RESTORE ACT CENTER OF EXCELLENCE FOR LOUISIANA FINAL TECHNICAL REPORT

Due within 30 days of the close of the award

Project Title:

Principal Investigator:	**Giulio Mariotti**
Principal Investigator Institution:	**Louisiana State University**
Co-Principal Investigator:	**Tracy Quirk**
Co-Principal Investigator Institution:	**Louisiana State University**
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A. TECHNICAL ACTIVITIES

1. **Research Summary**: Please include methods, main findings and conclusions, significance of the research, and any representative tables or figures. Approximately 5 pages**.**

Basin-Wide marsh survey of soil shear strength in Barataria Basin. 66 sites were sampled between September 2021 and July 2023. An additional 8 sites that were sampled in a previous study in 2018 were also included in the database. At each site, vegetation species cover, elevation and soil shear strength measurements were taken at the edge (~1 m from edge) and interior (~25 m from edge). Each sampling location consisted of 5-11 replicate soil shear strength profiles using a Humboldt shear vane. Each profile consisted of measurements taken at 5, 15, 25, 35, 45, and 55 cm below the marsh surface. Profiles were taken approximately 0.5 m from each other. A peat borer (50 cm by 5cm diameter) was used to collect a soil core at each site (both edge and interior). Soil bulk density and organic matter content, estimated through Loss on Ignition (LOI), were then determined for 10-cm segments of each core. Elevation was measured with RTK-GPS. Plant community composition was obtained using a 1 m^2 quadrat.

We found that the intermediate marshes were the weakest of all four types (Figs 1,2). Saline marshes were the strongest, and also had the largest difference between the edge (stronger) and the interior (weaker). Fresh marshes where somehow different from the others, and were stronger at the interior than at the edge. For all sites, the largest difference in strength was present in the top 20 cm, within the living root zone.

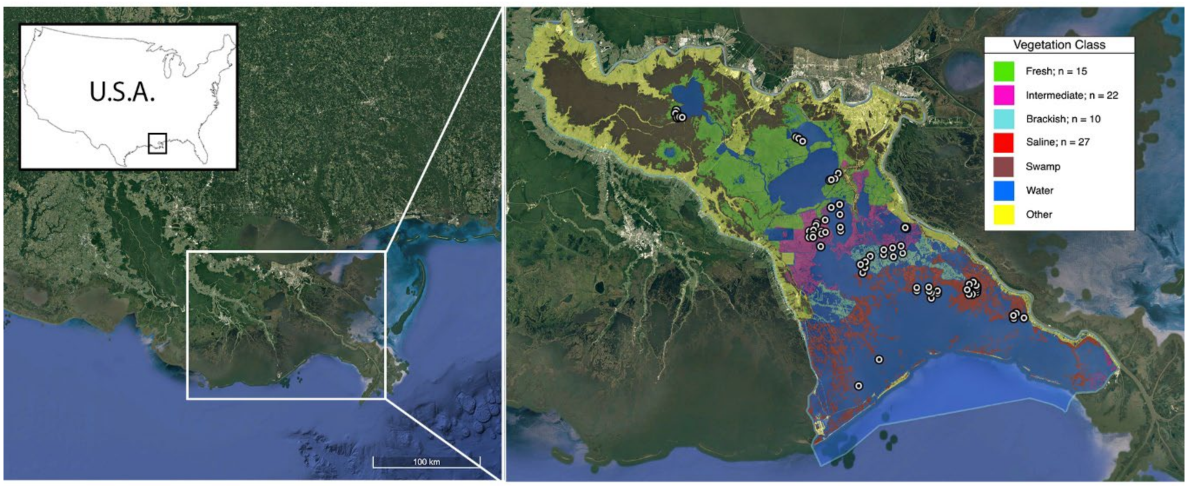

Figure 1. Map of Southeastern Louisiana (Google Earth Pro, 2023). Barataria Basin is overlain with vegetation classifications (CRMS, 2021). Points represent site locations (n = 74) within the basin.

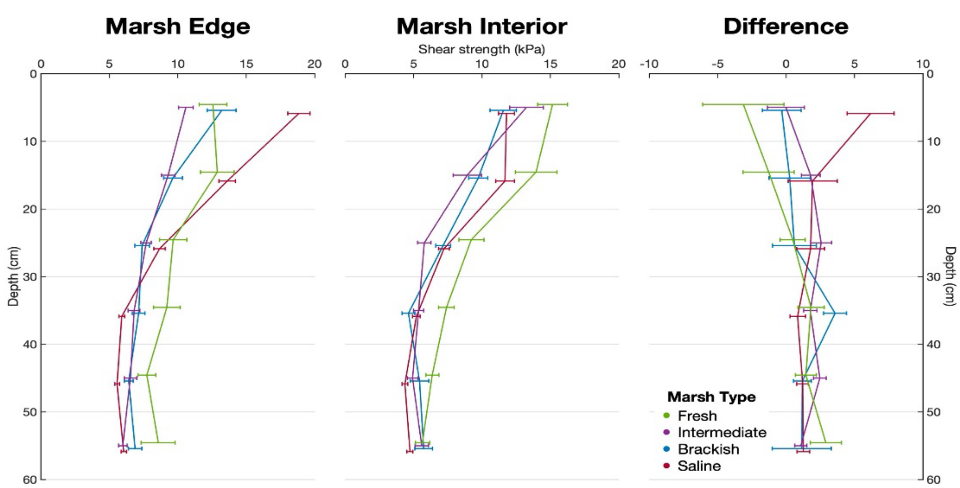

Figure 2. Mean soil shear strength for each marsh type and location sampled in Barataria Basin.

