Louisiana's RESTORE Center of Excellence Research Grants Program
FY2019 Annual Report to the RESTORE Council

Executive Summary

On April 8, 2014, the Louisiana Coastal and Protection and Restoration Authority (CPRA) named The Water Institute of the Gulf as the State of Louisiana's Center of Excellence. On November 1, 2015, the U.S. Department of the Treasury awarded CPRA a grant to begin its research program. The mission of the RESTORE Act Center of Excellence for Louisiana (LA-COE) is to support research directly relevant to implementation of Louisiana's Coastal Master Plan by administering a competitive grants program and providing the appropriate coordination and oversight support to ensure that success metrics are tracked and achieved.

The LA-COE has been managing research subrecipients that were executed in March 2018 under the first request for proposals (RFP1). A total of 13 research subawards were granted; six graduate studentship awards, two collaborative awards, and five research awards. Assessment and reporting on progress using defined metrics that address federal reporting requirements including reports to the U.S. Department of Treasury have been developed and are ongoing.

The LA-COE Research Strategy document was revised and renamed 'Research Needs' (to better reflect its technical content and layout). It was released for public comment November 1-30, 2018. Comments were reviewed by both LA-COE staff and CPRA, and discussions took place regarding how best to address the comments. Revisions were made to the document, and the final version was posted on the LA-COE website and on the [CPRA Coastal Information Management System (CIMS) website](#).

An in-person meeting with the Executive Committee was convened in January 2019 in Baton Rouge, LA. During the meeting, concurrence was received to finalize the 'notification of dissemination' and 'conflict of interest' language in the Standard Operating Procedures (SOP V2), and the finalized document was posted on the LA-COE website and on the [CPRA CIMS website](#).

Key highlights in 2019 include the LA-COE moderating a conference session at the Gulf of Mexico Oil Spill and Ecosystem Science Conference (GoMOSES) in February 2019 in New Orleans, LA. Presentations were given by two LA-COE research subrecipients, the CPRA COE Grant Program Project Manager, the LA-COE Director, and several other RESTORE Act Centers of Excellence Directors or Deputy Directors to highlight research findings, explain how the LA-COE research findings will be used to support Louisiana's Coastal Master Plan implementation, and to provide information regarding the various operations of the others COEs. The session concluded with a panel discussion, and a session summary was prepared and submitted to the GoMOSES organizers. Another important event included the hosting of the second All-hands meeting in August 2019 where researchers, post-doctoral fellows, students, coastal managers, and research officials of the Executive Committee met in person to receive updates on the funded research and to discuss how the results could help implement the Coastal Master Plan.

Programmatic Elements

<u>Award Recipient</u>
Following a mandate by the U.S. Department of Treasury requiring that Centers of Excellence must focus efforts on a selected set of disciplines, the LA-COE focuses on the following:

- Coastal and deltaic sustainability, restoration and protection, including solutions and technology that enable citizens to live in a safe and sustainable manner in a coastal delta in the Gulf Coast region
- Coastal fisheries and wildlife ecosystem research and monitoring in the Gulf Coast region
- Sustainable and resilient growth, economic, and commercial development in the Gulf Coast region
- Comprehensive observation, monitoring, and mapping of the Gulf of Mexico

The status of performance and annual accomplishments include that LA-COE: Coordinated the review of proposals by SMEs, CPRA, and the ERB. CPRA provided review of the relevance of the proposed research to implementation of Louisiana's Coastal Master Plan. Developed summary reviews and, subject to CPRA's concurrence, selected research projects for funding. Principal investigators were notified for selection of funding, and a project kick-off webinar with subrecipients was conducted. Subrecipient risk assessments were completed on all selected subrecipients, and subawards were drafted and sent to research institutions for review and negotiation. The LA-COE was operated according to Standard Operating Procedures, including development and maintenance of a website, coordination with other Centers of Excellence and additional outreach. A webinar was held in September 2019 with the External Review Board members to discuss the progress of LA-COE in the first four years and to gain written feedback from those members. Contracting and research grants management standards were developed and implemented to help manage subrecipients, including quarterly performance progress reports from the subrecipients. Assessment and reporting on progress using defined metrics that address federal reporting, including reports to the U.S. Department of Treasury, was also conducted.

