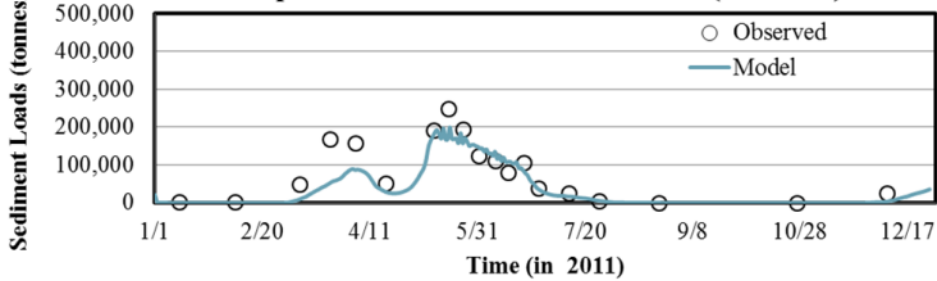
Flow at Belle Chasse (RK 117.5)



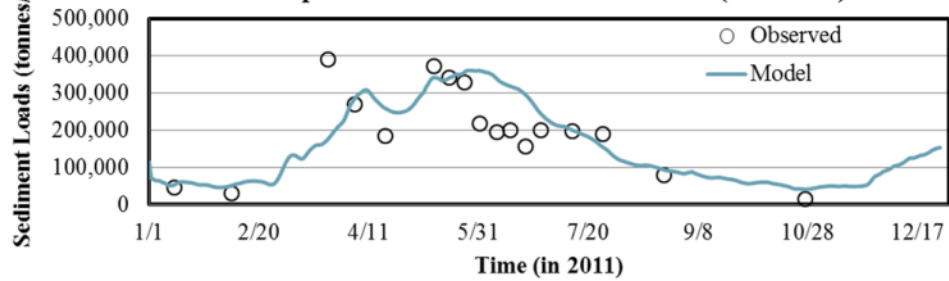
Belle Chasse (RK 117.5)



Suspended Sand Load at Belle Chasse (RK 117.5)

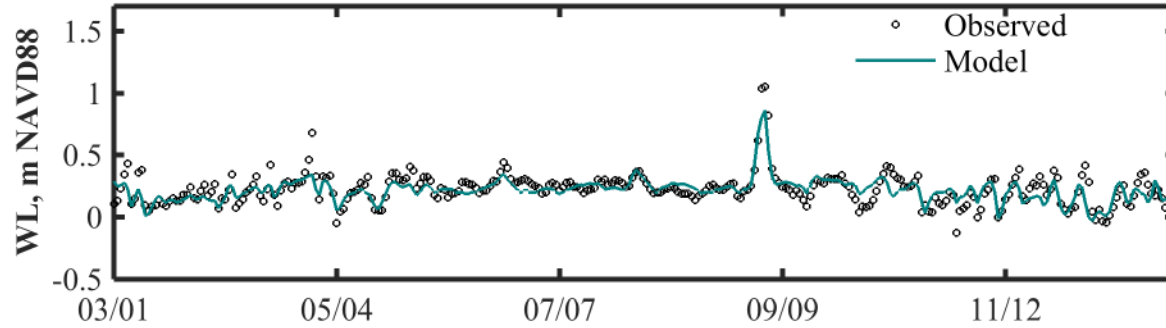


Suspended Fine Load at Belle Chasse (RK 117.5)