Marsh erosion modeling. We improved a model for marsh morphodynamics (MarshMorpho2D), and specifically we included a wave-induced erodibility of the marsh edge that depends on the salinity (calculated by the model as a function of freshwater inputs and tidal transport). We applied it to Barataria Basin (Fig. 3), aiming to reconstruct its morphodynamic evolution from 1932 to 2013. By comparison with the observed retreat, we calibrated the wave-induced edge erodibility and found it equal to 0.3 m/yr/(Wm^{-1}) for saline, 0.6 m/yr/(Wm^{-1}) for brackish, 1.5 m/yr/(Wm^{-1}) for intermediate, and 0.3 m/yr/(Wm^{-1}) for fresh marshes. These values apply for northerly facing marsh edges, whereas the value is halved for marsh edges exposed to the south (accounting for the correlation between water levels and wind direction, as showed by previous research in the area).

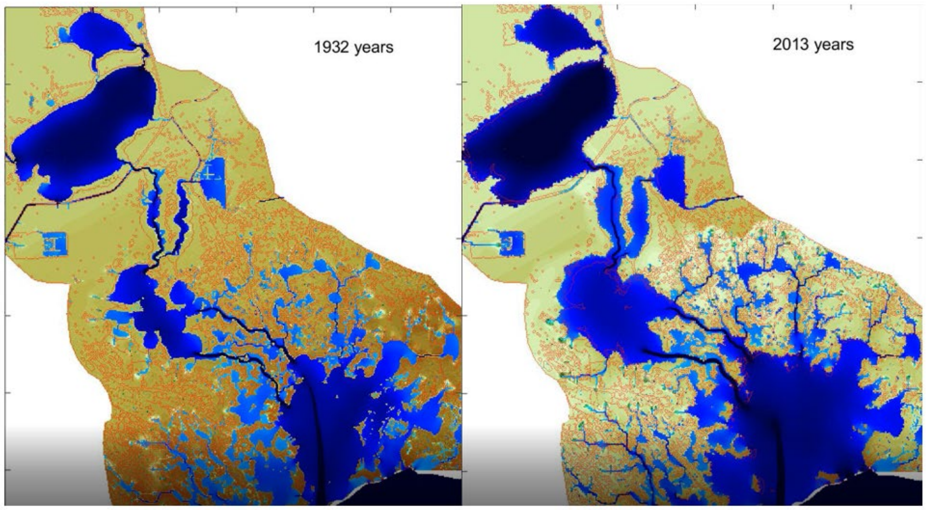

Figure 3. Marsh evolution from 1932 to 2013 reproduced with MarshMorpho2D, with erodibility dependent on salinity. The red lines represent the observed marsh shoreline in 2013.

Sampling at GIWW. We performed three deployemnts in the GIWW at Larose (current velocimeter, automatic water samplers, motion-triggered camera). We collected water quality data (total suspended sediment, nitrate, sulfate) every 3 hours for a total of 9 days. With these data we refined the estimate of sediment transport in the GIWW (and associated it to barge-driven resuspension). Contrary to our initial hypothesis, we found that sulfate and nitrate only change by 10-30% at the short (1-2 days) temporal scales, e.g., in concomitance with cold-fronts. We thus ignored this short-term variability when computing their fluxes through the GIWW and into Barataria Basin.

Comparative field study focused on brackish-intermediate marshes. A comparative field study was performed at selected sites to test the hypothesis that flood-stressed *Sporobolus* (formerly known as *Spartina patens*) marshes have weaker soils due species-specific response to excessive inundation. *Sporobolus* tends to form tussocks with a phalanx growth strategy, concentrating the rhizome and root growth directly below the shoots. This creates a landscape microtopography of hummocks and hollows, which may ultimately cause weaker soils locally, and more broadly, a marsh more vulnerable to erosion. We selected four marshes for study including two stable *Sporobolus* -dominated marshes, one in the Chenier Plain region of Louisiana and the other in Grand Bay, Mississippi, an unstable, flood-stressed *Sporobolus* marsh in Barataria Bay, Louisiana and a relatively stable *Sagittaria lancifolia*-dominated marsh also in Barataria Bay. In each marsh, we established three ~100 m long transects from the marsh edge to the interior. Elevation (RTK GPS) and vegetation measurements (species percent cover) were collected every 10 m. Soil shear strength measurements were taken every 20 m from the marsh surface every 10 cm to a 50 cm depth. Groundwater level and salinity data were collected at each site using continuous water level and salinity recorders installed in 60 cm deep perforated wells (In-situ Solonst, Inc.). To examine the possible mechanisms of greater erodibility in *Sporobolus* marshes in LA as compared to the other two marshes, we measured above- and belowground biomass depth profiles (30 cm diameter x 60 cm depth) and microtopographic heterogeneity. In marshes where hummocks and hollows are present, measurements were made in hummocks and hollows.

Both the stable and unstable *Sporobolus* marshes in Sabine and Barataria had a hummock-hollow topography with hummocks approximately 10 cm higher in elevation than hollows (Fig. 4). The hollows were devoid of aboveground biomass and had significantly less belowground biomass than hummocks, as expected (Fig. 5,6). Soil shear strength was also significantly lower in hollows than in the hummocks. Despite relatively high soil shear strength in the hummocks, the average soil strength across the marsh in the root zone was lower than in the other more stable marshes (Fig. 7). Both the unstable *Sporobolus*-dominated marsh and the stable *Sagittaria*-dominated marsh in Barataria Bay were lower in elevation relative to mean high water (MHW) than the other stable *Sporobolus* marshes in Grand Bay and Sabine. Although elevations were similar between the Barataria Bay marshes, the marsh with hummocks and hollows had lower soil shear strength than the stable *Sagittaria* marsh with a more uniform topography.

Overall, these findings support the hypothesis that the hummock-hollow microtopographic variation associated with greater inundation of *Sporobolus* marshes results in a weaker soil throughout the marsh due to low biomass and weak hollows.