<u>Award Subrecipient(s) Selected for Funding:</u>
1. Louisiana State University, Dr. Kehui Xu
   - Researcher role: Help implement Louisiana's Coastal Master Plan
   - Eligible discipline: Coastal and deltaic sustainability, restoration and protection, including solutions and technology that allow citizens to live in a safe and sustainable manner in a coastal delta in the Gulf Coast
   - Research project undertaken: Integrating High-Fidelity Models with New Remote Sensing Techniques to Predict Storm Impacts on Louisiana Coastal and Deltaic Systems
   - Subaward executed in April 2018. Summary: The role and dynamics of barrier islands and back-barrier marshes is important to understand as they represent the "first line of defense" against sea level rise and erosion by wave impacts and storms. The research goal of this project is to develop and apply an innovative model system that integrates Delft3D and XBeach models with field and remotely-sensed observations of hydrodynamic and biophysical data. This

integration will enable the prediction of barrier-marsh dynamics, and assess the effectiveness of marshes as a nature-based defense. New XBeach model results indicate that including back-barrier marshes and a realistic thickness of the sand layer is important. This was found by the successful coupling of Delft3D, SWAN, and XBeach, processing remotely sensed data, and validating XBeach for wave reduction in wetlands with two field datasets. Ultimately, this research shows that the coupling of Delft3D-XBeach enables realistic modeling of storm impacts on barrier islands and wetlands, which can be a powerful and useful implementation tool for the Louisiana Coastal Master Plan, in which a major focus is on barrier island restoration.

2. Louisiana State University, Dr. Scott Hagen
   - Researcher role: Help implement Louisiana's Coastal Master Plan
   - Eligible discipline: Coastal and deltaic sustainability, restoration and protection, including solutions and technology that allow citizens to live in a safe and sustainable manner in a coastal delta in the Gulf Coast
   - Research project undertaken: Coupling Hydrologic, Tide and Surge Processes to Enhance Flood Risk Assessments for the Louisiana Coastal Master Plan
   - Subaward executed in March 2018. Summary: In the wake of the August 2016 floods in southeastern Louisiana, officials were concerned about the potential consequences of a tropical storm making landfall on already saturated soils and a flooded landscape. This project seeks to understand the compound effect of rainfall with storm surge on flooding in low-lying coastal areas as defined by flood transition zones (see graphic from Bilskie & Hagen, "Defining Flood Zone Transitions in Low-Gradient Coastal Regions." Geophysical Research Letters, Vol. 45(6), pp. 2761-2770, 2018. https://doi.org/10.1002/2018GL077524). By coupling hydrologic (e.g., rainfall and runoff) and tide and surge flooding processes at the coastal land margin, the ability to model the overall process was enhanced. This compound flood modeling application could provide further information on the combined effects of storms (winter and tropical) with antecedent rainfall, lead to a more complete return period analyses, and ultimately result in the capability to assess flood risk in the transition zone – all of which will benefit restoration projects. Research outputs include numerical models on the Lake Maurepas and Barataria watersheds that can capture surge and wind with modeled and/or gridded rain. This modeling tool can be especially important for the assessment of Coastal Master Plan projects in low gradient coastal regions and is the basis for all work that will be done within flood transition zones under the Louisiana Watershed Initiative.

3. University of New Orleans, Dr. Mark Kulp
   - Researcher role: Help implement Louisiana's Coastal Master Plan
   - Eligible discipline: Coastal and deltaic sustainability, restoration and protection, including solutions and technology that allow citizens to live in a safe and sustainable manner in a coastal delta in the Gulf Coast
   - Research project undertaken: An Evaluation of Faulting in Holocene Mississippi River Delta Strata through the Merger of Deep 3-D and 2-D Seismic Data with

Near Surface Imaging and Measurements of Vertical Motion at Three Study Areas

- Subaward executed in March 2018. Summary: South Louisiana contains a number of faults, some of which could extend to the surface which would be essential to be aware of in planning coastal restoration projects since these surface-impacting faults could impact how land subsides locally. While there is a good amount of information from deep seismic data collected through oil and gas exploration, this project is meant to bridge the gap between this data set and the surface. Looking at deep faults in three study areas using seismic industry data, this team is working to determine things like slip rates where possible, determine whether these faults have had impacts near the surface, and assess impacts to infrastructure by mapping elevation changes along roads that cross the faults. Three study areas are planned in northern Terrebonne-Timbalier Bay, Bayou Lafourche near Golden Meadow, and the Lake Pontchartrain/Lake Borgne areas of the Deltaic Plain to better understand the vertical motion of land surfaces. While the work continues, early results show that shallow movement of faults in the Lake Pontchartrain study area coincide with visible offsets and elevation changes along the Causeway and Highway 11 bridges. Similar surveys are being done in the Terrebonne Parish study area. Overall, this research will help develop a template for determining whether the presence of a fault should be considered during a project to improve a project's long-term success or viability.