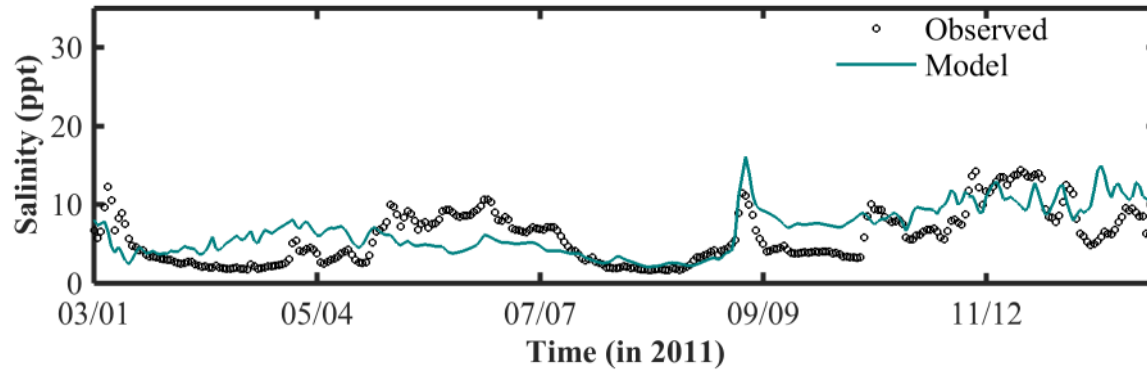


BASIN HYDRODYNAMICS: CALIBRATION & VALIDATION

Water Level

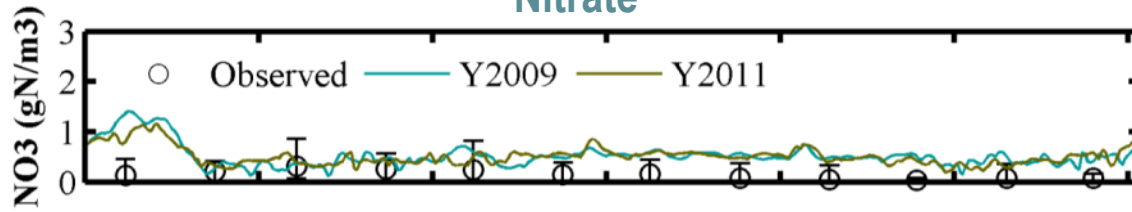


Salinity

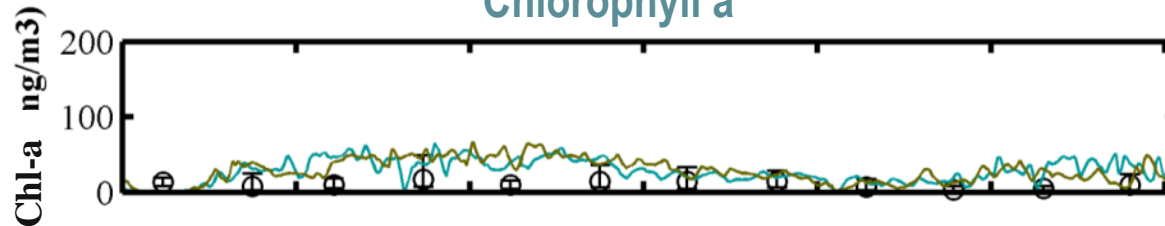