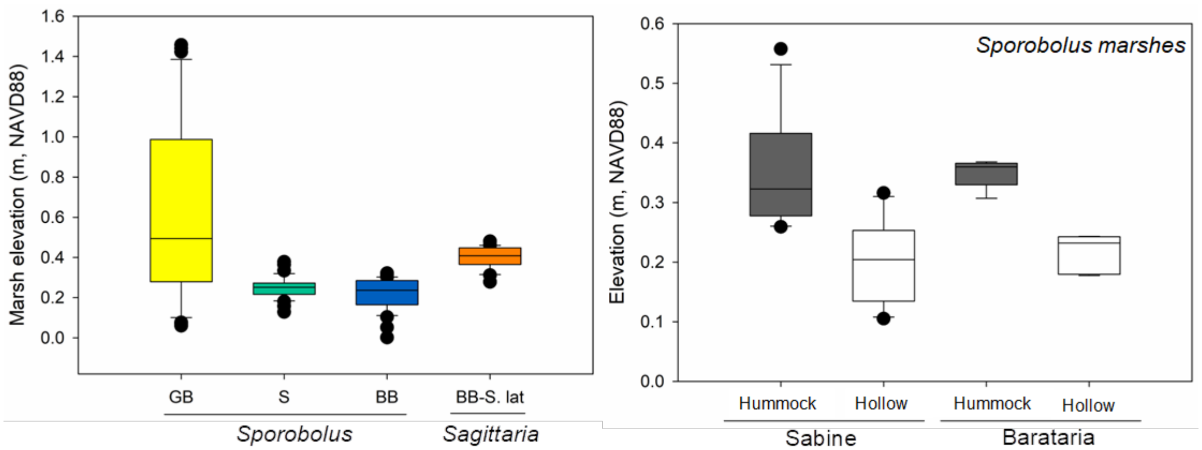

Fig. 4. Elevations of *Sporobolus* and *Sagittaria*-dominated marshes and hummock and hollows.

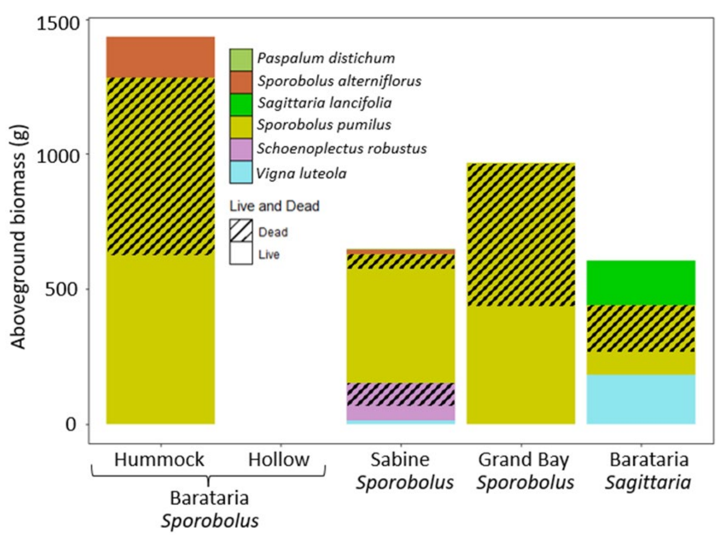

Fig. 5. Aboveground biomass in stable (Sabine and Grand Bay) and unstable (Barataria) *Sporobolus* marshes and a stable (Barataria) *Sagittaria* marsh.

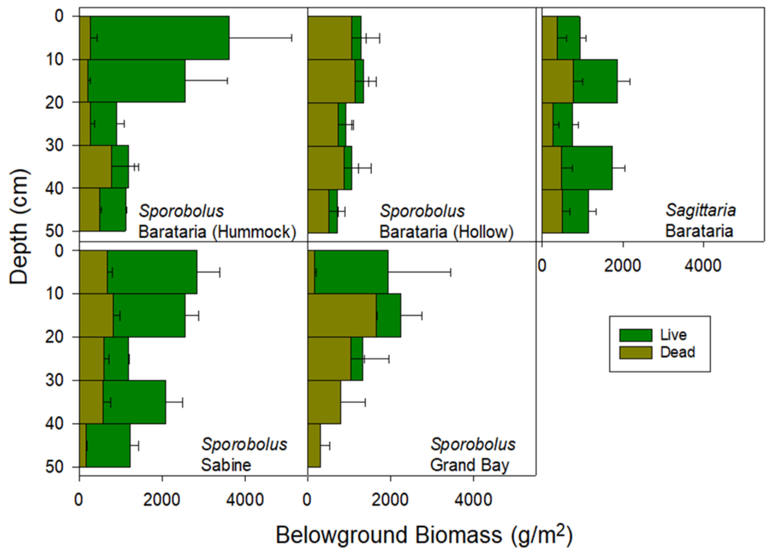

Fig. 6. Belowground biomass in stable (Sabine and Grand Bay) and unstable (Barataria) *Sporobolus* marshes and a stable (Barataria) *Sagittaria* marsh.