4. University of Louisiana at Lafayette, Dr. Paul Leberg
   - Researcher role: Help implement Louisiana's Coastal Master Plan
   - Eligible discipline: Coastal fisheries and wildlife ecosystem research and monitoring in the Gulf Coast Region
   - Research project undertaken: Assessment of Coastal Island Restoration Practices for the Creation of Brown Pelican Nesting Habitat
   - Subaward executed in March 2018. Summary: Restoration efforts on coastal islands, such as barrier islands, can significantly impact the habitats and the livelihoods of the seabirds that rely on them. This work seeks to understand the effects of restoration efforts on the suitability of coastal islands as seabird sites for breeding, nesting, and foraging, and how changes in vegetation and predator communities affect seabird colony success. Two field seasons are completed, and one more season of transmitter and nest success data remains to be collected. At this time, some of the preliminary results indicate that birds tend to use smaller islands and ones that are further away from the mainland, that they are much more likely to nest on restored islands, and that the number of islands used by seabirds is rapidly declining. This research has many potential implications for the Louisiana Coastal Master Plan, for example, these results can be used to improve habitat suitability models for the Brown Pelican in the upcoming and future Coastal Master Plan.

5. University of New Orleans, Dr. Marla Nelson
   - Researcher role: Help implement Louisiana's Coastal Master Plan

- Eligible discipline: Sustainable and resilient growth, economic and commercial development in the Gulf Coast Region
- Research project undertaken: From Adapting in Place to Adaptive Migration: Designing and Facilitating an Equitable Relocation Strategy
- Subaward executed in March 2018. Summary: As sea levels encroach upon our coasts and threaten coastal communities, difficult decisions about adaption and, in some extreme cases, relocation, must be considered. This project is working to understand how households adapt and respond to increasing environmental vulnerability, as well as the role of public officials in facilitating and supporting equitable relocation. Several communities in Terrebonne Parish are identified in the Louisiana Coastal Master Plan as particularly vulnerable to flooding in the next 25 and 50 years. In order to better understand the challenges and identify innovative practices, interviews were conducted with Terrebonne Parish residents and officials, and past policies and programs were reviewed. This research can inform policy in the Louisiana Coastal Master Plan to assist in implementing relocation as nonstructural mitigation. Specifically, the following outputs from this research can be utilized: (1) identification of resident and public official priorities and concerns, (2) explanation of how residents make adaptation decisions, (3) identification of innovative practices and barriers from other buy-out and relocation efforts, (4) development of a strategy to collaborate with communities to design, evaluate, and implement relocation strategies, and (5) development of criteria for identifying suitable relocation and resettlement sites.

6. Louisiana State University, Dr. Kehui Xu
   - Researcher role: Help implement Louisiana's Coastal Master Plan
   - Eligible discipline: Coastal and deltaic sustainability, restoration and protection, including solutions and technology that allow citizens to live in a safe and sustainable manner in a coastal delta in the Gulf Coast
   - Research project undertaken: Enhancing Sediment Retention Rates of Receiving Basins of Louisiana Sediment Diversions
   - Subaward executed in March 2018. Summary: One of the major coastal restoration and protection efforts undertaken by CPRA is to build river sediment diversions to reconnect the river to its floodplain and mitigate land loss. This project is investigating the sediment transport and retention rate in Barataria Bay, one of the proposed sites for a sediment diversion. Specifically, the study explores the sediment characteristics, the settling and compaction of dredged sediment, and the impact of Sediment Retention Enhancement Devices (SREDs) on how well sediment can be retained (in order to build land) in the receiving area of a river diversion site. Two tripods were deployed in Barataria Bay in late 2018 to early 2019 to capture the effects of winter cold fronts. A conceptual model was developed, wherein the SREDs effectively divide the receiving area into smaller sub-basins. This model showed that the sediment retention rates generally increased landward (or upstream), but that this can be complicated by impacts of storm surge. There are several potential uses of this research for implementation in the Louisiana Coastal Master Plan. These include focusing on enhancing river sediment delivery, increasing sediment retention, minimizing erosion, testing the

design of SREDs, terraces, and living shorelines, and considering the potential benefit of higher retention rates in more landward receiving basins.