NUTRIENT DYNAMICS: CALIBRATION & VALIDATION

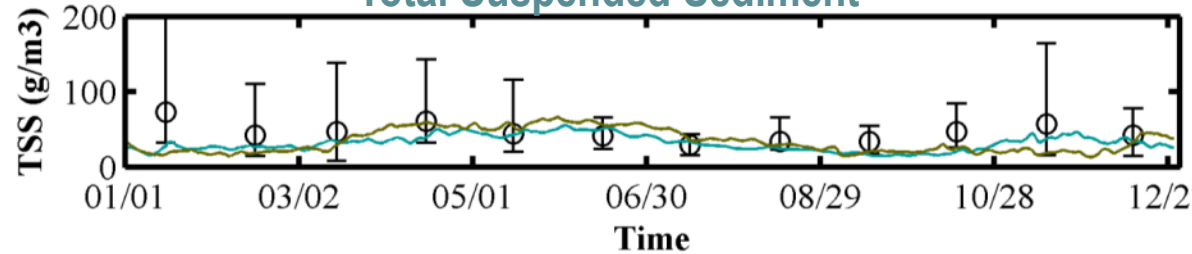
Nitrate



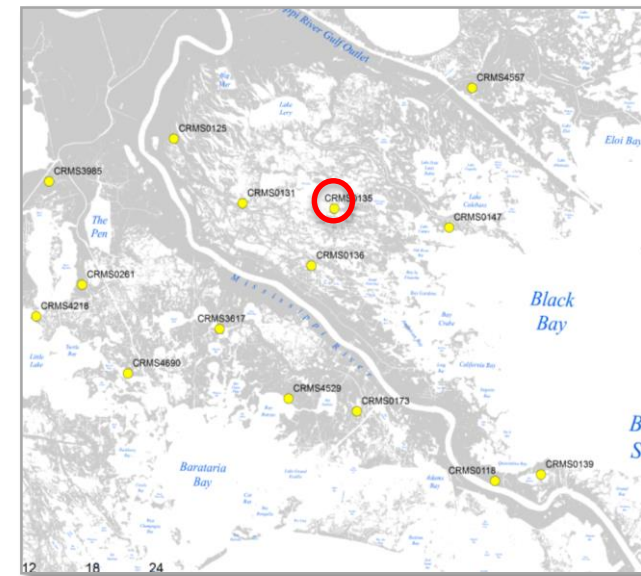
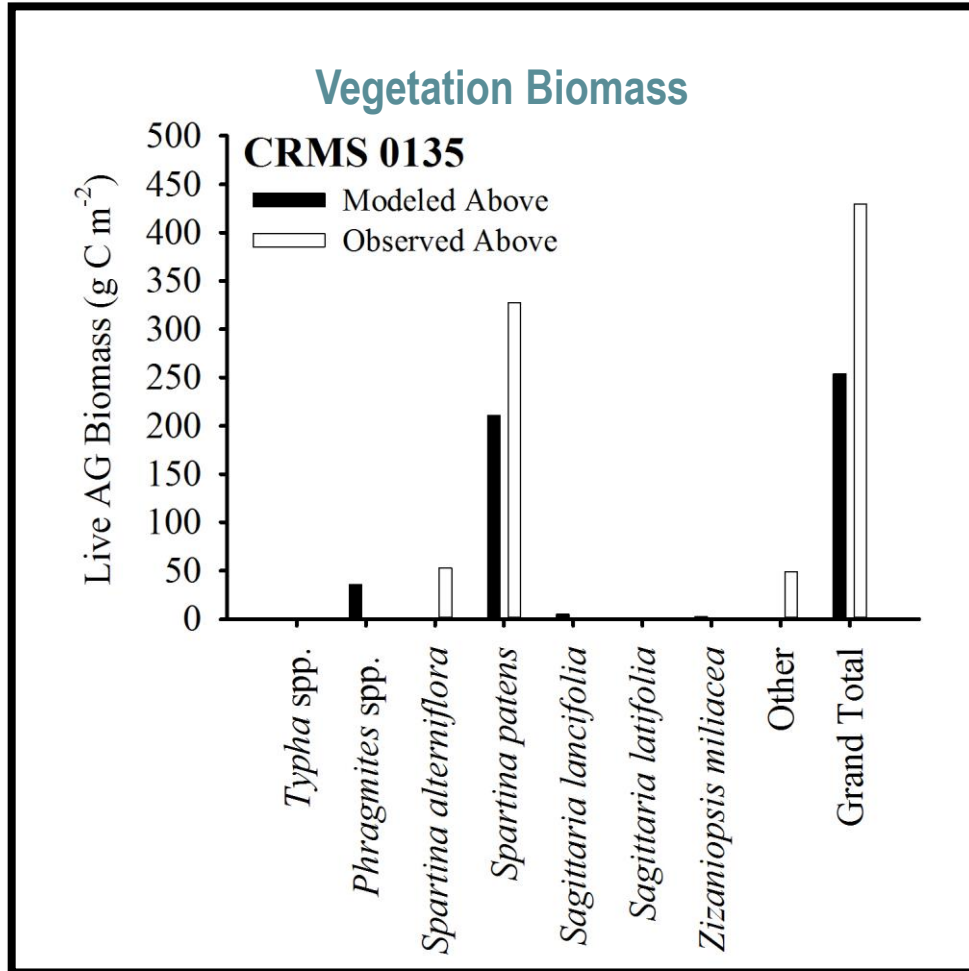
Chlorophyll a