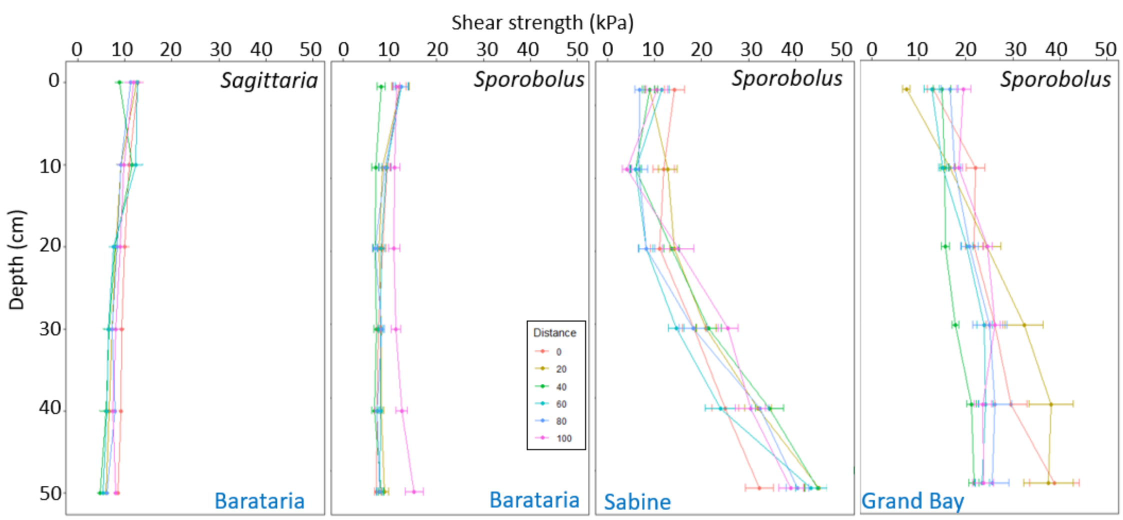

Fig. 7. Soil shear strength to at 50 cm depth at 0, 20, 40, 60, 80 and 100 cm distances from the edge in four marshes- a stable *Sagittaria* marsh and unstable *Sporobolus* marsh in Barataria and two stable Sporobolus marshes in Sabine and Grand Bay.

Greenhouse study to test the effects of elevation and nutrient-enrichment on productivity and soil strength of *Sporobolus* and *Sagittaria lancifolia*. To test the hypothesis that inundation, soil type, and nutrient-enrichment interact to affect the productivity and soil strength of *Sporobolus* and *Sagittaria* differently, we established a controlled experiment in the greenhouse (Fig. 8).

Stem density of *Sporobolus* was lowest at low elevations while the density of *Sagittaria* was lowest at the highest elevation indicating species-specific flooding optimums. *Sporobolus* had the greatest aboveground biomass in clay soil at high elevation without nutrient-enrichment. Adding nutrients reduced live biomass of *Sporobolus* at low elevations in clay soil (Fig. 9). In organic soil, *Sporobolus* had the greater aboveground biomass at moderate elevation and in all but the lowest elevation, nutrient addition reduced live biomass production. Aboveground biomass of *Sagittaria* was negatively affected by nutrient addition at high elevations (Fig. 9).

Shear strength of *Sporobolus* soil was greatest at high elevations for both organic and clay soil types, but nutrients had a negative effect on this relationship in organic soil (Fig. 10). Shear strength of *Sporobolus* was greater in clay than organic soil generally. Nutrient-enrichment reduced shear strength of *Sagittaria* soil at low elevations.

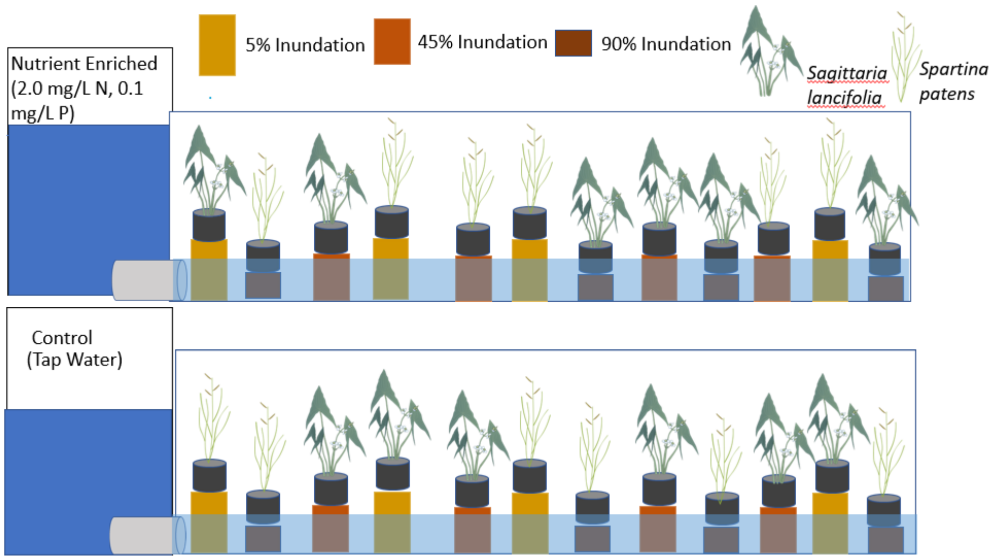

Fig. 8. Greenhouse Set-up with spilt-plot design. 4 tanks per nutrient treatment for whole plot factor (Control and Nutrient-enriched) and subplot factors divided by elevation treatments in each tank with 2 replicates per species per elevation treatment.