7. Louisiana State University, Dr. Tracy Quirk
   - Researcher role: Help implement Louisiana's Coastal Master Plan
   - Eligible discipline: Coastal and deltaic sustainability, restoration and protection, including solutions and technology that allow citizens to live in a safe and sustainable manner in a coastal delta in the Gulf Coast
   - Research project undertaken: Plant and Soil Response to the Interactive Effects of Nutrient and Sediment Availability: Enhancing Predictive Capabilities for the Use of Sediment Diversions and Dredge Sediment for Marsh Creation Subaward executed in March 2018. Summary: This project seeks to understand the interactive effects of nutrient and sediment availability on marsh nutrient cycling, plant productivity, biomass allocation, decomposition, and soil organic matter accumulation and accretion. This work can enhance the predictive modeling capabilities of sediment retention at diversion sites. The hypothesis is that the availability of mineral sediment deposition and elevation influences plant and soil response to nutrient-enrichment. One field-based study in Barataria Bay and two greenhouse studies were conducted. Results indicate that mineral sedimentation deposition and nutrient enrichment treatments generally resulted in stimulated plant growth (above and below ground) or at least reduced the negative effects of low intertidal elevations. These results can be incorporated in predictive models of marsh morphology and accretion response to sediment diversions (e.g., the basin wide Delft3D model and the Master Plan model), this can also inform adaptive management (e.g., thin-layer deposition, marsh creation).

8. Louisiana Tech University, Dr. Sanjay Tewari
   - Researcher role: Help implement Louisiana's Coastal Master Plan
   - Eligible discipline: Coastal and deltaic sustainability, restoration and protection, including solutions and technology that allow citizens to live in a safe and sustainable manner in a coastal delta in the Gulf Coast & Comprehensive observation, monitoring, and mapping of the Gulf of Mexico
   - Research project undertaken: Electrokinetic Barrier for Seawater Intrusion
   - Subaward executed in March 2018. Summary: The project investigates electrokinetic barriers against seawater intrusion in the coastal region of Louisiana. Efforts will be made to compare the efficacy of this electrokinetic barrier against other techniques that are being used, which is important for many coastal areas that have freshwater crises due to saltwater intrusion. Tewari and his graduate student both left Louisiana Tech University and moved to separate universities. Subaward has been terminated.

9. Louisiana State University, Dr. Robert Twilley
   - Researcher role: Help implement Louisiana's Coastal Master Plan
   - Eligible discipline: Coastal and deltaic sustainability, restoration and protection, including solutions and technology that allow citizens to live in a safe and sustainable manner in a coastal delta in the Gulf Coast

- Research project undertaken: Multiple Tools for Determining the Fate of Nitrate
- Subaward executed in March 2018. Summary: Graduate student Alex Christensen presented the updates at the All-Hands meeting on the research looking at how nitrates travel through the water column. Fieldwork in the spring of 2019 was interrupted when Hurricane Barry came to shore in July which killed all the plants at the Wax Lake study area. Sampling continued in August with plans to continue in October. Research is ongoing, but one of the interesting things the researchers think might be going on is that some of the nitrate is turning into ammonium. Fieldwork and modeling results will help refine water quality models currently in use which could be applied to more specific planning of marsh creation projects for nitrogen uptake and potential impacts from upcoming sediment diversions.

10. Louisiana State University, Dr. George Xue
- Researcher role: Help implement Louisiana's Coastal Master Plan
- Eligible discipline: Coastal and deltaic sustainability, restoration and protection, including solutions and technology that allow citizens to live in a safe and sustainable manner in a coastal delta in the Gulf Coast.
- Research project undertaken: Project Louisiana Rivers' Sediment Flux to the Coastal Ocean
- Subaward executed in March 2018. Summary: This research aims to better understand the contribution local rivers such as the Calcasieu, Mermentau, and Vermillion have on the stability of the Chenier Plain, especially as these local rivers are more vulnerable to long-term and short-term disturbances such as climate change, sea level rise, flooding, and restoration projects. This project is coupling surface water and sediment modeling to better understand sediment movement through these local rivers and examine possible changes in water and sediment changes due to climate change or future restoration projects. Test runs of coupled models have been performed and the next step is to transfer this combination of models to the coastal landscape of Louisiana.