Total Suspended Sediment



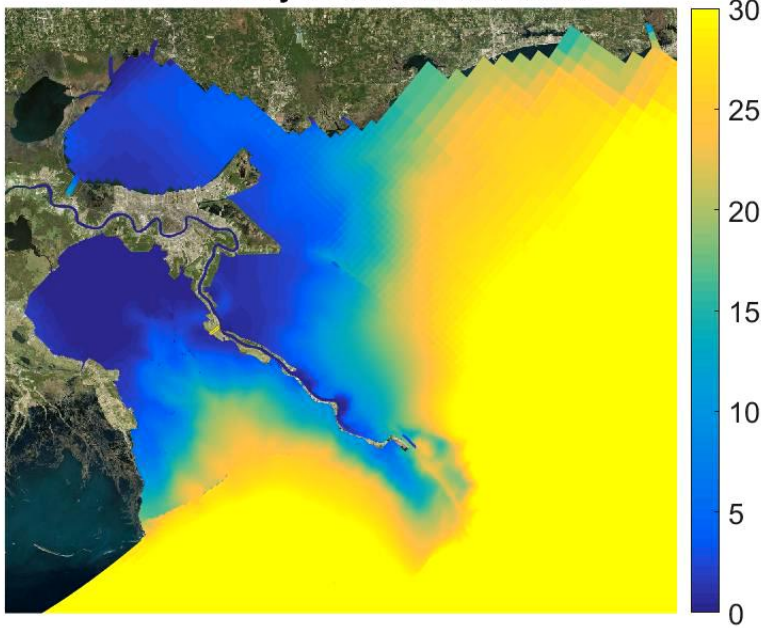
VEGETATION DYNAMICS: CALIBRATION & VALIDATION