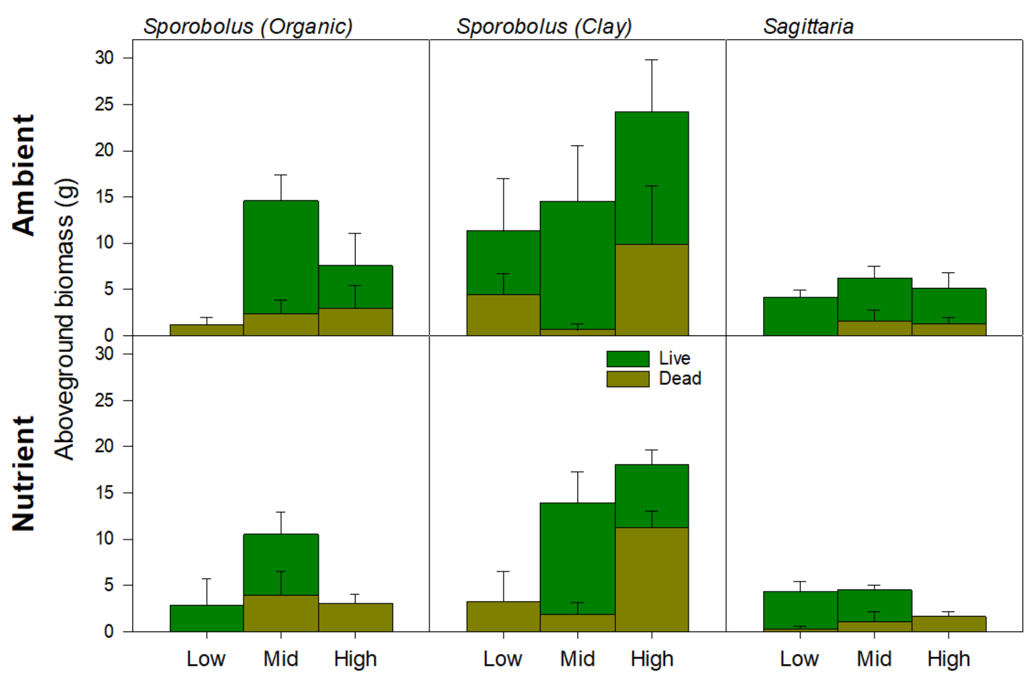

Fig. 9. Aboveground biomass of *Sporobolus* in in-situ organic and clay soil and *Sagittaria* in in-situ organic soil after two growing seasons at low, moderate and high elevations and control and nutrient-enriched conditions.

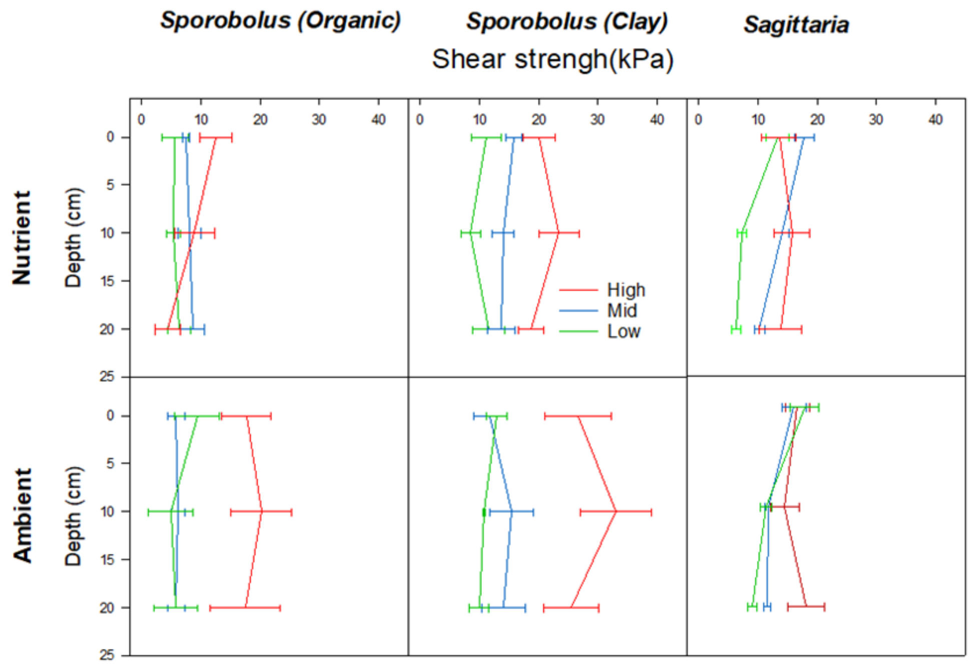

Fig. 10. Results from greenhouse experiments. Soil shear strength of *Sporobolus* in in-situ organic and clay soil and *Sagittaria* after two growing seasons at low, moderate and high elevations and control and nutrient-enriched conditions.

Hydrodynamic modeling (FVCOM). The main objective of FVCOM simulations was to quantify the loading of DIN from the GIWW into Barataria Basin and their fate, i.e., change in their quantities over space and time.

Improvement of FVCOM hydrodynamic simulation. An existing FVCOM grid for the Barataria Basin and adjacent continental shelf was refined based on updated bathymetric measurements inside the basin provided by CPRA and collected by G. Mariotti. High spatial resolution (~10 m) mesh was added in and around Gulf Intracoastal Waterway (GIWW), Bayou Perot, and Bayou Rigolettes in order to improve the water current simulation accuracy that is crucial for subsequent DIN transport. In addition to traditional NOAA and USGS water level data for model validation, this project possessed a 75-day water current observation near the southern tip of Bayou Perot. In order to match the observed currents (and in particular the residual seaward directed flow), we found that a spatially non-uniform precipitation-evaporation data and runoff from the Barataria Basin watershed was needed as additional model forcing. FVCOM 3-D simulations were run for two time periods: 1/1/2021 – 8/25/2021 (Period1), and 8/22/2016 – 12/31/2017 (Period2). Performance metrics (comparison of predicted and observed water levels and currents) improved considerably.

Building a predictive model of GIWW discharge at Larose. In FVCOM hydrodynamic simulation, GIWW at Larose is treated as a river open boundary. USGS Larose station #07381235 has been measuring hourly water discharge from 2002 to 2019, but it is discontinued afterward. In order to reconstruct the flow and impose it as a boundary condition, a multiple linear regression equation was proposed, which relates Larose discharge to the gage heights of Atchafalaya River at Morgan City and Bayou Perot, and to the east-west wind component at Barataria Bay at Grand Isle, all of which are currently measured by USGS and will be continuously measured in the future. This analysis further elucidated how flow in the GIWW is controlled by riverine, tidal, and meteorological forcings.