11. University of Louisiana at Lafayette, Dr. Emad Habib
- Researcher role: Help implement Louisiana's Coastal Master Plan
- Eligible discipline: Coastal and deltaic sustainability, restoration and protection, including solutions and technology that allow citizens to live in a safe and sustainable manner in a coastal delta in the Gulf Coast & Comprehensive observation, monitoring, and mapping of the Gulf of Mexico
- Research project undertaken: Evaluation of Radar-Based Precipitation Datasets
- Subaward executed in March 2018. Summary: Precipitation varies over space and time and no dataset that currently exists is perfect, but it is an input into various models used by CPRA for coastal restoration and protection planning. In addition, there are currently only 10-15 rain gauges included within the 946 model compartments included in the model used in the 2017 Coastal Master Plan. This research looks into whether radar-based precipitation datasets could provide a vital improvement to these models for future plans. Radar-based precipitation products offer the advantage of identifying short- and long-term spatial rainfall patterns, ability to provide rainfall estimates at different time scales (hourly, daily,

monthly), and could better support project-scale modeling studies that require high-resolution rainfall patterns.

12. Louisiana State University, Dr. Frank Tsai
    - Researcher role: Help implement Louisiana's Coastal Master Plan
    - Eligible discipline: Coastal and deltaic sustainability, restoration and protection, including solutions and technology that allow citizens to live in a safe and sustainable manner in a coastal delta in the Gulf Coast
    - Research project undertaken: Constructing Mississippi River Delta Plain Soil Stratigraphy
    - Subaward executed in March 2018. Summary: This study investigates coastal land building and compactional subsidence through soil stratigraphy analysis and subsidence modeling of the Mississippi River Deltaic Plain. Essentially, this work hopes to show how groundwater impacts coastal projects. The project is developing a three-dimensional soil stratigraphy model, analyzing spatial patterns to identify seepage pathways for surface-groundwater interaction, and to develop a groundwater flow model which will imply where the ground rises, where it sinks, and where erosion could be implicated. Preliminary information shows interactions between the river, the gulf, and the groundwater system, can particularly be seen during high water events.

13. Louisiana State University, Dr. John White
    - Researcher role: Help implement Louisiana's Coastal Master Plan
    - Eligible discipline: Coastal and deltaic sustainability, restoration and protection, including solutions and technology that allow citizens to live in a safe and sustainable manner in a coastal delta in the Gulf Coast
    - Research project undertaken: Determining the Influence of Surface Water Diversions
    - Subaward executed in March 2018. Summary: In 2007, a series of 139 stations in the Davis Pond outflow area were sampled for plant type, bulk density, total carbon, nitrogen and phosphorus, pH, moisture content, and organic matter content. Results from this were published in 2012. Now more than 11 years later and with years of operation at Davis Pond, this project team is taking samples in the same areas to help answer the questions on whether the operation of the diversion has altered soil properties such as bulk density, organic matter content, or nutrient content, all of which are important to coastal marsh growth and resilience in Barataria Basin. Field work on this project is underway. Data from this research could help inform CPRA about the continued use of freshwater diversions such as Davis Pond and Caernarvon.

Financial Elements

Award Recipient
The RESTORE Act Center of Excellence Research Grant Program amended award to CPRA was issued on May 25, 2017 and is funded for $4,202,509.00. An amended Cooperative Endeavor Agreement dated June 9, 2017 was executed between CPRA and The Water Institute of the Gulf

(The Water Institute) to administer the award with a current contract value of $4,036,238. Invoices from The Water Institute total $2,571,796.77 through the period ending August 31, 2019, including subaward expenditures.

Award Subrecipient(s)

As a result of a competitive and peer-reviewed request for proposal process, subrecipients of research awards were selected. Subawards were executed in March & April 2018. The subrecipients and associated subaward amounts are provided below:

Number	Subrecipient	Subaward Amount
1	Louisiana State University	$501,270.00
2	Louisiana State University	$499,882.00
3	University of New Orleans	$349,173.52
4	University of Louisiana at Lafayette	$299,733.16
5	University of New Orleans	$295,338.00
6	Louisiana State University	$292,495.00
7	Louisiana State University	$292,914.80
8	Louisiana Tech University	$57,519.00
9	Louisiana State University	$63,100.00
10	Louisiana State University	$77,015.26
11	University of Louisiana at Lafayette	$71,148.00
12	Louisiana State University	$70,070.00
13	Louisiana State University	$83,328.00

Gulf Coast Ecosystem Restoration Council Elements

Leveraging Multipliers

The LA-COE and CPRA participate in bimonthly conference calls of the Gulf of Mexico Restoration and Science Programs Coordination Forum that allows for funding organizations in the Gulf region to discuss their programs, share ideas, and promote collaborations.