BASIN-WIDE DELFT3D : YEAR 50 (2070) SALINITY

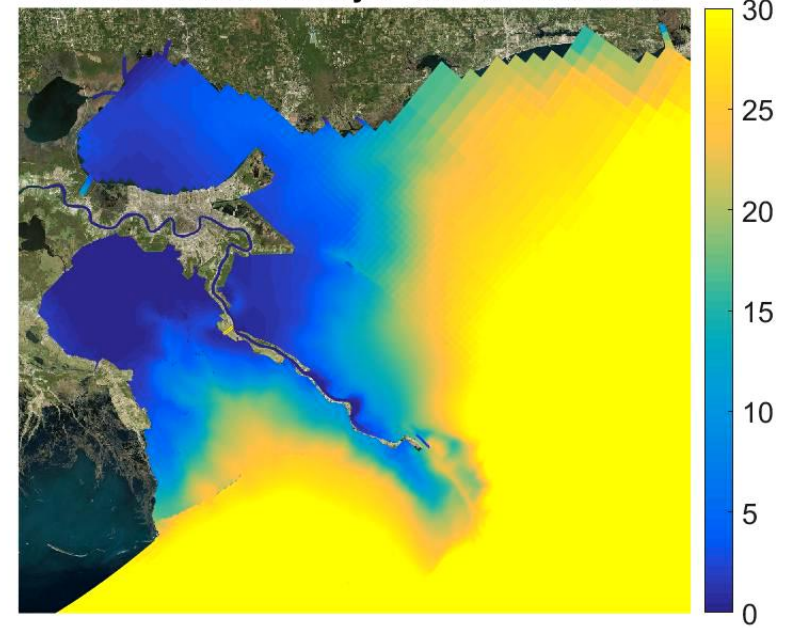
No Diversions Active

FWOP: Salinity 01-Jan-2070 00:00:00



Mid Diversions Active

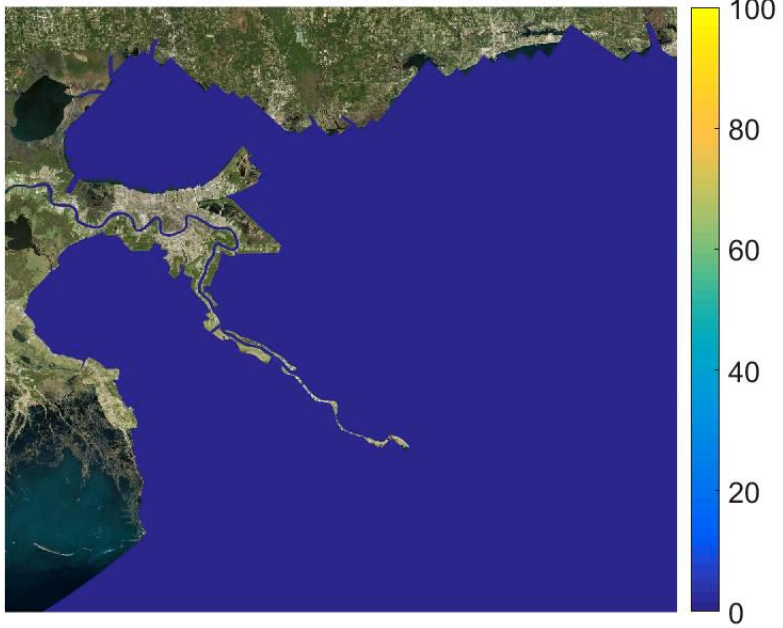
Mid Diversions: Salinity 01-Jan-2070 00:00:00