Quantification of the Barataria Basin spatio-temporal dynamics of constitute concentration (i.e., DIN) from the GIWW. A passive tracer advection-diffusion model was online coupled to the above calibrated FVCOM hydrodynamic model to simulate DIN distribution inside the Barataria Basin. There are three possible sources for DIN, released from GIWW at Larose, input from Mississippi River at Davis Pond Diversion, and possible marine influx crossing various Barataria Bay tidal inlets. The initial DIN condition was obtained by combining the interpolated field from Dr. Turner's Barataria Basin water quality transect and shelf hypoxia model's output for outside of the basin. Mississippi and Atchafalaya River open boundary DIN condition was based on USGS measurement at Baton Rouge and Morgan City station, respectively. For Davis Pond, a 39% reduction of Baton

Rouge's DIN observation was used, which accounted for the uptake of DIN in the Davis Pond marshes. Larose DIN concentration was estimated from the data collected by the Louisiana Department of Environmental quality (LDEQ), which provides water quality measurements at many sites along the GIWW (LDEQ station 0111 at Larose has 178 data points collected at monthly intervals). The simulation started from the climatological January condition, forced at all open boundaries with climatological monthly forcing. Two numerical experiments were performed. The first one was run with GIWW at Larose as the only river input (David Pond, Mississippi and Atchafalaya Rivers were closed) and the second one with all four river boundaries open. Fig. 11 illustrates the instantaneous DIN distribution after four-month simulation for both simulations. Analysis of the simulation results is underway that will quantify DIN distribution pattern inside the Barataria Basin from the riverine (GIWW, Davis Pond) and from marine sources, as well as reveal the DIN transport mechanism (Advective transport vs Dispersive transport).

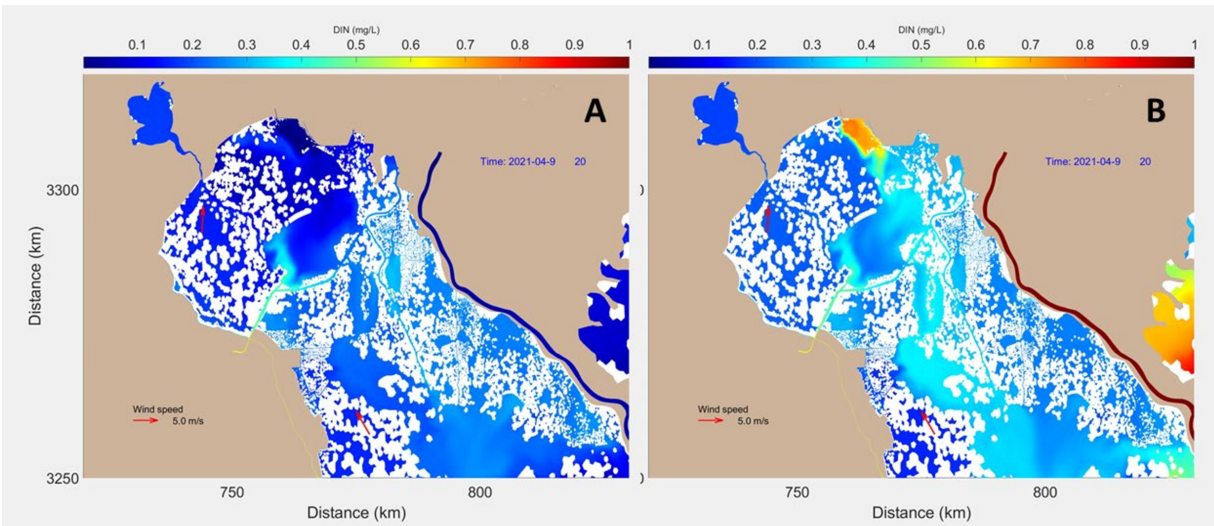

Fig. 11. DIN distribution on April 9, 2021 for A) GIWW Larose as the only riverine input and B) four riverine inputs from GIWW Larose, Davis Pond, Mississippi River and Atchafalaya River. Both simulations start from January 1, 2021 with climatological January DIN distribution

2. Application of research to implementation of Coastal Master Plan: Bulleted list of suggested applications

- Our field survey found that intermediate marshes are exceptionally weak and hence susceptible to wave edge erosion. Greenhouse experiments indicate that within intermediate marshes, *Sporobolus* (*S. patens*) is weaker than *Sagittaria*, especially when flood stressed (low elevation) or when at high elevation and exposed to high nutrients.
- Intermediate marshes (especially *Sporobolus*) can also be susceptible to wave erosion during hurricanes, through a scalping-mechanism (as it occurred during Katrina in Breton Sound and during Ida in Barataria Bay). This mechanism needs to be further investigated and included as a scenario in the Master Plan.
- Nutrients (nitrate) from the GIWW might have contributed to weakening the intermediate marshes in mid Barataria. However, their low strength is likely mostly due to their low elevation (inundation stress), brought about by an increase in relative sea level rise rate and a reduction in sediment supply. Increasing the marsh elevation through sediment augmentation (thin-layer deposition, or sediment introduction) will increase the biomass and soil strength of brackish marshes dominated by *Sporobolus*. Edge protection (e.g., breakwaters) could reduce edge erosion in these marshes, but it will not likely prevent the scalping mechanism during hurricanes and will not address the persistent and likely worsening problem of inundation stress.
- Controlled greenhouse experiments indicate that *Sporobolus* marshes have greater soil strength at higher elevations in both organic and clay soils. However, nutrients negatively affect soil strength of *Sporobolus* marshes, especially at high elevations. This effect is larger where *Sporobolus* grows in organic-rich soil than in clay soil. This suggests that a reduction in strength due to high nutrients might be compensated by the addition of mineral sediment (e.g., through a river diversion). Overall, our results indicate that the nutrients from a river diversion into intermediate marshes have the potential to reduce marsh strength especially for marshes higher in elevation and more oxidized. We strongly suggest to monitor marsh strength in the marsh areas in the outfall of the mid-Barataria and mid-Breton diversion. Monitoring should start 1-2 years before the diversion becomes operative. Performing the measurements of shear strength is cheap (even though time intensive). Perhaps these measurements could be routinely taken at the CRMS sites as part of the monitoring already established.
- In the current Coastal Master Plan, hydrodynamic simulation in the Barataria Basin only considers the basin itself. Our project indicates that GIWW is an important conduit that connects the Atchafalaya River and Terrebonne Basin with Barataria Basin. A complete and accurate account of Barataria hydrodynamics (including salinity, temperature, and nutrient dynamics) must include GIWW, either as an open boundary (with boundary conditions specified by observations or model prediction) or as a part of the model domain (e.g., combining both Barataria and Terrebonne Basins).

B. DELIVERABLES

*Note – please submit all PDFs of reports, papers, and presentations with the final report **in the portal (LA-COE Apply)**. Thank you!*

1. **Deliverables on proposed goals and objectives.** If a goal or activity is not completed, please describe in the "comments" why actual output / deliverable deviated from the proposed.

#	Proposed goal / objective / activity	Target output / deliverable	Completed (Y/N)	Comments	Topical area (s) and research need(s) addressed (as described in the proposal)
1	**O1: Improve predictions of marsh edge erosion across salinity zones and marsh types.**	1) Quantification of marsh strength as a function of salinity. We produced a Basin-wide survey in Barataria as well as a more detailed survey at selected sites (Barataria, Sabine, Gran Bay). 2) Implementation of marsh edge erosion model with erodibility dependent on salinity	Y	The field surveys provide information about erodibility. The model provides an example of how to include marsh-type (salinity) dependent erodibility. The model, or some of its component, might be implemented in the model used for the Master Plan.	*Designing methods, measuring, and predicting long-term marsh edge erosion rates, potentially relating wave power, storm events, wetland vegetation density, and incorporating bio-erosion mechanisms*
2	**O2: Quantify the loading of DIN and sulfate from the GIWW into Barataria Basin and their fate, i.e., change in their quantities over space and time.**	1) Detailed high-frequency measurements in the GIWW at Larose 2) Results from FVCOM Hydrodynamic modeling	N	Analysis of the FVCOM model results is still under way, even though all the key simulations have already been performed. Also, all field data collection in the GIWW has been completed.	*Quantification of nutrient loads (nitrogen and phosphorus constituents) at the basin or watershed spatial scale in coastal Louisiana."*
3	**O3: Determine whether the chemical input from the GIWW has accelerated marsh edge erosion in Barataria Basin.**	1) Greenhouse experiments indicate that nutrients decrease the strength of *Sporobolu*	Y	Marsh strength was measured with the exact same method as the field survey in the marshes, so that the results are fully comparable.	*Designing methods, measuring, and predicting long-term marsh edge erosion rates, potentially relating wave power, storm events, wetland vegetation density, and incorporating bio-erosion mechanisms*

2. Peer-reviewed publications. Please provide .pdf copies of all publications.

Authors	List author names of graduate students/post docs	Title	Journal	DOI (or other identifier)	Published; submitted; in prep; planned?	Date
Mariotti G., Boswell K.,	Boswell K.	Barge-driven resuspension facilitates sediment bypass in the Gulf Intracoastal Waterway (Louisiana, USA).	Coastal Engineering	https://doi.org/10.1016/j. coastaleng.2023.104326	Published	2023
Boswell K., Mariotti G.	Boswell K.	Losing Barataria: Investigating Marsh Erosion Drivers via a Basin-Wide Field Survey	M.S. thesis and then journal article		In preparation	
Mariotti G		Modeling marsh edge erosion along a salinity gradient	TBD		Planned	
Huang H, Wang L, Mariotti G., and Justic D		A novel method to estimate stream discharge for low-gradient coastal waterway	TBD		In preparation	
Huang H, Wang L., Justic D, and Mariotti G		Spatio-temporal dynamics of dissolved inorganic nutrients in a dynamic subtropical estuary, Barataria Basin, Louisiana: Comparison between riverine	TBD		Planned	

		and oceanic contributions				
Matherne, N., Elsey-Quirk, T., & Mariotti G.	Natalie Matherne	Erodibility of brackish marshes: the role of inundation stress and hummock-hollow topography	TBD		In prep	Spring 2023
Matherne, N., Elsey-Quirk, T., & Mariotti G.	Natalie Matherne	The interactive effects of flooding and nutrients on soil strength of *Sporobolus pumulis* and *Sagittaria lancifolia*	TBD		In prep	Spring 2023

3. **Oral presentations and posters.** Please provide .pdf copies.

Presenter	Co-authors	List author names of graduate students/Postdocs	Title	Oral or poster?	Conference or meeting name	Date	Proceedings published? (Y/N)
G Mariotti	K Boswell	K Boswell	Barge-driven resuspension facilitates sediment bypass in the Gulf Intracoastal Waterway (Louisiana, USA)	Poster	LA State of the Coast conference 2023	June 2023	Y
K Boswell	G Mariotti	K Boswell	The Effect of Salinity on Marsh Erodibility in Barataria Basin	Oral	LA State of the Coast conference 2023	June 2023	Y
N Matherne	T Quirk	N Matherne	Investigating Erodibility of Brackish Marshes of the Mississippi River Delta	Oral	LA State of the Coast conference 2023	June 2023	Y
K Boswell	G Mariotti	K Boswell	Losing Barataria: Investigating Marsh Erosion Drivers via a Basin-Wide Field Survey	Poster	Coastal, Estuarine Research Federation conference 2023	11/15/2023	N
Natalie Matherne	Tracy Quirk, Giulio Mariotti	Natalie Matherne	Investigating the Erodibility of Brackish Marshes of the	Oral	Coastal, Estuarine Research Federation conference 2023	11/15/2023	Y

			Mississippi River Delta				

4. **List other products or deliverables**. These can include white papers, patent applications, workshops, outreach activities/products. Describe and provide .pdf copies, as applicable.