BASIN-WIDE DELFT3D : YEAR 50 (2070) WATER QUALITY

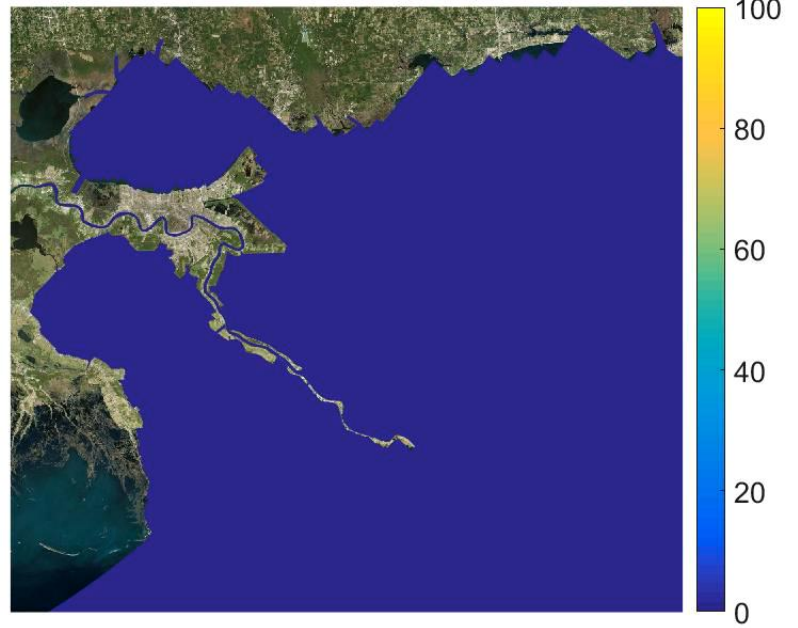
Mid Diversions Active

TSS 01-Jan-2070 00:00:00

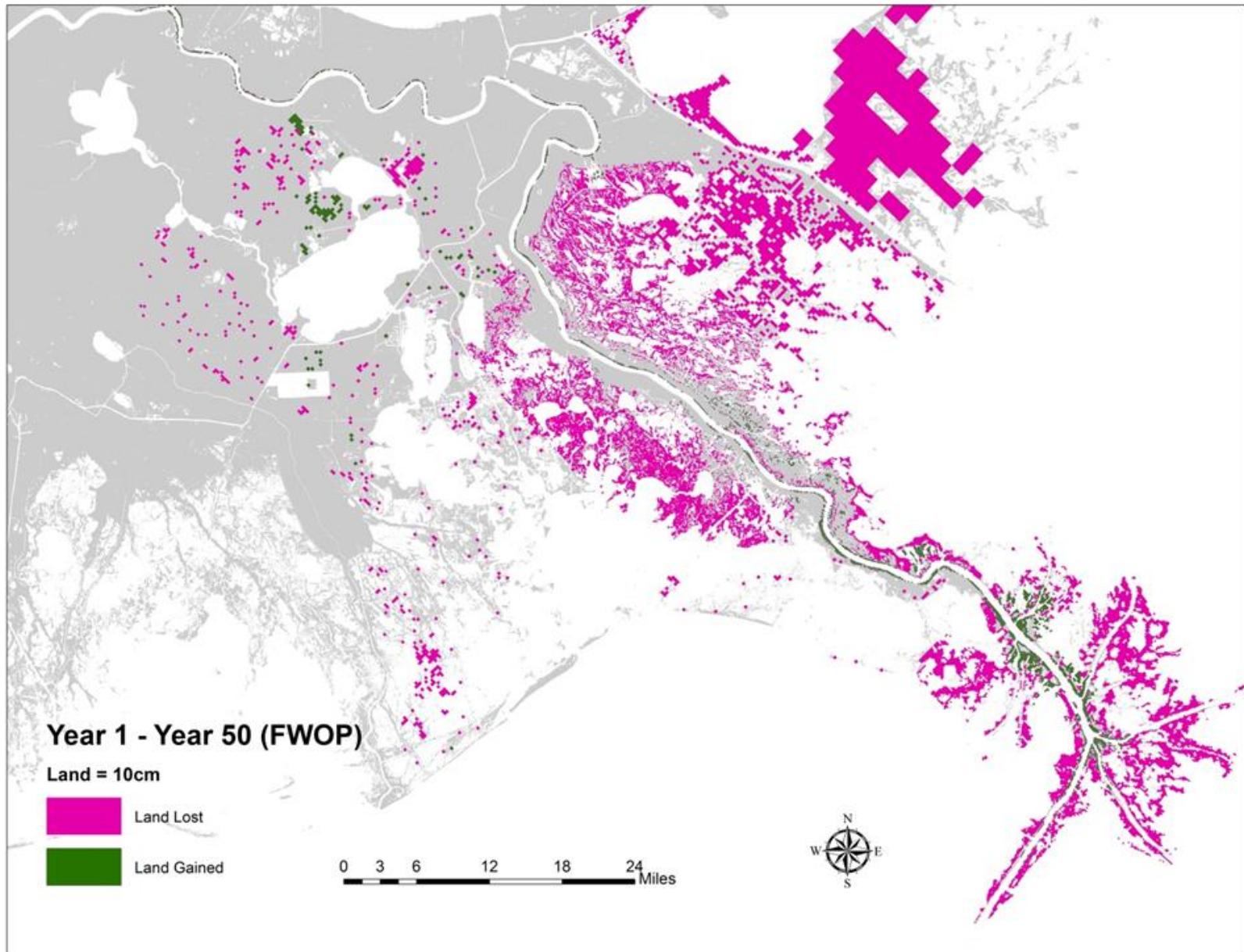


Mid Diversions Active

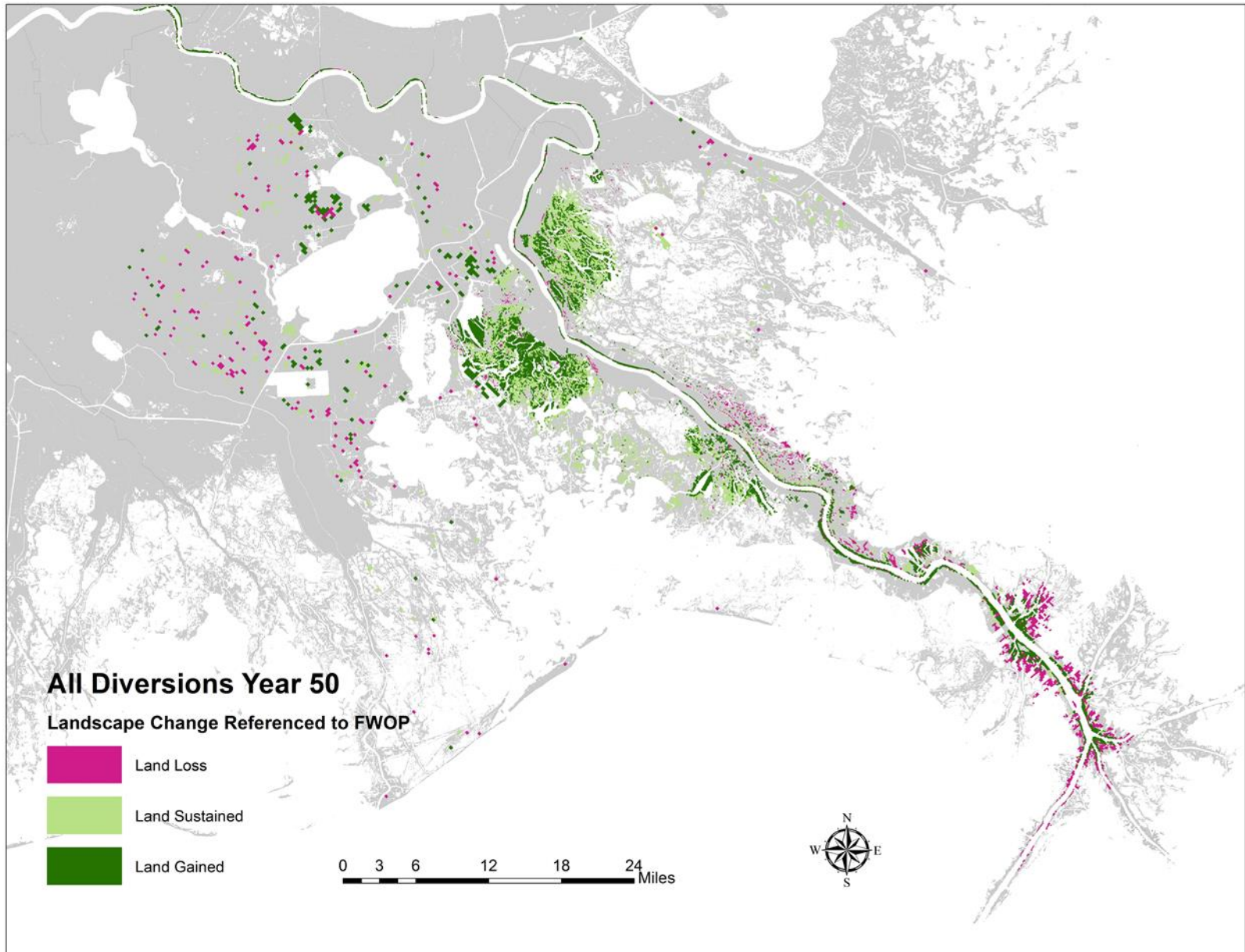
Chl-a 01-Jan-2070 00:00:00



BASIN-WIDE DELFT3D : 50-YEAR FUTURE WITH NO PROJECT



BASIN-WIDE DELFT3D : 50-YEAR FUTURE WITH ALL DIVERSIONS





**THE WATER INSTITUTE
OF THE GULF®**

THANK YOU

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