5. **Data.** Making data publicly accessible in a timely manner is a key goal of the data management policy of RESTORE Act Center of Excellence. All projects must ensure that data and ISO metadata are collected, archived, digitized, and made available using methods that allow current and future investigators to address new questions as they arise. Per the U.S. Department of the Treasury's Office of Gulf Coast Restoration Data Accessibility and Management Best Practices[1] *"Data are generally expected to be made publicly available at the time of publication of a peer- reviewed article relying on the data or two years after the data are collected."* All information products resulting from funded projects must be associated with detailed, machine-readable metadata (ISO format) and shared in a regional or national digital repository or data center (e.g., National Centers for Environmental Information, Gulf of Mexico Research Initiative Information & Data Cooperative, Inter-university Consortium for Political and Social Research, DataOne Dash) for discovery and long-term preservation. Metadata, a brief description of the data, and location of the data (e.g., repository, DOI) must be provided to the LA-COE to enable tracking of all data and information products.

#	Data Title	Data Description	Repository or Data Center	Date by when it will be publicly available (1 year after final report)	DOI link (if already available)
1	Along-channel velocity and calculated total suspended sediment measurements using an acoustic doppler velocimeter (ADV) in the Gulf Intracoastal Waterway at Larose, Louisiana from 2022-04-21 to 2022-05-01 (NCEI Accession 0276517)	An acoustic doppler velocimeter (ADV) was deployed in the Gulf Intracoastal Waterway (GIWW) near Larose (LA) using a 6000 kHz Nortek Acoustic Doppler Velocimeter (ADV). The cross section is about 75 m wide, with a depth of ~4.5 m toward the center and ~4 m toward the side. The instrument was deployed about 3 m from the bank, where the water depth is about 4 m. The three-dimensional velocity was recorded 0.4 m above the bed. Both the 3-dimensional	NOAA NCEI	Already available	https://www.ncei.noaa.gov/access/metadata/landing-page/bin/iso?id=gov.noaa.nodc:0276517

[1] https://www.fio.usf.edu/documents/flracep/program-documents/Treasury%20RESTORE%20COE%20data%20management%20best%20practices%20Jan%202018.pdf

		velocity and the backscatter was recorded continuously at a frequency of 8 Hz. In post-processing, data were converted into bursts of 16 seconds, which were then averaged to give a single measurement per burst. The backscatter signal-to-noise ratio (S) [dB] was converted to TSS [mg/l] using a laboratory-calibrated formula (TSS=10^(0.052S+0.04).			
2	Survey of marsh properties (shear strength profiles, elevation, plant composition, bulk density, organic content) in Barataria Basin (LA, USA) 2021-2023	Total of 74 sites. Edge and interior.	NOAA NCEI	Spring 2024	
3	Measurements of water quality characteristics in the Gulf Intracoastal Waterway at Larose, Louisiana in January and March 2022	Water quality measured 3 hourly for 9 days in the GIWW. Suspended sediment, nitrate, sulfate.	NOAA NCEI	Spring 2024	
4	Marsh evolution model with salinity-dependent erodibility	Marsh evolution model (MarshMorpho2D), improved to include salinity-dependent erosion. Model applied	CSDMS	Spring 2024	

		to Barataria Basin, reconstructing its trajectory from 1932 to 2016.			
5	FVCOM simulated water level, 3-d velocities, salinity in Barataria Basin and adjacent continental shelf	For two time periods 08/22/2016 – 08/31/2017 and 1/1/2021 – 8/29/2021	National Centers for Environmental Information	1 year after final report	
6	FVCOM simulated dissolved inorganic nitrogen (DIN) in Barataria Basin and adjacent continental shelf	1/1/2021 – 4/30/2021	National Centers for Environmental Information	1 year after final report	
7	Drivers of marsh soil strength across Gulf coast brackish marshes	Field data – elevations, plant cover, hydro and salinity, soil shear strength	DRYAD	1 year after final report	
8	The effects of nutrients and flooding on *Sporobolus pumilus* and *Sagittaria lancifolia*	Greenhouse data – above- and belowground productivity, soil shear strength	DRYAD	1 year after final report	

6. Mentoring and Training. Please list post-doctoral and graduate and undergraduate student participants (provide .pdf copies of thesis/dissertation).

First Name	Last Name	BS/MS/PhD/Postdoc	# Years involved	Institution	Thesis/Dissertation Title/Research Topic or Tasks	Did the student graduate? (Y/N)	If they graduated, current position/location?
Kyrsten	Boswell	MS	2.5	LSU	Losing Barataria: Investigating Marsh Erosion Drivers via a Basin-Wide Field Survey	N	
Natalie	Matherne	MS	2.5	LSU	Comparative field study and greenhouse experiment	N	
Shayla	McSally	BS	1	LSU	Field and lab assistant	N	
Jamarion	Johnson	BS	1	LSU	Field and lab assistant	N	
Olivia	Hurley	BS	1	LSU	Field and lab assistant	Y	Currently a MS student, Quirk Wetland Plant Ecol Lab, LSU

C. CERTIFICATION

Certification: I certify to the best of my knowledge and belief that this report is correct and complete for performance of activities for the purposes set forth in the award documents.

Principal Investigator: Giulio Mariotti

Signature: Giulio Mariotti

Name: Giulio Mariotti

Date Signed: 11/29/2023

Approval: I have evaluated the final report and associated invoice and confirm that the project is finished.

LA-COE Technical Point of Contact:

Signature: Christopher Esposito

Name: Christopher Esposito

Date Signed: 11Dec2023

Approval: I have reviewed the final report and approve for payment.

LA-COE Director:

Signature: Jessica R. Henkel

Name: Jessica R. Henkel

Date Signed: 12/20/2023